bra: $= \langle \frac{1}{2}, \frac{1}{2}; s |, \langle \frac{1}{2}, -\frac{1}{2}; s |$
ket: $= | \frac{1}{2}, \frac{1}{2}; s \rangle, | \frac{1}{2}, -\frac{1}{2}; s \rangle$

Table 1: (s,s) block.

| No. | multipole | matrix |
|-----|-----------|--------|
| 1 | symmetry | $1$ |
| | $\mathbb{Q}_0^{(a)}(A_{1g})$ | $\begin{bmatrix} \frac{\sqrt{2}}{2} & 0 \\ 0 & \frac{\sqrt{2}}{2} \end{bmatrix}$ |
| 2 | symmetry | $z$ |
| | $\mathbb{M}_1^{(1,-1;a)}(A_{2g})$ | $\begin{bmatrix} \frac{\sqrt{2}}{2} & 0 \\ 0 & -\frac{\sqrt{2}}{2} \end{bmatrix}$ |
| 3 | symmetry | $x$ |
| | $\mathbb{M}_{1,1}^{(1,-1;a)}(E_g)$ | $\begin{bmatrix} 0 & \frac{\sqrt{2}}{2} \\ \frac{\sqrt{2}}{2} & 0 \end{bmatrix}$ |
| 4 | symmetry | $-y$ |
| | $\mathbb{M}_{1,2}^{(1,-1;a)}(E_g)$ | $\begin{bmatrix} 0 & \frac{\sqrt{2}i}{2} \\ -\frac{\sqrt{2}i}{2} & 0 \end{bmatrix}$ |

bra: $= \langle \frac{1}{2}, \frac{1}{2}; s |, \langle \frac{1}{2}, -\frac{1}{2}; s |$
ket: $= | \frac{1}{2}, \frac{1}{2}; p \rangle, | \frac{1}{2}, -\frac{1}{2}; p \rangle, | \frac{3}{2}, \frac{3}{2}; p \rangle, | \frac{3}{2}, \frac{1}{2}; p \rangle, | \frac{3}{2}, -\frac{1}{2}; p \rangle, | \frac{3}{2}, -\frac{3}{2}; p \rangle$

Table 2: (s,p) block.

| No. | multipole | matrix |
|-----|-----------|--------|
| 5 | symmetry | $z$ |
| | $\mathbb{Q}_1^{(a)}(A_{2u})$ | $\begin{bmatrix} -\frac{\sqrt{3}}{6} & 0 & 0 & \frac{\sqrt{6}}{6} & 0 & 0 \\ 0 & \frac{\sqrt{3}}{6} & 0 & 0 & \frac{\sqrt{6}}{6} & 0 \end{bmatrix}$ |
| 6 | symmetry | $x$ |
| | $\mathbb{Q}_{1,1}^{(a)}(E_u)$ | $\begin{bmatrix} 0 & -\frac{\sqrt{3}}{6} & -\frac{\sqrt{2}}{4} & 0 & \frac{\sqrt{6}}{12} & 0 \\ -\frac{\sqrt{3}}{6} & 0 & 0 & -\frac{\sqrt{6}}{12} & 0 & \frac{\sqrt{2}}{4} \end{bmatrix}$ |

*continued …*

Table 2

| No. | multipole | matrix |
|---|---|---|
| 7 | symmetry | $y$ |
| | $\mathbb{Q}_{1,2}^{(a)}(E_u)$ | $\begin{bmatrix} 0 & \frac{\sqrt{3}i}{6} & -\frac{\sqrt{2}i}{4} & 0 & -\frac{\sqrt{6}i}{12} & 0 \\ -\frac{\sqrt{3}i}{6} & 0 & 0 & -\frac{\sqrt{6}i}{12} & 0 & -\frac{\sqrt{2}i}{4} \end{bmatrix}$ |
| 8 | symmetry | $z$ |
| | $\mathbb{Q}_{1}^{(1,0;a)}(A_{2u})$ | $\begin{bmatrix} \frac{\sqrt{6}}{6} & 0 & 0 & \frac{\sqrt{3}}{6} & 0 & 0 \\ 0 & -\frac{\sqrt{6}}{6} & 0 & 0 & \frac{\sqrt{3}}{6} & 0 \end{bmatrix}$ |
| 9 | symmetry | $x$ |
| | $\mathbb{Q}_{1,1}^{(1,0;a)}(E_u)$ | $\begin{bmatrix} 0 & \frac{\sqrt{6}}{6} & -\frac{1}{4} & 0 & \frac{\sqrt{3}}{12} & 0 \\ \frac{\sqrt{6}}{6} & 0 & 0 & -\frac{\sqrt{3}}{12} & 0 & \frac{1}{4} \end{bmatrix}$ |
| 10 | symmetry | $y$ |
| | $\mathbb{Q}_{1,2}^{(1,0;a)}(E_u)$ | $\begin{bmatrix} 0 & -\frac{\sqrt{6}i}{6} & -\frac{i}{4} & 0 & -\frac{\sqrt{3}i}{12} & 0 \\ \frac{\sqrt{6}i}{6} & 0 & 0 & -\frac{\sqrt{3}i}{12} & 0 & -\frac{i}{4} \end{bmatrix}$ |
| 11 | symmetry | $-\frac{x^2}{2} - \frac{y^2}{2} + z^2$ |
| | $\mathbb{G}_{2}^{(1,-1;a)}(A_{1u})$ | $\begin{bmatrix} 0 & 0 & 0 & \frac{i}{2} & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{i}{2} & 0 \end{bmatrix}$ |
| 12 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |
| | $\mathbb{G}_{2}^{(1,-1;a)}(B_{1u})$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & \frac{i}{2} \\ 0 & 0 & -\frac{i}{2} & 0 & 0 & 0 \end{bmatrix}$ |
| 13 | symmetry | $\sqrt{3}xy$ |
| | $\mathbb{G}_{2}^{(1,-1;a)}(B_{2u})$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & \frac{1}{2} \\ 0 & 0 & \frac{1}{2} & 0 & 0 & 0 \end{bmatrix}$ |
| 14 | symmetry | $\sqrt{3}yz$ |
| | $\mathbb{G}_{2,1}^{(1,-1;a)}(E_u)$ | $\begin{bmatrix} 0 & 0 & \frac{1}{4} & 0 & \frac{\sqrt{3}}{4} & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{3}}{4} & 0 & -\frac{1}{4} \end{bmatrix}$ |
| 15 | symmetry | $-\sqrt{3}xz$ |
| | $\mathbb{G}_{2,2}^{(1,-1;a)}(E_u)$ | $\begin{bmatrix} 0 & 0 & \frac{i}{4} & 0 & -\frac{\sqrt{3}i}{4} & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{3}i}{4} & 0 & \frac{i}{4} \end{bmatrix}$ |
| 16 | symmetry | $1$ |

*continued …*

2

Table 2

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{G}_0^{(1,1;a)}(A_{1u})$ | $\begin{bmatrix} -\frac{i}{2} & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{i}{2} & 0 & 0 & 0 & 0 \end{bmatrix}$ |
| 17 | symmetry | $z$ |
| | $\mathbb{T}_1^{(a)}(A_{2u})$ | $\begin{bmatrix} -\frac{\sqrt{3}i}{6} & 0 & 0 & \frac{\sqrt{6}i}{6} & 0 & 0 \\ 0 & \frac{\sqrt{3}i}{6} & 0 & 0 & \frac{\sqrt{6}i}{6} & 0 \end{bmatrix}$ |
| 18 | symmetry | $x$ |
| | $\mathbb{T}_{1,1}^{(a)}(E_u)$ | $\begin{bmatrix} 0 & -\frac{\sqrt{3}i}{6} & -\frac{\sqrt{2}i}{4} & 0 & \frac{\sqrt{6}i}{12} & 0 \\ -\frac{\sqrt{3}i}{6} & 0 & 0 & -\frac{\sqrt{6}i}{12} & 0 & \frac{\sqrt{2}i}{4} \end{bmatrix}$ |
| 19 | symmetry | $y$ |
| | $\mathbb{T}_{1,2}^{(a)}(E_u)$ | $\begin{bmatrix} 0 & -\frac{\sqrt{3}}{6} & \frac{\sqrt{2}}{4} & 0 & \frac{\sqrt{6}}{12} & 0 \\ \frac{\sqrt{3}}{6} & 0 & 0 & \frac{\sqrt{6}}{12} & 0 & \frac{\sqrt{2}}{4} \end{bmatrix}$ |
| 20 | symmetry | $z$ |
| | $\mathbb{T}_1^{(1,0;a)}(A_{2u})$ | $\begin{bmatrix} -\frac{\sqrt{6}i}{6} & 0 & 0 & -\frac{\sqrt{3}i}{6} & 0 & 0 \\ 0 & \frac{\sqrt{6}i}{6} & 0 & 0 & -\frac{\sqrt{3}i}{6} & 0 \end{bmatrix}$ |
| 21 | symmetry | $x$ |
| | $\mathbb{T}_{1,1}^{(1,0;a)}(E_u)$ | $\begin{bmatrix} 0 & -\frac{\sqrt{6}i}{6} & \frac{i}{4} & 0 & -\frac{\sqrt{3}i}{12} & 0 \\ -\frac{\sqrt{6}i}{6} & 0 & 0 & \frac{\sqrt{3}i}{12} & 0 & -\frac{i}{4} \end{bmatrix}$ |
| 22 | symmetry | $y$ |
| | $\mathbb{T}_{1,2}^{(1,0;a)}(E_u)$ | $\begin{bmatrix} 0 & -\frac{\sqrt{6}}{6} & -\frac{1}{4} & 0 & -\frac{\sqrt{3}}{12} & 0 \\ \frac{\sqrt{6}}{6} & 0 & 0 & -\frac{\sqrt{3}}{12} & 0 & -\frac{1}{4} \end{bmatrix}$ |
| 23 | symmetry | $-\frac{x^2}{2} - \frac{y^2}{2} + z^2$ |
| | $\mathbb{M}_2^{(1,-1;a)}(A_{1u})$ | $\begin{bmatrix} 0 & 0 & 0 & \frac{1}{2} & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{1}{2} & 0 \end{bmatrix}$ |
| 24 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |
| | $\mathbb{M}_2^{(1,-1;a)}(B_{1u})$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & \frac{1}{2} \\ 0 & 0 & -\frac{1}{2} & 0 & 0 & 0 \end{bmatrix}$ |
| 25 | symmetry | $\sqrt{3}xy$ |

Table 2

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{M}_2^{(1,-1;a)}(B_{2u})$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & -\frac{i}{2} \\ 0 & 0 & -\frac{i}{2} & 0 & 0 & 0 \end{bmatrix}$ |
| 26 | symmetry | $\sqrt{3}yz$ |
| | $\mathbb{M}_{2,1}^{(1,-1;a)}(E_u)$ | $\begin{bmatrix} 0 & 0 & -\frac{i}{4} & 0 & -\frac{\sqrt{3}i}{4} & 0 \\ 0 & 0 & 0 & \frac{\sqrt{3}i}{4} & 0 & \frac{i}{4} \end{bmatrix}$ |
| 27 | symmetry | $-\sqrt{3}xz$ |
| | $\mathbb{M}_{2,2}^{(1,-1;a)}(E_u)$ | $\begin{bmatrix} 0 & 0 & \frac{1}{4} & 0 & -\frac{\sqrt{3}}{4} & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{3}}{4} & 0 & \frac{1}{4} \end{bmatrix}$ |
| 28 | symmetry | $1$ |
| | $\mathbb{M}_0^{(1,1;a)}(A_{1u})$ | $\begin{bmatrix} -\frac{1}{2} & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{1}{2} & 0 & 0 & 0 & 0 \end{bmatrix}$ |

bra: $= \langle \frac{1}{2}, \frac{1}{2}; s|, \langle \frac{1}{2}, -\frac{1}{2}; s|$

ket: $= |\frac{3}{2}, \frac{3}{2}; d\rangle, |\frac{3}{2}, \frac{1}{2}; d\rangle, |\frac{3}{2}, -\frac{1}{2}; d\rangle, |\frac{3}{2}, -\frac{3}{2}; d\rangle, |\frac{5}{2}, \frac{5}{2}; d\rangle, |\frac{5}{2}, \frac{3}{2}; d\rangle, |\frac{5}{2}, \frac{1}{2}; d\rangle, |\frac{5}{2}, -\frac{1}{2}; d\rangle, |\frac{5}{2}, -\frac{3}{2}; d\rangle, |\frac{5}{2}, -\frac{5}{2}; d\rangle$

Table 3: (s,d) block.

| No. | multipole | matrix |
|---|---|---|
| 29 | symmetry | $-\frac{x^2}{2} - \frac{y^2}{2} + z^2$ |
| | $\mathbb{Q}_2^{(a)}(A_{1g})$ | $\begin{bmatrix} 0 & -\frac{\sqrt{10}}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{10} & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{10}}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{10} & 0 & 0 \end{bmatrix}$ |
| 30 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |
| | $\mathbb{Q}_2^{(a)}(B_{1g})$ | $\begin{bmatrix} 0 & 0 & 0 & -\frac{\sqrt{10}}{10} & \frac{\sqrt{2}}{4} & 0 & 0 & 0 & \frac{\sqrt{10}}{20} & 0 \\ \frac{\sqrt{10}}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{20} & 0 & 0 & 0 & \frac{\sqrt{2}}{4} \end{bmatrix}$ |
| 31 | symmetry | $\sqrt{3}xy$ |
| | $\mathbb{Q}_2^{(a)}(B_{2g})$ | $\begin{bmatrix} 0 & 0 & 0 & \frac{\sqrt{10}i}{10} & \frac{\sqrt{2}i}{4} & 0 & 0 & 0 & -\frac{\sqrt{10}i}{20} & 0 \\ \frac{\sqrt{10}i}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{20} & 0 & 0 & 0 & -\frac{\sqrt{2}i}{4} \end{bmatrix}$ |
| 32 | symmetry | $\sqrt{3}yz$ |

*continued ...*

Table 3

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{2,1}^{(a)}(E_g)$

$$\begin{bmatrix} \frac{\sqrt{10}i}{20} & 0 & \frac{\sqrt{30}i}{20} & 0 & 0 & -\frac{\sqrt{10}i}{10} & 0 & -\frac{\sqrt{5}i}{10} & 0 & 0 \\ 0 & -\frac{\sqrt{30}i}{20} & 0 & -\frac{\sqrt{10}i}{20} & 0 & 0 & -\frac{\sqrt{5}i}{10} & 0 & -\frac{\sqrt{10}i}{10} & 0 \end{bmatrix}$$

33 symmetry $\sqrt{3}xz$

$\mathbb{Q}_{2,2}^{(a)}(E_g)$

$$\begin{bmatrix} \frac{\sqrt{10}}{20} & 0 & -\frac{\sqrt{30}}{20} & 0 & 0 & -\frac{\sqrt{10}}{10} & 0 & \frac{\sqrt{5}}{10} & 0 & 0 \\ 0 & -\frac{\sqrt{30}}{20} & 0 & \frac{\sqrt{10}}{20} & 0 & 0 & -\frac{\sqrt{5}}{10} & 0 & \frac{\sqrt{10}}{10} & 0 \end{bmatrix}$$

34 symmetry $-\frac{x^2}{2}-\frac{y^2}{2}+z^2$

$\mathbb{Q}_2^{(1,0;a)}(A_{1g})$

$$\begin{bmatrix} 0 & \frac{\sqrt{15}}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{10} & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{15}}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{10} & 0 & 0 \end{bmatrix}$$

35 symmetry $\frac{\sqrt{3}(x-y)(x+y)}{2}$

$\mathbb{Q}_2^{(1,0;a)}(B_{1g})$

$$\begin{bmatrix} 0 & 0 & 0 & \frac{\sqrt{15}}{10} & \frac{\sqrt{3}}{6} & 0 & 0 & 0 & \frac{\sqrt{15}}{30} & 0 \\ -\frac{\sqrt{15}}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{30} & 0 & 0 & 0 & \frac{\sqrt{3}}{6} \end{bmatrix}$$

36 symmetry $\sqrt{3}xy$

$\mathbb{Q}_2^{(1,0;a)}(B_{2g})$

$$\begin{bmatrix} 0 & 0 & 0 & -\frac{\sqrt{15}i}{10} & \frac{\sqrt{3}i}{6} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{30} & 0 \\ -\frac{\sqrt{15}i}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{30} & 0 & 0 & 0 & -\frac{\sqrt{3}i}{6} \end{bmatrix}$$

37 symmetry $\sqrt{3}yz$

$\mathbb{Q}_{2,1}^{(1,0;a)}(E_g)$

$$\begin{bmatrix} -\frac{\sqrt{15}i}{20} & 0 & -\frac{3\sqrt{5}i}{20} & 0 & 0 & -\frac{\sqrt{15}i}{15} & 0 & -\frac{\sqrt{30}i}{30} & 0 & 0 \\ 0 & \frac{3\sqrt{5}i}{20} & 0 & \frac{\sqrt{15}i}{20} & 0 & 0 & -\frac{\sqrt{30}i}{30} & 0 & -\frac{\sqrt{15}i}{15} & 0 \end{bmatrix}$$

38 symmetry $\sqrt{3}xz$

$\mathbb{Q}_{2,2}^{(1,0;a)}(E_g)$

$$\begin{bmatrix} -\frac{\sqrt{15}}{20} & 0 & \frac{3\sqrt{5}}{20} & 0 & 0 & -\frac{\sqrt{15}}{15} & 0 & \frac{\sqrt{30}}{30} & 0 & 0 \\ 0 & \frac{3\sqrt{5}}{20} & 0 & -\frac{\sqrt{15}}{20} & 0 & 0 & -\frac{\sqrt{30}}{30} & 0 & \frac{\sqrt{15}}{15} & 0 \end{bmatrix}$$

39 symmetry $-\frac{z(3x^2+3y^2-2z^2)}{2}$

$\mathbb{G}_3^{(1,-1;a)}(A_{2g})$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & \frac{i}{2} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{i}{2} & 0 & 0 \end{bmatrix}$$

40 symmetry $\sqrt{15}xyz$

$\mathbb{G}_3^{(1,-1;a)}(B_{1g})$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{12} & 0 & 0 & 0 & \frac{\sqrt{30}}{12} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{12} & 0 & 0 & 0 & -\frac{\sqrt{6}}{12} \end{bmatrix}$$

41 symmetry $\frac{\sqrt{15}z(x-y)(x+y)}{2}$

Table 3

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{G}_3^{(1,-1;a)}(B_{2g})$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{12} & 0 & 0 & 0 & \frac{\sqrt{30}i}{12} & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{12} & 0 & 0 & 0 & -\frac{\sqrt{6}i}{12} \end{bmatrix}$ |
| 42 | symmetry | $\frac{x(2x^2-3y^2-3z^2)}{2}$ |
| | $\mathbb{G}_{3,1}^{(1,-1;a)}(E_g,1)$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{8} & 0 & -\frac{i}{4} & 0 & \frac{\sqrt{10}i}{8} \\ 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{8} & 0 & -\frac{i}{4} & 0 & \frac{\sqrt{2}i}{8} & 0 \end{bmatrix}$ |
| 43 | symmetry | $\frac{y(3x^2-2y^2+3z^2)}{2}$ |
| | $\mathbb{G}_{3,2}^{(1,-1;a)}(E_g,1)$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{8} & 0 & \frac{1}{4} & 0 & \frac{\sqrt{10}}{8} \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{8} & 0 & -\frac{1}{4} & 0 & -\frac{\sqrt{2}}{8} & 0 \end{bmatrix}$ |
| 44 | symmetry | $\frac{\sqrt{15}x(y-z)(y+z)}{2}$ |
| | $\mathbb{G}_{3,1}^{(1,-1;a)}(E_g,2)$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{24} & 0 & -\frac{\sqrt{15}i}{12} & 0 & -\frac{\sqrt{6}i}{8} \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{8} & 0 & -\frac{\sqrt{15}i}{12} & 0 & \frac{\sqrt{30}i}{24} & 0 \end{bmatrix}$ |
| 45 | symmetry | $-\frac{\sqrt{15}y(x-z)(x+z)}{2}$ |
| | $\mathbb{G}_{3,2}^{(1,-1;a)}(E_g,2)$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{24} & 0 & \frac{\sqrt{15}}{12} & 0 & -\frac{\sqrt{6}}{8} \\ 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{8} & 0 & -\frac{\sqrt{15}}{12} & 0 & -\frac{\sqrt{30}}{24} & 0 \end{bmatrix}$ |
| 46 | symmetry | $z$ |
| | $\mathbb{G}_1^{(1,1;a)}(A_{2g})$ | $\begin{bmatrix} 0 & -\frac{i}{2} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{i}{2} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$ |
| 47 | symmetry | $x$ |
| | $\mathbb{G}_{1,1}^{(1,1;a)}(E_g)$ | $\begin{bmatrix} \frac{\sqrt{3}i}{4} & 0 & -\frac{i}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{i}{4} & 0 & -\frac{\sqrt{3}i}{4} & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$ |
| 48 | symmetry | $-y$ |
| | $\mathbb{G}_{1,2}^{(1,1;a)}(E_g)$ | $\begin{bmatrix} \frac{\sqrt{3}}{4} & 0 & \frac{1}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{1}{4} & 0 & \frac{\sqrt{3}}{4} & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$ |
| 49 | symmetry | $-\frac{x^2}{2} - \frac{y^2}{2} + z^2$ |
| | $\mathbb{T}_2^{(a)}(A_{1g})$ | $\begin{bmatrix} 0 & -\frac{\sqrt{10}i}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{10} & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{10}i}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{10} & 0 & 0 \end{bmatrix}$ |
| 50 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |

Table 3

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{T}_2^{(a)}(B_{1g})$ | $\begin{bmatrix} 0 & 0 & 0 & -\frac{\sqrt{10}i}{10} & \frac{\sqrt{2}i}{4} & 0 & 0 & 0 & \frac{\sqrt{10}i}{20} & 0 \\ \frac{\sqrt{10}i}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{20} & 0 & 0 & 0 & \frac{\sqrt{2}i}{4} \end{bmatrix}$ |
| 51 | symmetry | $\sqrt{3}xy$ |
| | $\mathbb{T}_2^{(a)}(B_{2g})$ | $\begin{bmatrix} 0 & 0 & 0 & -\frac{\sqrt{10}}{10} & -\frac{\sqrt{2}}{4} & 0 & 0 & 0 & \frac{\sqrt{10}}{20} & 0 \\ -\frac{\sqrt{10}}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{20} & 0 & 0 & 0 & \frac{\sqrt{2}}{4} \end{bmatrix}$ |
| 52 | symmetry | $\sqrt{3}yz$ |
| | $\mathbb{T}_{2,1}^{(a)}(E_g)$ | $\begin{bmatrix} -\frac{\sqrt{10}}{20} & 0 & -\frac{\sqrt{30}}{20} & 0 & 0 & \frac{\sqrt{10}}{10} & 0 & \frac{\sqrt{5}}{10} & 0 & 0 \\ 0 & \frac{\sqrt{30}}{20} & 0 & \frac{\sqrt{10}}{20} & 0 & 0 & \frac{\sqrt{5}}{10} & 0 & \frac{\sqrt{10}}{10} & 0 \end{bmatrix}$ |
| 53 | symmetry | $\sqrt{3}xz$ |
| | $\mathbb{T}_{2,2}^{(a)}(E_g)$ | $\begin{bmatrix} \frac{\sqrt{10}i}{20} & 0 & -\frac{\sqrt{30}i}{20} & 0 & 0 & -\frac{\sqrt{10}i}{10} & 0 & \frac{\sqrt{5}i}{10} & 0 & 0 \\ 0 & -\frac{\sqrt{30}i}{20} & 0 & \frac{\sqrt{10}i}{20} & 0 & 0 & -\frac{\sqrt{5}i}{10} & 0 & \frac{\sqrt{10}i}{10} & 0 \end{bmatrix}$ |
| 54 | symmetry | $-\frac{x^2}{2}-\frac{y^2}{2}+z^2$ |
| | $\mathbb{T}_2^{(1,0;a)}(A_{1g})$ | $\begin{bmatrix} 0 & -\frac{\sqrt{15}i}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{10} & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{15}i}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{10} & 0 & 0 \end{bmatrix}$ |
| 55 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |
| | $\mathbb{T}_2^{(1,0;a)}(B_{1g})$ | $\begin{bmatrix} 0 & 0 & 0 & -\frac{\sqrt{15}i}{10} & -\frac{\sqrt{3}i}{6} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{30} & 0 \\ \frac{\sqrt{15}i}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{30} & 0 & 0 & 0 & -\frac{\sqrt{3}i}{6} \end{bmatrix}$ |
| 56 | symmetry | $\sqrt{3}xy$ |
| | $\mathbb{T}_2^{(1,0;a)}(B_{2g})$ | $\begin{bmatrix} 0 & 0 & 0 & -\frac{\sqrt{15}}{10} & \frac{\sqrt{3}}{6} & 0 & 0 & 0 & -\frac{\sqrt{15}}{30} & 0 \\ -\frac{\sqrt{15}}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{30} & 0 & 0 & 0 & -\frac{\sqrt{3}}{6} \end{bmatrix}$ |
| 57 | symmetry | $\sqrt{3}yz$ |
| | $\mathbb{T}_{2,1}^{(1,0;a)}(E_g)$ | $\begin{bmatrix} -\frac{\sqrt{15}}{20} & 0 & -\frac{3\sqrt{5}}{20} & 0 & 0 & -\frac{\sqrt{15}}{15} & 0 & -\frac{\sqrt{30}}{30} & 0 & 0 \\ 0 & \frac{3\sqrt{5}}{20} & 0 & \frac{\sqrt{15}}{20} & 0 & 0 & -\frac{\sqrt{30}}{30} & 0 & -\frac{\sqrt{15}}{15} & 0 \end{bmatrix}$ |
| 58 | symmetry | $\sqrt{3}xz$ |
| | $\mathbb{T}_{2,2}^{(1,0;a)}(E_g)$ | $\begin{bmatrix} \frac{\sqrt{15}i}{20} & 0 & -\frac{3\sqrt{5}i}{20} & 0 & 0 & \frac{\sqrt{15}i}{15} & 0 & -\frac{\sqrt{30}i}{30} & 0 & 0 \\ 0 & -\frac{3\sqrt{5}i}{20} & 0 & \frac{\sqrt{15}i}{20} & 0 & 0 & \frac{\sqrt{30}i}{30} & 0 & -\frac{\sqrt{15}i}{15} & 0 \end{bmatrix}$ |
| 59 | symmetry | $-\frac{z\left(3x^2+3y^2-2z^2\right)}{2}$ |

Table 3

| No. | multipole | matrix |
|-----|-----------|--------|
| | $\mathbb{M}_3^{(1,-1;a)}(A_{2g})$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{2} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{2} & 0 & 0 \end{bmatrix}$ |
| 60 | symmetry | $\sqrt{15}xyz$ |
| | $\mathbb{M}_3^{(1,-1;a)}(B_{1g})$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{12} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{12} & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{12} & 0 & 0 & 0 & \frac{\sqrt{6}i}{12} \end{bmatrix}$ |
| 61 | symmetry | $\frac{\sqrt{15}z(x-y)(x+y)}{2}$ |
| | $\mathbb{M}_3^{(1,-1;a)}(B_{2g})$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{12} & 0 & 0 & 0 & \frac{\sqrt{30}}{12} & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{12} & 0 & 0 & 0 & -\frac{\sqrt{6}}{12} \end{bmatrix}$ |
| 62 | symmetry | $\frac{x\left(2x^2-3y^2-3z^2\right)}{2}$ |
| | $\mathbb{M}_{3,1}^{(1,-1;a)}(E_g,1)$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{8} & 0 & -\frac{1}{4} & 0 & \frac{\sqrt{10}}{8} \\ 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{8} & 0 & -\frac{1}{4} & 0 & \frac{\sqrt{2}}{8} & 0 \end{bmatrix}$ |
| 63 | symmetry | $\frac{y\left(3x^2-2y^2+3z^2\right)}{2}$ |
| | $\mathbb{M}_{3,2}^{(1,-1;a)}(E_g,1)$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{8} & 0 & -\frac{i}{4} & 0 & -\frac{\sqrt{10}i}{8} \\ 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{8} & 0 & \frac{i}{4} & 0 & \frac{\sqrt{2}i}{8} & 0 \end{bmatrix}$ |
| 64 | symmetry | $\frac{\sqrt{15}x(y-z)(y+z)}{2}$ |
| | $\mathbb{M}_{3,1}^{(1,-1;a)}(E_g,2)$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{24} & 0 & -\frac{\sqrt{15}}{12} & 0 & -\frac{\sqrt{6}}{8} \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{8} & 0 & -\frac{\sqrt{15}}{12} & 0 & \frac{\sqrt{30}}{24} & 0 \end{bmatrix}$ |
| 65 | symmetry | $-\frac{\sqrt{15}y(x-z)(x+z)}{2}$ |
| | $\mathbb{M}_{3,2}^{(1,-1;a)}(E_g,2)$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{24} & 0 & -\frac{\sqrt{15}i}{12} & 0 & \frac{\sqrt{6}i}{8} \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{8} & 0 & \frac{\sqrt{15}i}{12} & 0 & \frac{\sqrt{30}i}{24} & 0 \end{bmatrix}$ |
| 66 | symmetry | $z$ |
| | $\mathbb{M}_1^{(1,1;a)}(A_{2g})$ | $\begin{bmatrix} 0 & -\frac{1}{2} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{1}{2} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$ |
| 67 | symmetry | $x$ |
| | $\mathbb{M}_{1,1}^{(1,1;a)}(E_g)$ | $\begin{bmatrix} \frac{\sqrt{3}}{4} & 0 & -\frac{1}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{1}{4} & 0 & -\frac{\sqrt{3}}{4} & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$ |
| 68 | symmetry | $-y$ |

Table 3

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{M}_{1,2}^{(1,1;a)}(E_g)$ | $\begin{bmatrix} -\frac{\sqrt{3}i}{4} & 0 & -\frac{i}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{i}{4} & 0 & -\frac{\sqrt{3}i}{4} & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$ |

bra: $= \langle \frac{1}{2},\frac{1}{2};s|, \langle \frac{1}{2},-\frac{1}{2};s|$

ket: $= |\frac{5}{2},\frac{5}{2};f\rangle, |\frac{5}{2},\frac{3}{2};f\rangle, |\frac{5}{2},\frac{1}{2};f\rangle, |\frac{5}{2},-\frac{1}{2};f\rangle, |\frac{5}{2},-\frac{3}{2};f\rangle, |\frac{5}{2},-\frac{5}{2};f\rangle, |\frac{7}{2},\frac{7}{2};f\rangle, |\frac{7}{2},\frac{5}{2};f\rangle, |\frac{7}{2},\frac{3}{2};f\rangle, |\frac{7}{2},\frac{1}{2};f\rangle, |\frac{7}{2},-\frac{1}{2};f\rangle, |\frac{7}{2},-\frac{3}{2};f\rangle, |\frac{7}{2},-\frac{5}{2};f\rangle, |\frac{7}{2},-\frac{7}{2};f\rangle$

Table 4: (s,f) block.

| No. | multipole | matrix |
|---|---|---|
| 69 | symmetry | $-\frac{z(3x^2+3y^2-2z^2)}{2}$ |
| | $\mathbb{Q}_3^{(a)}(A_{2u})$ | $\begin{bmatrix} 0 & 0 & -\frac{\sqrt{21}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{7} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{21}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{7} & 0 & 0 & 0 \end{bmatrix}$ |
| 70 | symmetry | $\sqrt{15}xyz$ |
| | $\mathbb{Q}_3^{(a)}(B_{1u})$ | $\begin{bmatrix} -\frac{\sqrt{14}i}{28} & 0 & 0 & 0 & \frac{\sqrt{70}i}{28} & 0 & 0 & \frac{\sqrt{21}i}{14} & 0 & 0 & 0 & -\frac{\sqrt{7}i}{14} & 0 & 0 \\ 0 & \frac{\sqrt{70}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{14}i}{28} & 0 & 0 & \frac{\sqrt{7}i}{14} & 0 & 0 & 0 & -\frac{\sqrt{21}i}{14} & 0 \end{bmatrix}$ |
| 71 | symmetry | $\frac{\sqrt{15}z(x-y)(x+y)}{2}$ |
| | $\mathbb{Q}_3^{(a)}(B_{2u})$ | $\begin{bmatrix} -\frac{\sqrt{14}}{28} & 0 & 0 & 0 & -\frac{\sqrt{70}}{28} & 0 & 0 & \frac{\sqrt{21}}{14} & 0 & 0 & 0 & \frac{\sqrt{7}}{14} & 0 & 0 \\ 0 & \frac{\sqrt{70}}{28} & 0 & 0 & 0 & \frac{\sqrt{14}}{28} & 0 & 0 & \frac{\sqrt{7}}{14} & 0 & 0 & 0 & \frac{\sqrt{21}}{14} & 0 \end{bmatrix}$ |
| 72 | symmetry | $\frac{x(2x^2-3y^2-3z^2)}{2}$ |
| | $\mathbb{Q}_{3,1}^{(a)}(E_u,1)$ | $\begin{bmatrix} 0 & -\frac{\sqrt{42}}{56} & 0 & \frac{\sqrt{21}}{28} & 0 & -\frac{\sqrt{210}}{56} & -\frac{\sqrt{5}}{8} & 0 & \frac{\sqrt{105}}{56} & 0 & -\frac{3\sqrt{7}}{56} & 0 & \frac{\sqrt{35}}{56} & 0 \\ -\frac{\sqrt{210}}{56} & 0 & \frac{\sqrt{21}}{28} & 0 & -\frac{\sqrt{42}}{56} & 0 & 0 & -\frac{\sqrt{35}}{56} & 0 & \frac{3\sqrt{7}}{56} & 0 & -\frac{\sqrt{105}}{56} & 0 & \frac{\sqrt{5}}{8} \end{bmatrix}$ |
| 73 | symmetry | $-\frac{y(3x^2-2y^2+3z^2)}{2}$ |
| | $\mathbb{Q}_{3,2}^{(a)}(E_u,1)$ | $\begin{bmatrix} 0 & -\frac{\sqrt{42}i}{56} & 0 & -\frac{\sqrt{21}i}{28} & 0 & -\frac{\sqrt{210}i}{56} & \frac{\sqrt{5}i}{8} & 0 & \frac{\sqrt{105}i}{56} & 0 & \frac{3\sqrt{7}i}{56} & 0 & \frac{\sqrt{35}i}{56} & 0 \\ \frac{\sqrt{210}i}{56} & 0 & \frac{\sqrt{21}i}{28} & 0 & \frac{\sqrt{42}i}{56} & 0 & 0 & \frac{\sqrt{35}i}{56} & 0 & \frac{3\sqrt{7}i}{56} & 0 & \frac{\sqrt{105}i}{56} & 0 & \frac{\sqrt{5}i}{8} \end{bmatrix}$ |
| 74 | symmetry | $\frac{\sqrt{15}x(y-z)(y+z)}{2}$ |
| | $\mathbb{Q}_{3,1}^{(a)}(E_u,2)$ | $\begin{bmatrix} 0 & -\frac{\sqrt{70}}{56} & 0 & \frac{\sqrt{35}}{28} & 0 & \frac{3\sqrt{14}}{56} & \frac{\sqrt{3}}{8} & 0 & \frac{5\sqrt{7}}{56} & 0 & -\frac{\sqrt{105}}{56} & 0 & -\frac{\sqrt{21}}{56} & 0 \\ \frac{3\sqrt{14}}{56} & 0 & \frac{\sqrt{35}}{28} & 0 & -\frac{\sqrt{70}}{56} & 0 & 0 & \frac{\sqrt{21}}{56} & 0 & \frac{\sqrt{105}}{56} & 0 & -\frac{5\sqrt{7}}{56} & 0 & -\frac{\sqrt{3}}{8} \end{bmatrix}$ |
| 75 | symmetry | $\frac{\sqrt{15}y(x-z)(x+z)}{2}$ |

*continued ...*

Table 4

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{3,2}^{(a)}(E_u,2)$

$$\begin{bmatrix} 0 & -\frac{\sqrt{70}i}{56} & 0 & -\frac{\sqrt{35}i}{28} & 0 & \frac{3\sqrt{14}i}{56} & -\frac{\sqrt{3}i}{8} & 0 & \frac{5\sqrt{7}i}{56} & 0 & \frac{\sqrt{105}i}{56} & 0 & -\frac{\sqrt{21}i}{56} & 0 \\ -\frac{3\sqrt{14}i}{56} & 0 & \frac{\sqrt{35}i}{28} & 0 & \frac{\sqrt{70}i}{56} & 0 & 0 & -\frac{\sqrt{21}i}{56} & 0 & \frac{\sqrt{105}i}{56} & 0 & \frac{5\sqrt{7}i}{56} & 0 & -\frac{\sqrt{3}i}{8} \end{bmatrix}$$

| 76 | symmetry | $-\frac{z\left(3x^2+3y^2-2z^2\right)}{2}$ |

$\mathbb{Q}_3^{(1,0;a)}(A_{2u})$

$$\begin{bmatrix} 0 & 0 & \frac{\sqrt{7}}{7} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}}{14} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{7}}{7} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}}{14} & 0 & 0 & 0 \end{bmatrix}$$

| 77 | symmetry | $\sqrt{15}xyz$ |

$\mathbb{Q}_3^{(1,0;a)}(B_{1u})$

$$\begin{bmatrix} \frac{\sqrt{42}i}{42} & 0 & 0 & 0 & -\frac{\sqrt{210}i}{42} & 0 & 0 & \frac{3\sqrt{7}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{21}i}{28} & 0 & 0 \\ 0 & -\frac{\sqrt{210}i}{42} & 0 & 0 & 0 & \frac{\sqrt{42}i}{42} & 0 & 0 & \frac{\sqrt{21}i}{28} & 0 & 0 & 0 & -\frac{3\sqrt{7}i}{28} & 0 \end{bmatrix}$$

| 78 | symmetry | $\frac{\sqrt{15}z(x-y)(x+y)}{2}$ |

$\mathbb{Q}_3^{(1,0;a)}(B_{2u})$

$$\begin{bmatrix} \frac{\sqrt{42}}{42} & 0 & 0 & 0 & \frac{\sqrt{210}}{42} & 0 & 0 & \frac{3\sqrt{7}}{28} & 0 & 0 & 0 & \frac{\sqrt{21}}{28} & 0 & 0 \\ 0 & -\frac{\sqrt{210}}{42} & 0 & 0 & 0 & -\frac{\sqrt{42}}{42} & 0 & 0 & \frac{\sqrt{21}}{28} & 0 & 0 & 0 & \frac{3\sqrt{7}}{28} & 0 \end{bmatrix}$$

| 79 | symmetry | $\frac{x\left(2x^2-3y^2-3z^2\right)}{2}$ |

$\mathbb{Q}_{3,1}^{(1,0;a)}(E_u,1)$

$$\begin{bmatrix} 0 & \frac{\sqrt{14}}{28} & 0 & -\frac{\sqrt{7}}{14} & 0 & \frac{\sqrt{70}}{28} & -\frac{\sqrt{15}}{16} & 0 & \frac{3\sqrt{35}}{112} & 0 & -\frac{3\sqrt{21}}{112} & 0 & \frac{\sqrt{105}}{112} & 0 \\ \frac{\sqrt{70}}{28} & 0 & -\frac{\sqrt{7}}{14} & 0 & \frac{\sqrt{14}}{28} & 0 & 0 & -\frac{\sqrt{105}}{112} & 0 & \frac{3\sqrt{21}}{112} & 0 & -\frac{3\sqrt{35}}{112} & 0 & \frac{\sqrt{15}}{16} \end{bmatrix}$$

| 80 | symmetry | $-\frac{y\left(3x^2-2y^2+3z^2\right)}{2}$ |

$\mathbb{Q}_{3,2}^{(1,0;a)}(E_u,1)$

$$\begin{bmatrix} 0 & \frac{\sqrt{14}i}{28} & 0 & \frac{\sqrt{7}i}{14} & 0 & \frac{\sqrt{70}i}{28} & \frac{\sqrt{15}i}{16} & 0 & \frac{3\sqrt{35}i}{112} & 0 & \frac{3\sqrt{21}i}{112} & 0 & \frac{\sqrt{105}i}{112} & 0 \\ -\frac{\sqrt{70}i}{28} & 0 & -\frac{\sqrt{7}i}{14} & 0 & -\frac{\sqrt{14}i}{28} & 0 & 0 & \frac{\sqrt{105}i}{112} & 0 & \frac{3\sqrt{21}i}{112} & 0 & \frac{3\sqrt{35}i}{112} & 0 & \frac{\sqrt{15}i}{16} \end{bmatrix}$$

| 81 | symmetry | $\frac{\sqrt{15}x(y-z)(y+z)}{2}$ |

$\mathbb{Q}_{3,1}^{(1,0;a)}(E_u,2)$

$$\begin{bmatrix} 0 & \frac{\sqrt{210}}{84} & 0 & -\frac{\sqrt{105}}{42} & 0 & -\frac{\sqrt{42}}{28} & \frac{3}{16} & 0 & \frac{5\sqrt{21}}{112} & 0 & -\frac{3\sqrt{35}}{112} & 0 & -\frac{3\sqrt{7}}{112} & 0 \\ -\frac{\sqrt{42}}{28} & 0 & -\frac{\sqrt{105}}{42} & 0 & \frac{\sqrt{210}}{84} & 0 & 0 & \frac{3\sqrt{7}}{112} & 0 & \frac{3\sqrt{35}}{112} & 0 & -\frac{5\sqrt{21}}{112} & 0 & -\frac{3}{16} \end{bmatrix}$$

| 82 | symmetry | $\frac{\sqrt{15}y(x-z)(x+z)}{2}$ |

$\mathbb{Q}_{3,2}^{(1,0;a)}(E_u,2)$

$$\begin{bmatrix} 0 & \frac{\sqrt{210}i}{84} & 0 & \frac{\sqrt{105}i}{42} & 0 & -\frac{\sqrt{42}i}{28} & -\frac{3i}{16} & 0 & \frac{5\sqrt{21}i}{112} & 0 & \frac{3\sqrt{35}i}{112} & 0 & -\frac{3\sqrt{7}i}{112} & 0 \\ \frac{\sqrt{42}i}{28} & 0 & -\frac{\sqrt{105}i}{42} & 0 & -\frac{\sqrt{210}i}{84} & 0 & 0 & -\frac{3\sqrt{7}i}{112} & 0 & \frac{3\sqrt{35}i}{112} & 0 & \frac{5\sqrt{21}i}{112} & 0 & -\frac{3i}{16} \end{bmatrix}$$

| 83 | symmetry | $\frac{\sqrt{21}\left(x^4-3x^2y^2-3x^2z^2+y^4-3y^2z^2+z^4\right)}{6}$ |

$\mathbb{G}_4^{(1,-1;a)}(A_{1u},1)$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}i}{12} & 0 & 0 & 0 & \frac{\sqrt{15}i}{12} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{12} & 0 & 0 & 0 & -\frac{\sqrt{21}i}{12} & 0 & 0 & 0 \end{bmatrix}$$

| 84 | symmetry | $-\frac{\sqrt{15}\left(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4\right)}{12}$ |

## Table 4

| No. | multipole | matrix |
|-----|-----------|--------|

$$\mathbb{G}_4^{(1,-1;a)}(A_{1u},2)$$

$$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{12} & 0 & 0 & 0 & -\frac{\sqrt{21}i}{12} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}i}{12} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{12} & 0 & 0 & 0 \end{pmatrix}$$

**85**    symmetry

$$\frac{\sqrt{35}xy(x-y)(x+y)}{2}$$

$$\mathbb{G}_4^{(1,-1;a)}(A_{2u})$$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{2} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{2} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

**86**    symmetry

$$\frac{\sqrt{5}(x-y)(x+y)\left(x^2+y^2-6z^2\right)}{4}$$

$$\mathbb{G}_4^{(1,-1;a)}(B_{1u})$$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{i}{4} & 0 & 0 & 0 & -\frac{\sqrt{3}i}{4} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{4} & 0 & 0 & 0 & \frac{i}{4} & 0 \end{bmatrix}$$

**87**    symmetry

$$-\frac{\sqrt{5}xy\left(x^2+y^2-6z^2\right)}{2}$$

$$\mathbb{G}_4^{(1,-1;a)}(B_{2u})$$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & 0 & \frac{\sqrt{3}}{4} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{4} & 0 & 0 & 0 & -\frac{1}{4} & 0 \end{bmatrix}$$

**88**    symmetry

$$\frac{\sqrt{35}yz(y-z)(y+z)}{2}$$

$$\mathbb{G}_{4,1}^{(1,-1;a)}(E_u,1)$$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{16} & 0 & -\frac{\sqrt{21}}{16} & 0 & -\frac{\sqrt{35}}{16} & 0 & -\frac{\sqrt{7}}{16} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{16} & 0 & \frac{\sqrt{35}}{16} & 0 & \frac{\sqrt{21}}{16} & 0 & \frac{1}{16} \end{bmatrix}$$

**89**    symmetry

$$-\frac{\sqrt{35}xz(x-z)(x+z)}{2}$$

$$\mathbb{G}_{4,2}^{(1,-1;a)}(E_u,1)$$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{i}{16} & 0 & -\frac{\sqrt{21}i}{16} & 0 & \frac{\sqrt{35}i}{16} & 0 & -\frac{\sqrt{7}i}{16} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{16} & 0 & \frac{\sqrt{35}i}{16} & 0 & -\frac{\sqrt{21}i}{16} & 0 & \frac{i}{16} \end{bmatrix}$$

**90**    symmetry

$$\frac{\sqrt{5}yz\left(6x^2-y^2-z^2\right)}{2}$$

$$\mathbb{G}_{4,1}^{(1,-1;a)}(E_u,2)$$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{16} & 0 & -\frac{\sqrt{3}}{16} & 0 & -\frac{\sqrt{5}}{16} & 0 & \frac{7}{16} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{7}{16} & 0 & \frac{\sqrt{5}}{16} & 0 & \frac{\sqrt{3}}{16} & 0 & -\frac{\sqrt{7}}{16} \end{bmatrix}$$

**91**    symmetry

$$\frac{\sqrt{5}xz\left(x^2-6y^2+z^2\right)}{2}$$

$$\mathbb{G}_{4,2}^{(1,-1;a)}(E_u,2)$$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{16} & 0 & -\frac{\sqrt{3}i}{16} & 0 & \frac{\sqrt{5}i}{16} & 0 & \frac{7i}{16} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{7i}{16} & 0 & \frac{\sqrt{5}i}{16} & 0 & -\frac{\sqrt{3}i}{16} & 0 & -\frac{\sqrt{7}i}{16} \end{bmatrix}$$

**92**    symmetry

$$-\frac{x^2}{2}-\frac{y^2}{2}+z^2$$

$$\mathbb{G}_2^{(1,1;a)}(A_{1u})$$

$$\begin{bmatrix} 0 & 0 & -\frac{i}{2} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{i}{2} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

**93**    symmetry

$$\frac{\sqrt{3}(x-y)(x+y)}{2}$$

Table 4

| No. | multipole | matrix |
|---|---|---|
|  | $\mathbb{G}_2^{(1,1;a)}(B_{1u})$ | $\begin{bmatrix} -\frac{\sqrt{30}i}{12} & 0 & 0 & 0 & -\frac{\sqrt{6}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{6}i}{12} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$ |
| 94 | symmetry | $\sqrt{3}xy$ |
|  | $\mathbb{G}_2^{(1,1;a)}(B_{2u})$ | $\begin{bmatrix} \frac{\sqrt{30}}{12} & 0 & 0 & 0 & -\frac{\sqrt{6}}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{6}}{12} & 0 & 0 & 0 & -\frac{\sqrt{30}}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$ |
| 95 | symmetry | $\sqrt{3}yz$ |
|  | $\mathbb{G}_{2,1}^{(1,1;a)}(E_u)$ | $\begin{bmatrix} 0 & -\frac{\sqrt{6}}{6} & 0 & -\frac{\sqrt{3}}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{3}}{6} & 0 & -\frac{\sqrt{6}}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$ |
| 96 | symmetry | $-\sqrt{3}xz$ |
|  | $\mathbb{G}_{2,2}^{(1,1;a)}(E_u)$ | $\begin{bmatrix} 0 & -\frac{\sqrt{6}i}{6} & 0 & \frac{\sqrt{3}i}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{3}i}{6} & 0 & \frac{\sqrt{6}i}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$ |
| 97 | symmetry | $-\frac{z\left(3x^2+3y^2-2z^2\right)}{2}$ |
|  | $\mathbb{T}_3^{(a)}(A_{2u})$ | $\begin{bmatrix} 0 & 0 & -\frac{\sqrt{21}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{7} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{21}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{7} & 0 & 0 & 0 \end{bmatrix}$ |
| 98 | symmetry | $\sqrt{15}xyz$ |
|  | $\mathbb{T}_3^{(a)}(B_{1u})$ | $\begin{bmatrix} \frac{\sqrt{14}}{28} & 0 & 0 & 0 & -\frac{\sqrt{70}}{28} & 0 & 0 & -\frac{\sqrt{21}}{14} & 0 & 0 & 0 & \frac{\sqrt{7}}{14} & 0 & 0 \\ 0 & -\frac{\sqrt{70}}{28} & 0 & 0 & 0 & \frac{\sqrt{14}}{28} & 0 & 0 & -\frac{\sqrt{7}}{14} & 0 & 0 & 0 & \frac{\sqrt{21}}{14} & 0 \end{bmatrix}$ |
| 99 | symmetry | $\frac{\sqrt{15}z(x-y)(x+y)}{2}$ |
|  | $\mathbb{T}_3^{(a)}(B_{2u})$ | $\begin{bmatrix} -\frac{\sqrt{14}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{70}i}{28} & 0 & 0 & \frac{\sqrt{21}i}{14} & 0 & 0 & 0 & \frac{\sqrt{7}i}{14} & 0 & 0 \\ 0 & \frac{\sqrt{70}i}{28} & 0 & 0 & 0 & \frac{\sqrt{14}i}{28} & 0 & 0 & \frac{\sqrt{7}i}{14} & 0 & 0 & 0 & \frac{\sqrt{21}i}{14} & 0 \end{bmatrix}$ |
| 100 | symmetry | $\frac{x\left(2x^2-3y^2-3z^2\right)}{2}$ |
|  | $\mathbb{T}_{3,1}^{(a)}(E_u,1)$ | $\begin{bmatrix} 0 & -\frac{\sqrt{42}i}{56} & 0 & \frac{\sqrt{21}i}{28} & 0 & -\frac{\sqrt{210}i}{56} & -\frac{\sqrt{5}i}{8} & 0 & \frac{\sqrt{105}i}{56} & 0 & -\frac{3\sqrt{7}i}{56} & 0 & \frac{\sqrt{35}i}{56} & 0 \\ -\frac{\sqrt{210}i}{56} & 0 & \frac{\sqrt{21}i}{28} & 0 & -\frac{\sqrt{42}i}{56} & 0 & 0 & -\frac{\sqrt{35}i}{56} & 0 & \frac{3\sqrt{7}i}{56} & 0 & -\frac{\sqrt{105}i}{56} & 0 & \frac{\sqrt{5}i}{8} \end{bmatrix}$ |
| 101 | symmetry | $-\frac{y\left(3x^2-2y^2+3z^2\right)}{2}$ |
|  | $\mathbb{T}_{3,2}^{(a)}(E_u,1)$ | $\begin{bmatrix} 0 & \frac{\sqrt{42}}{56} & 0 & \frac{\sqrt{21}}{28} & 0 & \frac{\sqrt{210}}{56} & -\frac{\sqrt{5}}{8} & 0 & -\frac{\sqrt{105}}{56} & 0 & -\frac{3\sqrt{7}}{56} & 0 & -\frac{\sqrt{35}}{56} & 0 \\ -\frac{\sqrt{210}}{56} & 0 & -\frac{\sqrt{21}}{28} & 0 & -\frac{\sqrt{42}}{56} & 0 & 0 & -\frac{\sqrt{35}}{56} & 0 & -\frac{3\sqrt{7}}{56} & 0 & -\frac{\sqrt{105}}{56} & 0 & -\frac{\sqrt{5}}{8} \end{bmatrix}$ |
| 102 | symmetry | $\frac{\sqrt{15}x(y-z)(y+z)}{2}$ |

*continued ...*

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Table 4

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{T}_{3,1}^{(a)}(E_u,2)$ | $\begin{bmatrix} 0 & -\frac{\sqrt{70}i}{56} & 0 & \frac{\sqrt{35}i}{28} & 0 & \frac{3\sqrt{14}i}{56} & \frac{\sqrt{3}i}{8} & 0 & \frac{5\sqrt{7}i}{56} & 0 & -\frac{\sqrt{105}i}{56} & 0 & -\frac{\sqrt{21}i}{56} & 0 \\ \frac{3\sqrt{14}i}{56} & 0 & \frac{\sqrt{35}i}{28} & 0 & -\frac{\sqrt{70}i}{56} & 0 & 0 & \frac{\sqrt{21}i}{56} & 0 & \frac{\sqrt{105}i}{56} & 0 & -\frac{5\sqrt{7}i}{56} & 0 & -\frac{\sqrt{3}i}{8} \end{bmatrix}$ |
| 103 | symmetry | $\dfrac{\sqrt{15}y(x-z)(x+z)}{2}$ |
| | $\mathbb{T}_{3,2}^{(a)}(E_u,2)$ | $\begin{bmatrix} 0 & \frac{\sqrt{70}}{56} & 0 & \frac{\sqrt{35}}{28} & 0 & -\frac{3\sqrt{14}}{56} & \frac{\sqrt{3}}{8} & 0 & -\frac{5\sqrt{7}}{56} & 0 & -\frac{\sqrt{105}}{56} & 0 & \frac{\sqrt{21}}{56} & 0 \\ \frac{3\sqrt{14}}{56} & 0 & -\frac{\sqrt{35}}{28} & 0 & -\frac{\sqrt{70}}{56} & 0 & 0 & \frac{\sqrt{21}}{56} & 0 & -\frac{\sqrt{105}}{56} & 0 & -\frac{5\sqrt{7}}{56} & 0 & \frac{\sqrt{3}}{8} \end{bmatrix}$ |
| 104 | symmetry | $-\dfrac{z\left(3x^2+3y^2-2z^2\right)}{2}$ |
| | $\mathbb{T}_3^{(1,0;a)}(A_{2u})$ | $\begin{bmatrix} 0 & 0 & -\frac{\sqrt{7}i}{7} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{14} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{7}i}{7} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{14} & 0 & 0 & 0 \end{bmatrix}$ |
| 105 | symmetry | $\sqrt{15}xyz$ |
| | $\mathbb{T}_3^{(1,0;a)}(B_{1u})$ | $\begin{bmatrix} \frac{\sqrt{42}}{42} & 0 & 0 & 0 & -\frac{\sqrt{210}}{42} & 0 & 0 & \frac{3\sqrt{7}}{28} & 0 & 0 & 0 & -\frac{\sqrt{21}}{28} & 0 & 0 \\ 0 & -\frac{\sqrt{210}}{42} & 0 & 0 & 0 & \frac{\sqrt{42}}{42} & 0 & 0 & \frac{\sqrt{21}}{28} & 0 & 0 & 0 & -\frac{3\sqrt{7}}{28} & 0 \end{bmatrix}$ |
| 106 | symmetry | $\dfrac{\sqrt{15}z(x-y)(x+y)}{2}$ |
| | $\mathbb{T}_3^{(1,0;a)}(B_{2u})$ | $\begin{bmatrix} -\frac{\sqrt{42}i}{42} & 0 & 0 & 0 & -\frac{\sqrt{210}i}{42} & 0 & 0 & -\frac{3\sqrt{7}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{21}i}{28} & 0 & 0 \\ 0 & \frac{\sqrt{210}i}{42} & 0 & 0 & 0 & \frac{\sqrt{42}i}{42} & 0 & 0 & -\frac{\sqrt{21}i}{28} & 0 & 0 & 0 & -\frac{3\sqrt{7}i}{28} & 0 \end{bmatrix}$ |
| 107 | symmetry | $\dfrac{x\left(2x^2-3y^2-3z^2\right)}{2}$ |
| | $\mathbb{T}_{3,1}^{(1,0;a)}(E_u,1)$ | $\begin{bmatrix} 0 & -\frac{\sqrt{14}i}{28} & 0 & \frac{\sqrt{7}i}{14} & 0 & -\frac{\sqrt{70}i}{28} & \frac{\sqrt{15}i}{16} & 0 & -\frac{3\sqrt{35}i}{112} & 0 & \frac{3\sqrt{21}i}{112} & 0 & -\frac{\sqrt{105}i}{112} & 0 \\ -\frac{\sqrt{70}i}{28} & 0 & \frac{\sqrt{7}i}{14} & 0 & -\frac{\sqrt{14}i}{28} & 0 & 0 & \frac{\sqrt{105}i}{112} & 0 & -\frac{3\sqrt{21}i}{112} & 0 & \frac{3\sqrt{35}i}{112} & 0 & -\frac{\sqrt{15}i}{16} \end{bmatrix}$ |
| 108 | symmetry | $-\dfrac{y\left(3x^2-2y^2+3z^2\right)}{2}$ |
| | $\mathbb{T}_{3,2}^{(1,0;a)}(E_u,1)$ | $\begin{bmatrix} 0 & \frac{\sqrt{14}}{28} & 0 & \frac{\sqrt{7}}{14} & 0 & \frac{\sqrt{70}}{28} & \frac{\sqrt{15}}{16} & 0 & \frac{3\sqrt{35}}{112} & 0 & \frac{3\sqrt{21}}{112} & 0 & \frac{\sqrt{105}}{112} & 0 \\ -\frac{\sqrt{70}}{28} & 0 & -\frac{\sqrt{7}}{14} & 0 & -\frac{\sqrt{14}}{28} & 0 & 0 & \frac{\sqrt{105}}{112} & 0 & \frac{3\sqrt{21}}{112} & 0 & \frac{3\sqrt{35}}{112} & 0 & \frac{\sqrt{15}}{16} \end{bmatrix}$ |
| 109 | symmetry | $\dfrac{\sqrt{15}x(y-z)(y+z)}{2}$ |
| | $\mathbb{T}_{3,1}^{(1,0;a)}(E_u,2)$ | $\begin{bmatrix} 0 & -\frac{\sqrt{210}i}{84} & 0 & \frac{\sqrt{105}i}{42} & 0 & \frac{\sqrt{42}i}{28} & -\frac{3i}{16} & 0 & -\frac{5\sqrt{21}i}{112} & 0 & \frac{3\sqrt{35}i}{112} & 0 & \frac{3\sqrt{7}i}{112} & 0 \\ \frac{\sqrt{42}i}{28} & 0 & \frac{\sqrt{105}i}{42} & 0 & -\frac{\sqrt{210}i}{84} & 0 & 0 & -\frac{3\sqrt{7}i}{112} & 0 & -\frac{3\sqrt{35}i}{112} & 0 & \frac{5\sqrt{21}i}{112} & 0 & \frac{3i}{16} \end{bmatrix}$ |
| 110 | symmetry | $\dfrac{\sqrt{15}y(x-z)(x+z)}{2}$ |
| | $\mathbb{T}_{3,2}^{(1,0;a)}(E_u,2)$ | $\begin{bmatrix} 0 & \frac{\sqrt{210}}{84} & 0 & \frac{\sqrt{105}}{42} & 0 & -\frac{\sqrt{42}}{28} & -\frac{3}{16} & 0 & \frac{5\sqrt{21}}{112} & 0 & \frac{3\sqrt{35}}{112} & 0 & -\frac{3\sqrt{7}}{112} & 0 \\ \frac{\sqrt{42}}{28} & 0 & -\frac{\sqrt{105}}{42} & 0 & -\frac{\sqrt{210}}{84} & 0 & 0 & -\frac{3\sqrt{7}}{112} & 0 & \frac{3\sqrt{35}}{112} & 0 & \frac{5\sqrt{21}}{112} & 0 & -\frac{3}{16} \end{bmatrix}$ |
| 111 | symmetry | $\dfrac{\sqrt{21}\left(x^4-3x^2y^2-3x^2z^2+y^4-3y^2z^2+z^4\right)}{6}$ |

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Table 4

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{M}_4^{(1,-1;a)}(A_{1u},1)$ | $\begin{bmatrix} 0&0&0&0&0&0&0&0&0&0&\frac{\sqrt{21}}{12}&0&0&0&\frac{\sqrt{15}}{12}\\[4pt] 0&0&0&0&0&0&-\frac{\sqrt{15}}{12}&0&0&0&-\frac{\sqrt{21}}{12}&0&0&0&0 \end{bmatrix}$ |
| 112 | symmetry | $-\dfrac{\sqrt{15}\left(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4\right)}{12}$ |
| | $\mathbb{M}_4^{(1,-1;a)}(A_{1u},2)$ | $\begin{bmatrix} 0&0&0&0&0&0&0&0&0&0&\frac{\sqrt{15}}{12}&0&0&0&-\frac{\sqrt{21}}{12}\\[4pt] 0&0&0&0&0&0&\frac{\sqrt{21}}{12}&0&0&0&-\frac{\sqrt{15}}{12}&0&0&0&0 \end{bmatrix}$ |
| 113 | symmetry | $\dfrac{\sqrt{35}xy(x-y)(x+y)}{2}$ |
| | $\mathbb{M}_4^{(1,-1;a)}(A_{2u})$ | $\begin{bmatrix} 0&0&0&0&0&0&0&0&0&0&0&0&0&0&-\frac{i}{2}\\[4pt] 0&0&0&0&0&0&0&-\frac{i}{2}&0&0&0&0&0&0&0 \end{bmatrix}$ |
| 114 | symmetry | $\dfrac{\sqrt{5}(x-y)(x+y)\left(x^2+y^2-6z^2\right)}{4}$ |
| | $\mathbb{M}_4^{(1,-1;a)}(B_{1u})$ | $\begin{bmatrix} 0&0&0&0&0&0&0&0&-\frac{1}{4}&0&0&0&-\frac{\sqrt{3}}{4}&0&0\\[4pt] 0&0&0&0&0&0&0&0&0&\frac{\sqrt{3}}{4}&0&0&0&\frac{1}{4}&0 \end{bmatrix}$ |
| 115 | symmetry | $-\dfrac{\sqrt{5}xy\left(x^2+y^2-6z^2\right)}{2}$ |
| | $\mathbb{M}_4^{(1,-1;a)}(B_{2u})$ | $\begin{bmatrix} 0&0&0&0&0&0&0&0&\frac{i}{4}&0&0&0&-\frac{\sqrt{3}i}{4}&0&0\\[4pt] 0&0&0&0&0&0&0&0&0&-\frac{\sqrt{3}i}{4}&0&0&0&\frac{i}{4}&0 \end{bmatrix}$ |
| 116 | symmetry | $\dfrac{\sqrt{35}yz(y-z)(y+z)}{2}$ |
| | $\mathbb{M}_{4,1}^{(1,-1;a)}(E_u,1)$ | $\begin{bmatrix} 0&0&0&0&0&0&\frac{i}{16}&0&\frac{\sqrt{21}i}{16}&0&\frac{\sqrt{35}i}{16}&0&\frac{\sqrt{7}i}{16}&0\\[4pt] 0&0&0&0&0&0&0&-\frac{\sqrt{7}i}{16}&0&-\frac{\sqrt{35}i}{16}&0&-\frac{\sqrt{21}i}{16}&0&-\frac{i}{16} \end{bmatrix}$ |
| 117 | symmetry | $-\dfrac{\sqrt{35}xz(x-z)(x+z)}{2}$ |
| | $\mathbb{M}_{4,2}^{(1,-1;a)}(E_u,1)$ | $\begin{bmatrix} 0&0&0&0&0&0&0&\frac{1}{16}&0&-\frac{\sqrt{21}}{16}&0&\frac{\sqrt{35}}{16}&0&-\frac{\sqrt{7}}{16}&0\\[4pt] 0&0&0&0&0&0&0&0&-\frac{\sqrt{7}}{16}&0&\frac{\sqrt{35}}{16}&0&-\frac{\sqrt{21}}{16}&0&\frac{1}{16} \end{bmatrix}$ |
| 118 | symmetry | $\dfrac{\sqrt{5}yz\left(6x^2-y^2-z^2\right)}{2}$ |
| | $\mathbb{M}_{4,1}^{(1,-1;a)}(E_u,2)$ | $\begin{bmatrix} 0&0&0&0&0&0&0&-\frac{\sqrt{7}i}{16}&0&\frac{\sqrt{3}i}{16}&0&\frac{\sqrt{5}i}{16}&0&-\frac{7i}{16}&0\\[4pt] 0&0&0&0&0&0&0&0&\frac{7i}{16}&0&-\frac{\sqrt{5}i}{16}&0&-\frac{\sqrt{3}i}{16}&0&\frac{\sqrt{7}i}{16} \end{bmatrix}$ |
| 119 | symmetry | $\dfrac{\sqrt{5}xz\left(x^2-6y^2+z^2\right)}{2}$ |
| | $\mathbb{M}_{4,2}^{(1,-1;a)}(E_u,2)$ | $\begin{bmatrix} 0&0&0&0&0&0&0&-\frac{\sqrt{7}}{16}&0&-\frac{\sqrt{3}}{16}&0&\frac{\sqrt{5}}{16}&0&\frac{7}{16}&0\\[4pt] 0&0&0&0&0&0&0&0&\frac{7}{16}&0&\frac{\sqrt{5}}{16}&0&-\frac{\sqrt{3}}{16}&0&-\frac{\sqrt{7}}{16} \end{bmatrix}$ |
| 120 | symmetry | $-\dfrac{x^2}{2}-\dfrac{y^2}{2}+z^2$ |

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Table 4

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{M}_2^{(1,1;a)}(A_{1u})$ | $\begin{bmatrix} 0 & 0 & -\frac{1}{2} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{1}{2} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$ |
| 121 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |
| | $\mathbb{M}_2^{(1,1;a)}(B_{1u})$ | $\begin{bmatrix} -\frac{\sqrt{30}}{12} & 0 & 0 & 0 & -\frac{\sqrt{6}}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{6}}{12} & 0 & 0 & 0 & -\frac{\sqrt{30}}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$ |
| 122 | symmetry | $\sqrt{3}xy$ |
| | $\mathbb{M}_2^{(1,1;a)}(B_{2u})$ | $\begin{bmatrix} -\frac{\sqrt{30}i}{12} & 0 & 0 & 0 & \frac{\sqrt{6}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{6}i}{12} & 0 & 0 & 0 & \frac{\sqrt{30}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$ |
| 123 | symmetry | $\sqrt{3}yz$ |
| | $\mathbb{M}_{2,1}^{(1,1;a)}(E_u)$ | $\begin{bmatrix} 0 & \frac{\sqrt{6}i}{6} & 0 & \frac{\sqrt{3}i}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{3}i}{6} & 0 & \frac{\sqrt{6}i}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$ |
| 124 | symmetry | $-\sqrt{3}xz$ |
| | $\mathbb{M}_{2,2}^{(1,1;a)}(E_u)$ | $\begin{bmatrix} 0 & -\frac{\sqrt{6}}{6} & 0 & \frac{\sqrt{3}}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{3}}{6} & 0 & \frac{\sqrt{6}}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$ |

bra: $= \langle \frac{1}{2}, \frac{1}{2}; p|, \langle \frac{1}{2}, -\frac{1}{2}; p|, \langle \frac{3}{2}, \frac{3}{2}; p|, \langle \frac{3}{2}, \frac{1}{2}; p|, \langle \frac{3}{2}, -\frac{1}{2}; p|, \langle \frac{3}{2}, -\frac{3}{2}; p|$
ket: $= |\frac{1}{2}, \frac{1}{2}; p\rangle, |\frac{1}{2}, -\frac{1}{2}; p\rangle, |\frac{3}{2}, \frac{3}{2}; p\rangle, |\frac{3}{2}, \frac{1}{2}; p\rangle, |\frac{3}{2}, -\frac{1}{2}; p\rangle, |\frac{3}{2}, -\frac{3}{2}; p\rangle$

Table 5: (p,p) block.

| No. | multipole | matrix |
|---|---|---|
| 125 | symmetry | $1$ |
| | $\mathbb{Q}_0^{(a)}(A_{1g})$ | $\begin{bmatrix} \frac{\sqrt{6}}{6} & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{6}}{6} & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{6}}{6} & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{6}}{6} & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{6} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{6} \end{bmatrix}$ |

*continued ...*

Table  5

| No. | multipole | matrix |
| --- | --- | --- |
| 126 | symmetry | $-\frac{x^2}{2} - \frac{y^2}{2} + z^2$ |

$$\mathbb{Q}_2^{(a)}(A_{1g}) \quad \begin{bmatrix} 0 & 0 & 0 & -\frac{\sqrt{6}}{6} & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{6} & 0 \\ 0 & 0 & -\frac{\sqrt{3}}{6} & 0 & 0 & 0 \\ -\frac{\sqrt{6}}{6} & 0 & 0 & \frac{\sqrt{3}}{6} & 0 & 0 \\ 0 & \frac{\sqrt{6}}{6} & 0 & 0 & \frac{\sqrt{3}}{6} & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{6} \end{bmatrix}$$

| 127 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |

$$\mathbb{Q}_2^{(a)}(B_{1g}) \quad \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{6} \\ 0 & 0 & \frac{\sqrt{6}}{6} & 0 & 0 & 0 \\ 0 & \frac{\sqrt{6}}{6} & 0 & 0 & -\frac{\sqrt{3}}{6} & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{6} \\ 0 & 0 & -\frac{\sqrt{3}}{6} & 0 & 0 & 0 \\ -\frac{\sqrt{6}}{6} & 0 & 0 & -\frac{\sqrt{3}}{6} & 0 & 0 \end{bmatrix}$$

| 128 | symmetry | $\sqrt{3}xy$ |

$$\mathbb{Q}_2^{(a)}(B_{2g}) \quad \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{6} \\ 0 & 0 & \frac{\sqrt{6}i}{6} & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{6}i}{6} & 0 & 0 & \frac{\sqrt{3}i}{6} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{6} \\ 0 & 0 & -\frac{\sqrt{3}i}{6} & 0 & 0 & 0 \\ -\frac{\sqrt{6}i}{6} & 0 & 0 & -\frac{\sqrt{3}i}{6} & 0 & 0 \end{bmatrix}$$

| 129 | symmetry | $\sqrt{3}yz$ |

$$\mathbb{Q}_{2,1}^{(a)}(E_g) \quad \begin{bmatrix} 0 & 0 & \frac{\sqrt{6}i}{12} & 0 & \frac{\sqrt{2}i}{4} & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{2}i}{4} & 0 & -\frac{\sqrt{6}i}{12} \\ -\frac{\sqrt{6}i}{12} & 0 & 0 & \frac{\sqrt{3}i}{6} & 0 & 0 \\ 0 & \frac{\sqrt{2}i}{4} & -\frac{\sqrt{3}i}{6} & 0 & 0 & 0 \\ -\frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{6} \\ 0 & \frac{\sqrt{6}i}{12} & 0 & 0 & \frac{\sqrt{3}i}{6} & 0 \end{bmatrix}$$

| 130 | symmetry | $\sqrt{3}xz$ |

Table 5

| No. | multipole | matrix |
|-----|-----------|--------|

$$\mathbb{Q}_{2,2}^{(a)}(E_g)$$

$$\begin{bmatrix} 0 & 0 & \frac{\sqrt{6}}{12} & 0 & -\frac{\sqrt{2}}{4} & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{2}}{4} & 0 & \frac{\sqrt{6}}{12} \\ \frac{\sqrt{6}}{12} & 0 & 0 & -\frac{\sqrt{3}}{6} & 0 & 0 \\ 0 & -\frac{\sqrt{2}}{4} & -\frac{\sqrt{3}}{6} & 0 & 0 & 0 \\ -\frac{\sqrt{2}}{4} & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{6} \\ 0 & \frac{\sqrt{6}}{12} & 0 & 0 & \frac{\sqrt{3}}{6} & 0 \end{bmatrix}$$

| 131 | symmetry | $-\frac{x^2}{2} - \frac{y^2}{2} + z^2$ |
|-----|----------|-----|

$$\mathbb{Q}_2^{(1,-1;a)}(A_{1g})$$

$$\begin{bmatrix} 0 & 0 & 0 & -\frac{\sqrt{3}}{6} & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{6} & 0 \\ 0 & 0 & \frac{\sqrt{6}}{6} & 0 & 0 & 0 \\ -\frac{\sqrt{3}}{6} & 0 & 0 & -\frac{\sqrt{6}}{6} & 0 & 0 \\ 0 & \frac{\sqrt{3}}{6} & 0 & 0 & -\frac{\sqrt{6}}{6} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{6} \end{bmatrix}$$

| 132 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |
|-----|----------|-----|

$$\mathbb{Q}_2^{(1,-1;a)}(B_{1g})$$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{6} \\ 0 & 0 & \frac{\sqrt{3}}{6} & 0 & 0 & 0 \\ 0 & \frac{\sqrt{3}}{6} & 0 & 0 & \frac{\sqrt{6}}{6} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{6} \\ 0 & 0 & \frac{\sqrt{6}}{6} & 0 & 0 & 0 \\ -\frac{\sqrt{3}}{6} & 0 & 0 & \frac{\sqrt{6}}{6} & 0 & 0 \end{bmatrix}$$

| 133 | symmetry | $\sqrt{3}xy$ |
|-----|----------|-----|

$$\mathbb{Q}_2^{(1,-1;a)}(B_{2g})$$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{6} \\ 0 & 0 & \frac{\sqrt{3}i}{6} & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{3}i}{6} & 0 & 0 & -\frac{\sqrt{6}i}{6} & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{6} \\ 0 & 0 & \frac{\sqrt{6}i}{6} & 0 & 0 & 0 \\ -\frac{\sqrt{3}i}{6} & 0 & 0 & \frac{\sqrt{6}i}{6} & 0 & 0 \end{bmatrix}$$

| 134 | symmetry | $\sqrt{3}yz$ |
|-----|----------|-----|

*continued ...*

Table 5

| No. | multipole | matrix |
|-----|-----------|--------|

$$\mathbb{Q}_{2,1}^{(1,-1;a)}(E_g) \quad \begin{bmatrix} 0 & 0 & \frac{\sqrt{3}i}{12} & 0 & \frac{i}{4} & 0 \\ 0 & 0 & 0 & -\frac{i}{4} & 0 & -\frac{\sqrt{3}i}{12} \\ -\frac{\sqrt{3}i}{12} & 0 & 0 & -\frac{\sqrt{6}i}{6} & 0 & 0 \\ 0 & \frac{i}{4} & \frac{\sqrt{6}i}{6} & 0 & 0 & 0 \\ -\frac{i}{4} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{6} \\ 0 & \frac{\sqrt{3}i}{12} & 0 & 0 & -\frac{\sqrt{6}i}{6} & 0 \end{bmatrix}$$

| 135 | symmetry | $\sqrt{3}xz$ |
|-----|----------|--------------|

$$\mathbb{Q}_{2,2}^{(1,-1;a)}(E_g) \quad \begin{bmatrix} 0 & 0 & \frac{\sqrt{3}}{12} & 0 & -\frac{1}{4} & 0 \\ 0 & 0 & 0 & -\frac{1}{4} & 0 & \frac{\sqrt{3}}{12} \\ \frac{\sqrt{3}}{12} & 0 & 0 & \frac{\sqrt{6}}{6} & 0 & 0 \\ 0 & -\frac{1}{4} & \frac{\sqrt{6}}{6} & 0 & 0 & 0 \\ -\frac{1}{4} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{6} \\ 0 & \frac{\sqrt{3}}{12} & 0 & 0 & -\frac{\sqrt{6}}{6} & 0 \end{bmatrix}$$

| 136 | symmetry | $1$ |
|-----|----------|-----|

$$\mathbb{Q}_{0}^{(1,1;a)}(A_{1g}) \quad \begin{bmatrix} -\frac{\sqrt{3}}{3} & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{3}}{3} & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{3}}{6} & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{3}}{6} & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{6} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{6} \end{bmatrix}$$

| 137 | symmetry | $z$ |
|-----|----------|-----|

$$\mathbb{G}_{1}^{(1,0;a)}(A_{2g}) \quad \begin{bmatrix} 0 & 0 & 0 & -\frac{i}{2} & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{i}{2} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ \frac{i}{2} & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{i}{2} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

| 138 | symmetry | $x$ |
|-----|----------|-----|

Table 5

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{G}_{1,1}^{(1,0;a)}(E_g)$

$$\begin{bmatrix} 0 & 0 & \frac{\sqrt{3}i}{4} & 0 & -\frac{i}{4} & 0 \\ 0 & 0 & 0 & \frac{i}{4} & 0 & -\frac{\sqrt{3}i}{4} \\ -\frac{\sqrt{3}i}{4} & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{i}{4} & 0 & 0 & 0 & 0 \\ \frac{i}{4} & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{3}i}{4} & 0 & 0 & 0 & 0 \end{bmatrix}$$

| 139 | symmetry | $-y$ |

$\mathbb{G}_{1,2}^{(1,0;a)}(E_g)$

$$\begin{bmatrix} 0 & 0 & \frac{\sqrt{3}}{4} & 0 & \frac{1}{4} & 0 \\ 0 & 0 & 0 & \frac{1}{4} & 0 & \frac{\sqrt{3}}{4} \\ \frac{\sqrt{3}}{4} & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{1}{4} & 0 & 0 & 0 & 0 \\ \frac{1}{4} & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{3}}{4} & 0 & 0 & 0 & 0 \end{bmatrix}$$

| 140 | symmetry | $-\frac{x^2}{2} - \frac{y^2}{2} + z^2$ |

$\mathbb{T}_{2}^{(1,0;a)}(A_{1g})$

$$\begin{bmatrix} 0 & 0 & 0 & \frac{i}{2} & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{i}{2} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ -\frac{i}{2} & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{i}{2} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

| 141 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |

$\mathbb{T}_{2}^{(1,0;a)}(B_{1g})$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & \frac{i}{2} \\ 0 & 0 & -\frac{i}{2} & 0 & 0 & 0 \\ 0 & \frac{i}{2} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ -\frac{i}{2} & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

| 142 | symmetry | $\sqrt{3}xy$ |

*continued ...*

Table 5

| No. | multipole | matrix |
|-----|-----------|--------|
| | $\mathbb{T}_2^{(1,0;a)}(B_{2g})$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & \frac{1}{2} \\ 0 & 0 & \frac{1}{2} & 0 & 0 & 0 \\ 0 & \frac{1}{2} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ \frac{1}{2} & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$ |
| 143 | symmetry | $\sqrt{3}yz$ |
| | $\mathbb{T}_{2,1}^{(1,0;a)}(E_g)$ | $\begin{bmatrix} 0 & 0 & \frac{1}{4} & 0 & \frac{\sqrt{3}}{4} & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{3}}{4} & 0 & -\frac{1}{4} \\ \frac{1}{4} & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{3}}{4} & 0 & 0 & 0 & 0 \\ \frac{\sqrt{3}}{4} & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{1}{4} & 0 & 0 & 0 & 0 \end{bmatrix}$ |
| 144 | symmetry | $\sqrt{3}xz$ |
| | $\mathbb{T}_{2,2}^{(1,0;a)}(E_g)$ | $\begin{bmatrix} 0 & 0 & -\frac{i}{4} & 0 & \frac{\sqrt{3}i}{4} & 0 \\ 0 & 0 & 0 & \frac{\sqrt{3}i}{4} & 0 & -\frac{i}{4} \\ \frac{i}{4} & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{3}i}{4} & 0 & 0 & 0 & 0 \\ -\frac{\sqrt{3}i}{4} & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{i}{4} & 0 & 0 & 0 & 0 \end{bmatrix}$ |
| 145 | symmetry | $z$ |
| | $\mathbb{M}_1^{(a)}(A_{2g})$ | $\begin{bmatrix} \frac{1}{3} & 0 & 0 & \frac{\sqrt{2}}{6} & 0 & 0 \\ 0 & -\frac{1}{3} & 0 & 0 & \frac{\sqrt{2}}{6} & 0 \\ 0 & 0 & \frac{1}{2} & 0 & 0 & 0 \\ \frac{\sqrt{2}}{6} & 0 & 0 & \frac{1}{6} & 0 & 0 \\ 0 & \frac{\sqrt{2}}{6} & 0 & 0 & -\frac{1}{6} & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{1}{2} \end{bmatrix}$ |
| 146 | symmetry | $x$ |

Table 5

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_{1,1}^{(a)}(E_g)$

$$\begin{pmatrix} 0 & \frac{1}{3} & -\frac{\sqrt{6}}{12} & 0 & \frac{\sqrt{2}}{12} & 0 \\ \frac{1}{3} & 0 & 0 & -\frac{\sqrt{2}}{12} & 0 & \frac{\sqrt{6}}{12} \\ -\frac{\sqrt{6}}{12} & 0 & 0 & \frac{\sqrt{3}}{6} & 0 & 0 \\ 0 & -\frac{\sqrt{2}}{12} & \frac{\sqrt{3}}{6} & 0 & \frac{1}{3} & 0 \\ \frac{\sqrt{2}}{12} & 0 & 0 & \frac{1}{3} & 0 & \frac{\sqrt{3}}{6} \\ 0 & \frac{\sqrt{6}}{12} & 0 & 0 & \frac{\sqrt{3}}{6} & 0 \end{pmatrix}$$

| 147 | symmetry | $-y$ |
|---|---|---|

$\mathbb{M}_{1,2}^{(a)}(E_g)$

$$\begin{pmatrix} 0 & \frac{i}{3} & \frac{\sqrt{6}i}{12} & 0 & \frac{\sqrt{2}i}{12} & 0 \\ -\frac{i}{3} & 0 & 0 & \frac{\sqrt{2}i}{12} & 0 & \frac{\sqrt{6}i}{12} \\ -\frac{\sqrt{6}i}{12} & 0 & 0 & \frac{\sqrt{3}i}{6} & 0 & 0 \\ 0 & -\frac{\sqrt{2}i}{12} & -\frac{\sqrt{3}i}{6} & 0 & \frac{i}{3} & 0 \\ -\frac{\sqrt{2}i}{12} & 0 & 0 & -\frac{i}{3} & 0 & \frac{\sqrt{3}i}{6} \\ 0 & -\frac{\sqrt{6}i}{12} & 0 & 0 & -\frac{\sqrt{3}i}{6} & 0 \end{pmatrix}$$

| 148 | symmetry | $z$ |
|---|---|---|

$\mathbb{M}_{1}^{(1,-1;a)}(A_{2g})$

$$\begin{pmatrix} -\frac{\sqrt{6}}{18} & 0 & 0 & -\frac{2\sqrt{3}}{9} & 0 & 0 \\ 0 & \frac{\sqrt{6}}{18} & 0 & 0 & -\frac{2\sqrt{3}}{9} & 0 \\ 0 & 0 & \frac{\sqrt{6}}{6} & 0 & 0 & 0 \\ -\frac{2\sqrt{3}}{9} & 0 & 0 & \frac{\sqrt{6}}{18} & 0 & 0 \\ 0 & -\frac{2\sqrt{3}}{9} & 0 & 0 & -\frac{\sqrt{6}}{18} & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{6} \end{pmatrix}$$

| 149 | symmetry | $x$ |
|---|---|---|

$\mathbb{M}_{1,1}^{(1,-1;a)}(E_g)$

$$\begin{pmatrix} 0 & -\frac{\sqrt{6}}{18} & \frac{1}{3} & 0 & -\frac{\sqrt{3}}{9} & 0 \\ -\frac{\sqrt{6}}{18} & 0 & 0 & \frac{\sqrt{3}}{9} & 0 & -\frac{1}{3} \\ \frac{1}{3} & 0 & 0 & \frac{\sqrt{2}}{6} & 0 & 0 \\ 0 & \frac{\sqrt{3}}{9} & \frac{\sqrt{2}}{6} & 0 & \frac{\sqrt{6}}{9} & 0 \\ -\frac{\sqrt{3}}{9} & 0 & 0 & \frac{\sqrt{6}}{9} & 0 & \frac{\sqrt{2}}{6} \\ 0 & -\frac{1}{3} & 0 & 0 & \frac{\sqrt{2}}{6} & 0 \end{pmatrix}$$

| 150 | symmetry | $-y$ |
|---|---|---|

*continued ...*

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Table 5

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{M}_{1,2}^{(1,-1;a)}(E_g)$ | $\begin{bmatrix} 0 & -\frac{\sqrt{6}i}{18} & -\frac{i}{3} & 0 & -\frac{\sqrt{3}i}{9} & 0 \\ \frac{\sqrt{6}i}{18} & 0 & 0 & -\frac{\sqrt{3}i}{9} & 0 & -\frac{i}{3} \\ \frac{i}{3} & 0 & 0 & \frac{\sqrt{2}i}{6} & 0 & 0 \\ 0 & \frac{\sqrt{3}i}{9} & -\frac{\sqrt{2}i}{6} & 0 & \frac{\sqrt{6}i}{9} & 0 \\ \frac{\sqrt{3}i}{9} & 0 & 0 & -\frac{\sqrt{6}i}{9} & 0 & \frac{\sqrt{2}i}{6} \\ 0 & \frac{i}{3} & 0 & 0 & -\frac{\sqrt{2}i}{6} & 0 \end{bmatrix}$ |
| 151 | symmetry | $-\frac{z(3x^2+3y^2-2z^2)}{2}$ |
| | $\mathbb{M}_3^{(1,-1;a)}(A_{2g})$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{5}}{10} & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{3\sqrt{5}}{10} & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{3\sqrt{5}}{10} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{10} \end{bmatrix}$ |
| 152 | symmetry | $\sqrt{15}xyz$ |
| | $\mathbb{M}_3^{(1,-1;a)}(B_{1g})$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{i}{2} & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{i}{2} \\ 0 & 0 & -\frac{i}{2} & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{i}{2} & 0 & 0 \end{bmatrix}$ |
| 153 | symmetry | $\frac{\sqrt{15}z(x-y)(x+y)}{2}$ |
| | $\mathbb{M}_3^{(1,-1;a)}(B_{2g})$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{1}{2} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{1}{2} \\ 0 & 0 & -\frac{1}{2} & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{1}{2} & 0 & 0 \end{bmatrix}$ |
| 154 | symmetry | $\frac{x(2x^2-3y^2-3z^2)}{2}$ |

*continued ...*

Table 5

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{M}_{3,1}^{(1,-1;a)}(E_g,1)$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{15}}{20} & 0 & -\frac{\sqrt{5}}{4} \\ 0 & 0 & \frac{\sqrt{15}}{20} & 0 & -\frac{3\sqrt{5}}{20} & 0 \\ 0 & 0 & 0 & -\frac{3\sqrt{5}}{20} & 0 & \frac{\sqrt{15}}{20} \\ 0 & 0 & -\frac{\sqrt{5}}{4} & 0 & \frac{\sqrt{15}}{20} & 0 \end{bmatrix}$ |
| 155 | symmetry | $\frac{y(3x^2-2y^2+3z^2)}{2}$ |
| | $\mathbb{M}_{3,2}^{(1,-1;a)}(E_g,1)$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{15}i}{20} & 0 & \frac{\sqrt{5}i}{4} \\ 0 & 0 & -\frac{\sqrt{15}i}{20} & 0 & -\frac{3\sqrt{5}i}{20} & 0 \\ 0 & 0 & 0 & \frac{3\sqrt{5}i}{20} & 0 & \frac{\sqrt{15}i}{20} \\ 0 & 0 & -\frac{\sqrt{5}i}{4} & 0 & -\frac{\sqrt{15}i}{20} & 0 \end{bmatrix}$ |
| 156 | symmetry | $\frac{\sqrt{15}x(y-z)(y+z)}{2}$ |
| | $\mathbb{M}_{3,1}^{(1,-1;a)}(E_g,2)$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{1}{4} & 0 & \frac{\sqrt{3}}{4} \\ 0 & 0 & \frac{1}{4} & 0 & -\frac{\sqrt{3}}{4} & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{3}}{4} & 0 & \frac{1}{4} \\ 0 & 0 & \frac{\sqrt{3}}{4} & 0 & \frac{1}{4} & 0 \end{bmatrix}$ |
| 157 | symmetry | $-\frac{\sqrt{15}y(x-z)(x+z)}{2}$ |
| | $\mathbb{M}_{3,2}^{(1,-1;a)}(E_g,2)$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{i}{4} & 0 & -\frac{\sqrt{3}i}{4} \\ 0 & 0 & -\frac{i}{4} & 0 & -\frac{\sqrt{3}i}{4} & 0 \\ 0 & 0 & 0 & \frac{\sqrt{3}i}{4} & 0 & \frac{i}{4} \\ 0 & 0 & \frac{\sqrt{3}i}{4} & 0 & -\frac{i}{4} & 0 \end{bmatrix}$ |
| 158 | symmetry | $z$ |

*continued ...*

Table 5

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_1^{(1,1;a)}(A_{2g}) = \begin{pmatrix} \frac{\sqrt{30}}{9} & 0 & 0 & -\frac{\sqrt{15}}{18} & 0 & 0 \\ 0 & -\frac{\sqrt{30}}{9} & 0 & 0 & -\frac{\sqrt{15}}{18} & 0 \\ 0 & 0 & -\frac{\sqrt{30}}{30} & 0 & 0 & 0 \\ -\frac{\sqrt{15}}{18} & 0 & 0 & -\frac{\sqrt{30}}{90} & 0 & 0 \\ 0 & -\frac{\sqrt{15}}{18} & 0 & 0 & \frac{\sqrt{30}}{90} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{30} \end{pmatrix}$$

| 159 | symmetry | $x$ |
|---|---|---|

$$\mathbb{M}_{1,1}^{(1,1;a)}(E_g) = \begin{pmatrix} 0 & \frac{\sqrt{30}}{9} & \frac{\sqrt{5}}{12} & 0 & -\frac{\sqrt{15}}{36} & 0 \\ \frac{\sqrt{30}}{9} & 0 & 0 & \frac{\sqrt{15}}{36} & 0 & -\frac{\sqrt{5}}{12} \\ \frac{\sqrt{5}}{12} & 0 & 0 & -\frac{\sqrt{10}}{30} & 0 & 0 \\ 0 & \frac{\sqrt{15}}{36} & -\frac{\sqrt{10}}{30} & 0 & -\frac{\sqrt{30}}{45} & 0 \\ -\frac{\sqrt{15}}{36} & 0 & 0 & -\frac{\sqrt{30}}{45} & 0 & -\frac{\sqrt{10}}{30} \\ 0 & -\frac{\sqrt{5}}{12} & 0 & 0 & -\frac{\sqrt{10}}{30} & 0 \end{pmatrix}$$

| 160 | symmetry | $-y$ |
|---|---|---|

$$\mathbb{M}_{1,2}^{(1,1;a)}(E_g) = \begin{pmatrix} 0 & \frac{\sqrt{30}i}{9} & -\frac{\sqrt{5}i}{12} & 0 & -\frac{\sqrt{15}i}{36} & 0 \\ -\frac{\sqrt{30}i}{9} & 0 & 0 & -\frac{\sqrt{15}i}{36} & 0 & -\frac{\sqrt{5}i}{12} \\ \frac{\sqrt{5}i}{12} & 0 & 0 & -\frac{\sqrt{10}i}{30} & 0 & 0 \\ 0 & \frac{\sqrt{15}i}{36} & \frac{\sqrt{10}i}{30} & 0 & -\frac{\sqrt{30}i}{45} & 0 \\ \frac{\sqrt{15}i}{36} & 0 & 0 & \frac{\sqrt{30}i}{45} & 0 & -\frac{\sqrt{10}i}{30} \\ 0 & \frac{\sqrt{5}i}{12} & 0 & 0 & \frac{\sqrt{10}i}{30} & 0 \end{pmatrix}$$

bra: $= \langle \frac{1}{2}, \frac{1}{2}; p|, \langle \frac{1}{2}, -\frac{1}{2}; p|, \langle \frac{3}{2}, \frac{3}{2}; p|, \langle \frac{3}{2}, \frac{1}{2}; p|, \langle \frac{3}{2}, -\frac{1}{2}; p|, \langle \frac{3}{2}, -\frac{3}{2}; p|$

ket: $= |\frac{3}{2}, \frac{3}{2}; d\rangle, |\frac{3}{2}, \frac{1}{2}; d\rangle, |\frac{3}{2}, -\frac{1}{2}; d\rangle, |\frac{3}{2}, -\frac{3}{2}; d\rangle, |\frac{5}{2}, \frac{5}{2}; d\rangle, |\frac{5}{2}, \frac{3}{2}; d\rangle, |\frac{5}{2}, \frac{1}{2}; d\rangle, |\frac{5}{2}, -\frac{1}{2}; d\rangle, |\frac{5}{2}, -\frac{3}{2}; d\rangle, |\frac{5}{2}, -\frac{5}{2}; d\rangle$

Table 6: (p,d) block.

| No. | multipole | matrix |
|---|---|---|
| 161 | symmetry | $z$ |

*continued ...*

Table 6

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{Q}_1^{(a)}(A_{2u})$$

$$\begin{bmatrix} 0 & \frac{\sqrt{3}}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{3}}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ -\frac{\sqrt{6}}{20} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{10} & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{6}}{60} & 0 & 0 & 0 & 0 & \frac{3}{10} & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{6}}{60} & 0 & 0 & 0 & 0 & \frac{3}{10} & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{6}}{20} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{10} & 0 \end{bmatrix}$$

| 162 | symmetry | $x$ |
|---|---|---|

$$\mathbb{Q}_{1,1}^{(a)}(E_u)$$

$$\begin{bmatrix} -\frac{1}{4} & 0 & \frac{\sqrt{3}}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{3}}{12} & 0 & \frac{1}{4} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{2}}{20} & 0 & 0 & -\frac{\sqrt{30}}{20} & 0 & \frac{\sqrt{3}}{20} & 0 & 0 & 0 \\ -\frac{\sqrt{2}}{20} & 0 & -\frac{\sqrt{6}}{30} & 0 & 0 & -\frac{3\sqrt{2}}{20} & 0 & \frac{3}{20} & 0 & 0 \\ 0 & -\frac{\sqrt{6}}{30} & 0 & -\frac{\sqrt{2}}{20} & 0 & 0 & -\frac{3}{20} & 0 & \frac{3\sqrt{2}}{20} & 0 \\ 0 & 0 & -\frac{\sqrt{2}}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{20} & 0 & \frac{\sqrt{30}}{20} \end{bmatrix}$$

| 163 | symmetry | $y$ |
|---|---|---|

$$\mathbb{Q}_{1,2}^{(a)}(E_u)$$

$$\begin{bmatrix} -\frac{i}{4} & 0 & -\frac{\sqrt{3}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{3}i}{12} & 0 & -\frac{i}{4} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{2}i}{20} & 0 & 0 & -\frac{\sqrt{30}i}{20} & 0 & -\frac{\sqrt{3}i}{20} & 0 & 0 & 0 \\ -\frac{\sqrt{2}i}{20} & 0 & \frac{\sqrt{6}i}{30} & 0 & 0 & -\frac{3\sqrt{2}i}{20} & 0 & -\frac{3i}{20} & 0 & 0 \\ 0 & -\frac{\sqrt{6}i}{30} & 0 & \frac{\sqrt{2}i}{20} & 0 & 0 & -\frac{3i}{20} & 0 & -\frac{3\sqrt{2}i}{20} & 0 \\ 0 & 0 & -\frac{\sqrt{2}i}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{20} & 0 & -\frac{\sqrt{30}i}{20} \end{bmatrix}$$

| 164 | symmetry | $-\frac{z\left(3x^2+3y^2-2z^2\right)}{2}$ |
|---|---|---|

$$\mathbb{Q}_3^{(a)}(A_{2u})$$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{6} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{6} & 0 & 0 \\ \frac{1}{10} & 0 & 0 & 0 & 0 & -\frac{1}{5} & 0 & 0 & 0 & 0 \\ 0 & -\frac{3}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{15} & 0 & 0 & 0 \\ 0 & 0 & \frac{3}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{15} & 0 & 0 \\ 0 & 0 & 0 & -\frac{1}{10} & 0 & 0 & 0 & 0 & -\frac{1}{5} & 0 \end{bmatrix}$$

| 165 | symmetry | $\sqrt{15}xyz$ |
|---|---|---|

*continued ...*

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Table 6

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_3^{(a)}(B_{1u})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{12} & 0 & 0 & 0 & \frac{\sqrt{10}i}{12} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{12} & 0 & 0 & 0 & -\frac{\sqrt{2}i}{12} \\
0 & 0 & -\frac{\sqrt{5}i}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{30} & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{5}i}{10} & \frac{i}{6} & 0 & 0 & 0 & \frac{\sqrt{5}i}{30} & 0 \\
\frac{\sqrt{5}i}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}i}{30} & 0 & 0 & 0 & -\frac{i}{6} \\
0 & -\frac{\sqrt{5}i}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{30} & 0 & 0 & 0
\end{bmatrix}$$

**166**  symmetry  $\dfrac{\sqrt{15}z(x-y)(x+y)}{2}$

$\mathbb{Q}_3^{(a)}(B_{2u})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{12} & 0 & 0 & 0 & -\frac{\sqrt{10}}{12} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{12} & 0 & 0 & 0 & \frac{\sqrt{2}}{12} \\
0 & 0 & \frac{\sqrt{5}}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{30} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{5}}{10} & \frac{1}{6} & 0 & 0 & 0 & -\frac{\sqrt{5}}{30} & 0 \\
\frac{\sqrt{5}}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}}{30} & 0 & 0 & 0 & \frac{1}{6} \\
0 & -\frac{\sqrt{5}}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{30} & 0 & 0 & 0
\end{bmatrix}$$

**167**  symmetry  $\dfrac{x\left(2x^2-3y^2-3z^2\right)}{2}$

$\mathbb{Q}_{3,1}^{(a)}(E_u,1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{24} & 0 & \frac{\sqrt{3}}{12} & 0 & -\frac{\sqrt{30}}{24} \\
0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{24} & 0 & \frac{\sqrt{3}}{12} & 0 & -\frac{\sqrt{6}}{24} & 0 \\
0 & -\frac{\sqrt{3}}{20} & 0 & \frac{1}{4} & -\frac{\sqrt{5}}{40} & 0 & \frac{3\sqrt{2}}{40} & 0 & -\frac{1}{8} & 0 \\
-\frac{\sqrt{3}}{20} & 0 & \frac{3}{20} & 0 & 0 & \frac{7\sqrt{3}}{120} & 0 & -\frac{\sqrt{6}}{120} & 0 & -\frac{\sqrt{15}}{24} \\
0 & \frac{3}{20} & 0 & -\frac{\sqrt{3}}{20} & \frac{\sqrt{15}}{24} & 0 & \frac{\sqrt{6}}{120} & 0 & -\frac{7\sqrt{3}}{120} & 0 \\
\frac{1}{4} & 0 & -\frac{\sqrt{3}}{20} & 0 & 0 & \frac{1}{8} & 0 & -\frac{3\sqrt{2}}{40} & 0 & \frac{\sqrt{5}}{40}
\end{bmatrix}$$

**168**  symmetry  $-\dfrac{y\left(3x^2-2y^2+3z^2\right)}{2}$

$\mathbb{Q}_{3,2}^{(a)}(E_u,1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{24} & 0 & -\frac{\sqrt{3}i}{12} & 0 & -\frac{\sqrt{30}i}{24} \\
0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{24} & 0 & \frac{\sqrt{3}i}{12} & 0 & \frac{\sqrt{6}i}{24} & 0 \\
0 & \frac{\sqrt{3}i}{20} & 0 & \frac{i}{4} & -\frac{\sqrt{5}i}{40} & 0 & -\frac{3\sqrt{2}i}{40} & 0 & -\frac{i}{8} & 0 \\
-\frac{\sqrt{3}i}{20} & 0 & -\frac{3i}{20} & 0 & 0 & \frac{7\sqrt{3}i}{120} & 0 & \frac{\sqrt{6}i}{120} & 0 & -\frac{\sqrt{15}i}{24} \\
0 & \frac{3i}{20} & 0 & \frac{\sqrt{3}i}{20} & -\frac{\sqrt{15}i}{24} & 0 & \frac{\sqrt{6}i}{120} & 0 & \frac{7\sqrt{3}i}{120} & 0 \\
-\frac{i}{4} & 0 & -\frac{\sqrt{3}i}{20} & 0 & 0 & -\frac{i}{8} & 0 & -\frac{3\sqrt{2}i}{40} & 0 & -\frac{\sqrt{5}i}{40}
\end{bmatrix}$$

**169**  symmetry  $\dfrac{\sqrt{15}x(y-z)(y+z)}{2}$

Table 6

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{3,1}^{(a)}(E_u,2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{24} & 0 & \frac{\sqrt{5}}{12} & 0 & \frac{\sqrt{2}}{8} \\
0 & 0 & 0 & 0 & \frac{\sqrt{2}}{8} & 0 & \frac{\sqrt{5}}{12} & 0 & -\frac{\sqrt{10}}{24} & 0 \\
0 & -\frac{\sqrt{5}}{20} & 0 & -\frac{\sqrt{15}}{20} & -\frac{\sqrt{3}}{24} & 0 & \frac{\sqrt{30}}{40} & 0 & \frac{\sqrt{15}}{40} & 0 \\
-\frac{\sqrt{5}}{20} & 0 & \frac{\sqrt{15}}{20} & 0 & 0 & \frac{7\sqrt{5}}{120} & 0 & -\frac{\sqrt{10}}{120} & 0 & \frac{1}{8} \\
0 & \frac{\sqrt{15}}{20} & 0 & -\frac{\sqrt{5}}{20} & -\frac{1}{8} & 0 & \frac{\sqrt{10}}{120} & 0 & -\frac{7\sqrt{5}}{120} & 0 \\
-\frac{\sqrt{15}}{20} & 0 & -\frac{\sqrt{5}}{20} & 0 & 0 & -\frac{\sqrt{15}}{40} & 0 & -\frac{\sqrt{30}}{40} & 0 & \frac{\sqrt{3}}{24}
\end{bmatrix}$$

| 170 | symmetry | $\frac{\sqrt{15}y(x-z)(x+z)}{2}$ |
|---|---|---|

$\mathbb{Q}_{3,2}^{(a)}(E_u,2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{24} & 0 & -\frac{\sqrt{5}i}{12} & 0 & \frac{\sqrt{2}i}{8} \\
0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{8} & 0 & \frac{\sqrt{5}i}{12} & 0 & \frac{\sqrt{10}i}{24} & 0 \\
0 & \frac{\sqrt{5}i}{20} & 0 & -\frac{\sqrt{15}i}{20} & -\frac{\sqrt{3}i}{24} & 0 & -\frac{\sqrt{30}i}{40} & 0 & \frac{\sqrt{15}i}{40} & 0 \\
-\frac{\sqrt{5}i}{20} & 0 & -\frac{\sqrt{15}i}{20} & 0 & 0 & \frac{7\sqrt{5}i}{120} & 0 & \frac{\sqrt{10}i}{120} & 0 & \frac{i}{8} \\
0 & \frac{\sqrt{15}i}{20} & 0 & \frac{\sqrt{5}i}{20} & \frac{i}{8} & 0 & \frac{\sqrt{10}i}{120} & 0 & \frac{7\sqrt{5}i}{120} & 0 \\
\frac{\sqrt{15}i}{20} & 0 & -\frac{\sqrt{5}i}{20} & 0 & 0 & \frac{\sqrt{15}i}{40} & 0 & -\frac{\sqrt{30}i}{40} & 0 & -\frac{\sqrt{3}i}{24}
\end{bmatrix}$$

| 171 | symmetry | $-\frac{z(3x^2+3y^2-2z^2)}{2}$ |
|---|---|---|

$\mathbb{Q}_3^{(1,-1;a)}(A_{2u})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{6} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{6} & 0 & 0 \\
\frac{\sqrt{6}}{60} & 0 & 0 & 0 & 0 & \frac{2\sqrt{6}}{15} & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{6}}{20} & 0 & 0 & 0 & 0 & -\frac{4}{15} & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{6}}{20} & 0 & 0 & 0 & 0 & -\frac{4}{15} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{6}}{60} & 0 & 0 & 0 & 0 & \frac{2\sqrt{6}}{15} & 0
\end{bmatrix}$$

| 172 | symmetry | $\sqrt{15}xyz$ |
|---|---|---|

$\mathbb{Q}_3^{(1,-1;a)}(B_{1u})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{18} & 0 & 0 & 0 & \frac{\sqrt{15}i}{18} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{18} & 0 & 0 & 0 & -\frac{\sqrt{3}i}{18} \\
0 & 0 & -\frac{\sqrt{30}i}{60} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{5}i}{15} & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{30}i}{60} & -\frac{\sqrt{6}i}{9} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{45} & 0 \\
\frac{\sqrt{30}i}{60} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{45} & 0 & 0 & 0 & \frac{\sqrt{6}i}{9} \\
0 & -\frac{\sqrt{30}i}{60} & 0 & 0 & 0 & 0 & \frac{2\sqrt{5}i}{15} & 0 & 0 & 0
\end{bmatrix}$$

| 173 | symmetry | $\frac{\sqrt{15}z(x-y)(x+y)}{2}$ |
|---|---|---|

*continued …*

Table 6

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_3^{(1,-1;a)}(B_{2u})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{18} & 0 & 0 & 0 & -\frac{\sqrt{15}}{18} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{18} & 0 & 0 & 0 & \frac{\sqrt{3}}{18} \\
0 & 0 & \frac{\sqrt{30}}{60} & 0 & 0 & 0 & 0 & \frac{2\sqrt{5}}{15} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{30}}{60} & -\frac{\sqrt{6}}{9} & 0 & 0 & 0 & \frac{\sqrt{30}}{45} & 0 \\
\frac{\sqrt{30}}{60} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{45} & 0 & 0 & 0 & -\frac{\sqrt{6}}{9} \\
0 & -\frac{\sqrt{30}}{60} & 0 & 0 & 0 & 0 & \frac{2\sqrt{5}}{15} & 0 & 0 & 0
\end{bmatrix}$$

**174**  symmetry  $\dfrac{x\left(2x^2-3y^2-3z^2\right)}{2}$

$\mathbb{Q}_{3,1}^{(1,-1;a)}(E_u,1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & -\frac{1}{12} & 0 & \frac{\sqrt{2}}{12} & 0 & -\frac{\sqrt{5}}{12} \\
0 & 0 & 0 & 0 & -\frac{\sqrt{5}}{12} & 0 & \frac{\sqrt{2}}{12} & 0 & -\frac{1}{12} & 0 \\
0 & -\frac{\sqrt{2}}{40} & 0 & \frac{\sqrt{6}}{24} & \frac{\sqrt{30}}{60} & 0 & -\frac{\sqrt{3}}{10} & 0 & \frac{\sqrt{6}}{12} & 0 \\
-\frac{\sqrt{2}}{40} & 0 & \frac{\sqrt{6}}{40} & 0 & 0 & -\frac{7\sqrt{2}}{60} & 0 & \frac{1}{30} & 0 & \frac{\sqrt{10}}{12} \\
0 & \frac{\sqrt{6}}{40} & 0 & -\frac{\sqrt{2}}{40} & -\frac{\sqrt{10}}{12} & 0 & -\frac{1}{30} & 0 & \frac{7\sqrt{2}}{60} & 0 \\
\frac{\sqrt{6}}{24} & 0 & -\frac{\sqrt{2}}{40} & 0 & 0 & -\frac{\sqrt{6}}{12} & 0 & \frac{\sqrt{3}}{10} & 0 & -\frac{\sqrt{30}}{60}
\end{bmatrix}$$

**175**  symmetry  $-\dfrac{y\left(3x^2-2y^2+3z^2\right)}{2}$

$\mathbb{Q}_{3,2}^{(1,-1;a)}(E_u,1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & -\frac{i}{12} & 0 & -\frac{\sqrt{2}i}{12} & 0 & -\frac{\sqrt{5}i}{12} \\
0 & 0 & 0 & 0 & \frac{\sqrt{5}i}{12} & 0 & \frac{\sqrt{2}i}{12} & 0 & \frac{i}{12} & 0 \\
0 & \frac{\sqrt{2}i}{40} & 0 & \frac{\sqrt{6}i}{24} & \frac{\sqrt{30}i}{60} & 0 & \frac{\sqrt{3}i}{10} & 0 & \frac{\sqrt{6}i}{12} & 0 \\
-\frac{\sqrt{2}i}{40} & 0 & -\frac{\sqrt{6}i}{40} & 0 & 0 & -\frac{7\sqrt{2}i}{60} & 0 & -\frac{i}{30} & 0 & \frac{\sqrt{10}i}{12} \\
0 & \frac{\sqrt{6}i}{40} & 0 & \frac{\sqrt{2}i}{40} & \frac{\sqrt{10}i}{12} & 0 & -\frac{i}{30} & 0 & -\frac{7\sqrt{2}i}{60} & 0 \\
-\frac{\sqrt{6}i}{24} & 0 & -\frac{\sqrt{2}i}{40} & 0 & 0 & \frac{\sqrt{6}i}{12} & 0 & \frac{\sqrt{3}i}{10} & 0 & \frac{\sqrt{30}i}{60}
\end{bmatrix}$$

**176**  symmetry  $\dfrac{\sqrt{15}x(y-z)(y+z)}{2}$

$\mathbb{Q}_{3,1}^{(1,-1;a)}(E_u,2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{36} & 0 & \frac{\sqrt{30}}{36} & 0 & \frac{\sqrt{3}}{12} \\
0 & 0 & 0 & 0 & \frac{\sqrt{3}}{12} & 0 & \frac{\sqrt{30}}{36} & 0 & -\frac{\sqrt{15}}{36} & 0 \\
0 & -\frac{\sqrt{30}}{120} & 0 & -\frac{\sqrt{10}}{40} & \frac{\sqrt{2}}{12} & 0 & -\frac{\sqrt{5}}{10} & 0 & -\frac{\sqrt{10}}{20} & 0 \\
-\frac{\sqrt{30}}{120} & 0 & \frac{\sqrt{10}}{40} & 0 & 0 & -\frac{7\sqrt{30}}{180} & 0 & \frac{\sqrt{15}}{90} & 0 & -\frac{\sqrt{6}}{12} \\
0 & \frac{\sqrt{10}}{40} & 0 & -\frac{\sqrt{30}}{120} & \frac{\sqrt{6}}{12} & 0 & -\frac{\sqrt{15}}{90} & 0 & \frac{7\sqrt{30}}{180} & 0 \\
-\frac{\sqrt{10}}{40} & 0 & -\frac{\sqrt{30}}{120} & 0 & 0 & \frac{\sqrt{10}}{20} & 0 & \frac{\sqrt{5}}{10} & 0 & -\frac{\sqrt{2}}{12}
\end{bmatrix}$$

**177**  symmetry  $\dfrac{\sqrt{15}y(x-z)(x+z)}{2}$

*continued …*

Table  6

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{Q}_{3,2}^{(1,-1;a)}(E_u, 2) \quad
\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{36} & 0 & -\frac{\sqrt{30}i}{36} & 0 & \frac{\sqrt{3}i}{12} \\
0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{12} & 0 & \frac{\sqrt{30}i}{36} & 0 & \frac{\sqrt{15}i}{36} & 0 \\
0 & \frac{\sqrt{30}i}{120} & 0 & -\frac{\sqrt{10}i}{40} & \frac{\sqrt{2}i}{12} & 0 & \frac{\sqrt{5}i}{10} & 0 & -\frac{\sqrt{10}i}{20} & 0 \\
-\frac{\sqrt{30}i}{120} & 0 & -\frac{\sqrt{10}i}{40} & 0 & 0 & -\frac{7\sqrt{30}i}{180} & 0 & -\frac{\sqrt{15}i}{90} & 0 & -\frac{\sqrt{6}i}{12} \\
0 & \frac{\sqrt{10}i}{40} & 0 & \frac{\sqrt{30}i}{120} & -\frac{\sqrt{6}i}{12} & 0 & -\frac{\sqrt{15}i}{90} & 0 & -\frac{7\sqrt{30}i}{180} & 0 \\
\frac{\sqrt{10}i}{40} & 0 & -\frac{\sqrt{30}i}{120} & 0 & 0 & -\frac{\sqrt{10}i}{20} & 0 & \frac{\sqrt{5}i}{10} & 0 & \frac{\sqrt{2}i}{12}
\end{bmatrix}$$

**178**  symmetry  $z$

$$\mathbb{Q}_{1}^{(1,0;a)}(A_{2u}) \quad
\begin{bmatrix}
0 & -\frac{\sqrt{6}}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{6}}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{3}}{5} & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{10} & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{3}}{15} & 0 & 0 & 0 & 0 & \frac{3\sqrt{2}}{20} & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{3}}{15} & 0 & 0 & 0 & 0 & \frac{3\sqrt{2}}{20} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{3}}{5} & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{10} & 0
\end{bmatrix}$$

**179**  symmetry  $x$

$$\mathbb{Q}_{1,1}^{(1,0;a)}(E_u) \quad
\begin{bmatrix}
\frac{\sqrt{2}}{8} & 0 & -\frac{\sqrt{6}}{24} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{6}}{24} & 0 & -\frac{\sqrt{2}}{8} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{1}{5} & 0 & 0 & -\frac{\sqrt{15}}{20} & 0 & \frac{\sqrt{6}}{40} & 0 & 0 & 0 \\
\frac{1}{5} & 0 & \frac{2\sqrt{3}}{15} & 0 & 0 & -\frac{3}{20} & 0 & \frac{3\sqrt{2}}{40} & 0 & 0 \\
0 & \frac{2\sqrt{3}}{15} & 0 & \frac{1}{5} & 0 & 0 & -\frac{3\sqrt{2}}{40} & 0 & \frac{3}{20} & 0 \\
0 & 0 & \frac{1}{5} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{40} & 0 & \frac{\sqrt{15}}{20}
\end{bmatrix}$$

**180**  symmetry  $y$

$$\mathbb{Q}_{1,2}^{(1,0;a)}(E_u) \quad
\begin{bmatrix}
\frac{\sqrt{2}i}{8} & 0 & \frac{\sqrt{6}i}{24} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{6}i}{24} & 0 & \frac{\sqrt{2}i}{8} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{i}{5} & 0 & 0 & -\frac{\sqrt{15}i}{20} & 0 & -\frac{\sqrt{6}i}{40} & 0 & 0 & 0 \\
\frac{i}{5} & 0 & -\frac{2\sqrt{3}i}{15} & 0 & 0 & -\frac{3i}{20} & 0 & -\frac{3\sqrt{2}i}{40} & 0 & 0 \\
0 & \frac{2\sqrt{3}i}{15} & 0 & -\frac{i}{5} & 0 & 0 & -\frac{3\sqrt{2}i}{40} & 0 & -\frac{3i}{20} & 0 \\
0 & 0 & \frac{i}{5} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{40} & 0 & -\frac{\sqrt{15}i}{20}
\end{bmatrix}$$

**181**  symmetry  $-\frac{z\left(3x^2+3y^2-2z^2\right)}{2}$

continued …

Table 6

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{Q}_3^{(1,0;a)}(A_{2u})$$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{3} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{3} & 0 & 0 \\
-\frac{\sqrt{3}}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{30} & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{3}}{5} & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{30} & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{3}}{5} & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{30} & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{3}}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{30} & 0
\end{bmatrix}$$

182    symmetry    $\sqrt{15}xyz$

$$\mathbb{Q}_3^{(1,0;a)}(B_{1u})$$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{18} & 0 & 0 & 0 & \frac{\sqrt{30}i}{18} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{18} & 0 & 0 & 0 & -\frac{\sqrt{6}i}{18} \\
0 & 0 & \frac{\sqrt{15}i}{15} & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{60} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{15}i}{15} & \frac{\sqrt{3}i}{36} & 0 & 0 & 0 & \frac{\sqrt{15}i}{180} & 0 \\
-\frac{\sqrt{15}i}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{180} & 0 & 0 & 0 & -\frac{\sqrt{3}i}{36} \\
0 & \frac{\sqrt{15}i}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{60} & 0 & 0 & 0
\end{bmatrix}$$

183    symmetry    $\frac{\sqrt{15}z(x-y)(x+y)}{2}$

$$\mathbb{Q}_3^{(1,0;a)}(B_{2u})$$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{18} & 0 & 0 & 0 & -\frac{\sqrt{30}}{18} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{18} & 0 & 0 & 0 & \frac{\sqrt{6}}{18} \\
0 & 0 & -\frac{\sqrt{15}}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{60} & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{15}}{15} & \frac{\sqrt{3}}{36} & 0 & 0 & 0 & -\frac{\sqrt{15}}{180} & 0 \\
-\frac{\sqrt{15}}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{180} & 0 & 0 & 0 & \frac{\sqrt{3}}{36} \\
0 & \frac{\sqrt{15}}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{60} & 0 & 0 & 0
\end{bmatrix}$$

184    symmetry    $\frac{x(2x^2-3y^2-3z^2)}{2}$

$$\mathbb{Q}_{3,1}^{(1,0;a)}(E_u,1)$$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{12} & 0 & \frac{1}{6} & 0 & -\frac{\sqrt{10}}{12} \\
0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{12} & 0 & \frac{1}{6} & 0 & -\frac{\sqrt{2}}{12} & 0 \\
0 & \frac{1}{10} & 0 & -\frac{\sqrt{3}}{6} & -\frac{\sqrt{15}}{240} & 0 & \frac{\sqrt{6}}{80} & 0 & -\frac{\sqrt{3}}{48} & 0 \\
\frac{1}{10} & 0 & -\frac{\sqrt{3}}{10} & 0 & 0 & \frac{7}{240} & 0 & -\frac{\sqrt{2}}{240} & 0 & -\frac{\sqrt{5}}{48} \\
0 & -\frac{\sqrt{3}}{10} & 0 & \frac{1}{10} & \frac{\sqrt{5}}{48} & 0 & \frac{\sqrt{2}}{240} & 0 & -\frac{7}{240} & 0 \\
-\frac{\sqrt{3}}{6} & 0 & \frac{1}{10} & 0 & 0 & \frac{\sqrt{3}}{48} & 0 & -\frac{\sqrt{6}}{80} & 0 & \frac{\sqrt{15}}{240}
\end{bmatrix}$$

185    symmetry    $-\frac{y(3x^2-2y^2+3z^2)}{2}$

Table 6

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{3,2}^{(1,0;a)}(E_u,1)$

$$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{12} & 0 & -\frac{i}{6} & 0 & -\frac{\sqrt{10}i}{12} \\ 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{12} & 0 & \frac{i}{6} & 0 & \frac{\sqrt{2}i}{12} & 0 \\ 0 & -\frac{i}{10} & 0 & -\frac{\sqrt{3}i}{6} & -\frac{\sqrt{15}i}{240} & 0 & -\frac{\sqrt{6}i}{80} & 0 & -\frac{\sqrt{3}i}{48} & 0 \\ \frac{i}{10} & 0 & \frac{\sqrt{3}i}{10} & 0 & 0 & \frac{7i}{240} & 0 & \frac{\sqrt{2}i}{240} & 0 & -\frac{\sqrt{5}i}{48} \\ 0 & -\frac{\sqrt{3}i}{10} & 0 & -\frac{i}{10} & -\frac{\sqrt{5}i}{48} & 0 & \frac{\sqrt{2}i}{240} & 0 & \frac{7i}{240} & 0 \\ \frac{\sqrt{3}i}{6} & 0 & \frac{i}{10} & 0 & 0 & -\frac{\sqrt{3}i}{48} & 0 & -\frac{\sqrt{6}i}{80} & 0 & -\frac{\sqrt{15}i}{240} \end{pmatrix}$$

| 186 | symmetry | $\frac{\sqrt{15}x(y-z)(y+z)}{2}$ |
|---|---|---|

$\mathbb{Q}_{3,1}^{(1,0;a)}(E_u,2)$

$$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{36} & 0 & \frac{\sqrt{15}}{18} & 0 & \frac{\sqrt{6}}{12} \\ 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{12} & 0 & \frac{\sqrt{15}}{18} & 0 & -\frac{\sqrt{30}}{36} & 0 \\ 0 & \frac{\sqrt{15}}{30} & 0 & \frac{\sqrt{5}}{10} & -\frac{1}{48} & 0 & \frac{\sqrt{10}}{80} & 0 & \frac{\sqrt{5}}{80} & 0 \\ \frac{\sqrt{15}}{30} & 0 & -\frac{\sqrt{5}}{10} & 0 & 0 & \frac{7\sqrt{15}}{720} & 0 & -\frac{\sqrt{30}}{720} & 0 & \frac{\sqrt{3}}{48} \\ 0 & -\frac{\sqrt{5}}{10} & 0 & \frac{\sqrt{15}}{30} & -\frac{\sqrt{3}}{48} & 0 & \frac{\sqrt{30}}{720} & 0 & -\frac{7\sqrt{15}}{720} & 0 \\ \frac{\sqrt{5}}{10} & 0 & \frac{\sqrt{15}}{30} & 0 & 0 & -\frac{\sqrt{5}}{80} & 0 & -\frac{\sqrt{10}}{80} & 0 & \frac{1}{48} \end{pmatrix}$$

| 187 | symmetry | $\frac{\sqrt{15}y(x-z)(x+z)}{2}$ |
|---|---|---|

$\mathbb{Q}_{3,2}^{(1,0;a)}(E_u,2)$

$$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{36} & 0 & -\frac{\sqrt{15}i}{18} & 0 & \frac{\sqrt{6}i}{12} \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{12} & 0 & \frac{\sqrt{15}i}{18} & 0 & \frac{\sqrt{30}i}{36} & 0 \\ 0 & -\frac{\sqrt{15}i}{30} & 0 & \frac{\sqrt{5}i}{10} & -\frac{i}{48} & 0 & -\frac{\sqrt{10}i}{80} & 0 & \frac{\sqrt{5}i}{80} & 0 \\ \frac{\sqrt{15}i}{30} & 0 & \frac{\sqrt{5}i}{10} & 0 & 0 & \frac{7\sqrt{15}i}{720} & 0 & \frac{\sqrt{30}i}{720} & 0 & \frac{\sqrt{3}i}{48} \\ 0 & -\frac{\sqrt{5}i}{10} & 0 & -\frac{\sqrt{15}i}{30} & \frac{\sqrt{3}i}{48} & 0 & \frac{\sqrt{30}i}{720} & 0 & \frac{7\sqrt{15}i}{720} & 0 \\ -\frac{\sqrt{5}i}{10} & 0 & \frac{\sqrt{15}i}{30} & 0 & 0 & \frac{\sqrt{5}i}{80} & 0 & -\frac{\sqrt{10}i}{80} & 0 & -\frac{i}{48} \end{pmatrix}$$

| 188 | symmetry | $z$ |
|---|---|---|

$\mathbb{Q}_{1}^{(1,1;a)}(A_{2u})$

$$\begin{pmatrix} 0 & -\frac{\sqrt{2}}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{2}}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ -\frac{3}{10} & 0 & 0 & 0 & 0 & \frac{1}{10} & 0 & 0 & 0 & 0 \\ 0 & -\frac{1}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{20} & 0 & 0 & 0 \\ 0 & 0 & \frac{1}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{20} & 0 & 0 \\ 0 & 0 & 0 & \frac{3}{10} & 0 & 0 & 0 & 0 & \frac{1}{10} & 0 \end{pmatrix}$$

| 189 | symmetry | $x$ |
|---|---|---|

Table 6

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{Q}_{1,1}^{(1,1;a)}(E_u)$

$$
\begin{pmatrix}
\frac{\sqrt{6}}{8} & 0 & -\frac{\sqrt{2}}{8} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{2}}{8} & 0 & -\frac{\sqrt{6}}{8} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{3}}{10} & 0 & 0 & -\frac{\sqrt{5}}{20} & 0 & \frac{\sqrt{2}}{40} & 0 & 0 & 0 \\
-\frac{\sqrt{3}}{10} & 0 & -\frac{1}{5} & 0 & 0 & -\frac{\sqrt{3}}{20} & 0 & \frac{\sqrt{6}}{40} & 0 & 0 \\
0 & -\frac{1}{5} & 0 & -\frac{\sqrt{3}}{10} & 0 & 0 & -\frac{\sqrt{6}}{40} & 0 & \frac{\sqrt{3}}{20} & 0 \\
0 & 0 & -\frac{\sqrt{3}}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{40} & 0 & \frac{\sqrt{5}}{20}
\end{pmatrix}
$$

| 190 | symmetry | $y$ |

$\mathbb{Q}_{1,2}^{(1,1;a)}(E_u)$

$$
\begin{bmatrix}
\frac{\sqrt{6}i}{8} & 0 & \frac{\sqrt{2}i}{8} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{2}i}{8} & 0 & \frac{\sqrt{6}i}{8} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{3}i}{10} & 0 & 0 & -\frac{\sqrt{5}i}{20} & 0 & -\frac{\sqrt{2}i}{40} & 0 & 0 & 0 \\
-\frac{\sqrt{3}i}{10} & 0 & \frac{i}{5} & 0 & 0 & -\frac{\sqrt{3}i}{20} & 0 & -\frac{\sqrt{6}i}{40} & 0 & 0 \\
0 & -\frac{i}{5} & 0 & \frac{\sqrt{3}i}{10} & 0 & 0 & -\frac{\sqrt{6}i}{40} & 0 & -\frac{\sqrt{3}i}{20} & 0 \\
0 & 0 & -\frac{\sqrt{3}i}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{40} & 0 & -\frac{\sqrt{5}i}{20}
\end{bmatrix}
$$

| 191 | symmetry | $-\frac{x^2}{2} - \frac{y^2}{2} + z^2$ |

$\mathbb{G}_2^{(a)}(A_{1u})$

$$
\begin{bmatrix}
0 & \frac{\sqrt{5}i}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{30} & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{5}i}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{30} & 0 & 0 \\
-\frac{\sqrt{10}i}{20} & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{10} & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{10}i}{20} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{30} & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{10}i}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{30} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{10}i}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{10} & 0
\end{bmatrix}
$$

| 192 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |

$\mathbb{G}_2^{(a)}(B_{1u})$

$$
\begin{bmatrix}
0 & 0 & 0 & \frac{\sqrt{5}i}{10} & \frac{i}{6} & 0 & 0 & 0 & \frac{\sqrt{5}i}{30} & 0 \\
-\frac{\sqrt{5}i}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{5}i}{30} & 0 & 0 & 0 & \frac{i}{6} \\
0 & 0 & -\frac{\sqrt{10}i}{20} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{30} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{10}i}{20} & -\frac{\sqrt{2}i}{6} & 0 & 0 & 0 & \frac{\sqrt{10}i}{15} & 0 \\
-\frac{\sqrt{10}i}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{15} & 0 & 0 & 0 & \frac{\sqrt{2}i}{6} \\
0 & -\frac{\sqrt{10}i}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{30} & 0 & 0 & 0
\end{bmatrix}
$$

| 193 | symmetry | $\sqrt{3}xy$ |

*continued …*

Table 6

| No. | multipole | matrix |
|---|---|---|
|  | $\mathbb{G}_2^{(a)}(B_{2u})$ | $\begin{bmatrix} 0 & 0 & 0 & \frac{\sqrt{5}}{10} & -\frac{1}{6} & 0 & 0 & 0 & \frac{\sqrt{5}}{30} & 0 \\ \frac{\sqrt{5}}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}}{30} & 0 & 0 & 0 & \frac{1}{6} \\ 0 & 0 & -\frac{\sqrt{10}}{20} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{30} & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{10}}{20} & \frac{\sqrt{2}}{6} & 0 & 0 & 0 & \frac{\sqrt{10}}{15} & 0 \\ \frac{\sqrt{10}}{20} & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{15} & 0 & 0 & 0 & \frac{\sqrt{2}}{6} \\ 0 & \frac{\sqrt{10}}{20} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{30} & 0 & 0 & 0 \end{bmatrix}$ |
| 194 | symmetry | $\sqrt{3}yz$ |
|  | $\mathbb{G}_{2,1}^{(a)}(E_u)$ | $\begin{bmatrix} \frac{\sqrt{5}}{20} & 0 & \frac{\sqrt{15}}{20} & 0 & 0 & \frac{\sqrt{5}}{15} & 0 & \frac{\sqrt{10}}{30} & 0 & 0 \\ 0 & -\frac{\sqrt{15}}{20} & 0 & -\frac{\sqrt{5}}{20} & 0 & 0 & \frac{\sqrt{10}}{30} & 0 & \frac{\sqrt{5}}{15} & 0 \\ 0 & -\frac{\sqrt{10}}{20} & 0 & 0 & \frac{\sqrt{6}}{12} & 0 & \frac{\sqrt{15}}{20} & 0 & 0 & 0 \\ \frac{\sqrt{10}}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{60} & 0 & \frac{\sqrt{5}}{12} & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{10}}{20} & 0 & 0 & -\frac{\sqrt{5}}{12} & 0 & \frac{\sqrt{10}}{60} & 0 \\ 0 & 0 & -\frac{\sqrt{10}}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{20} & 0 & -\frac{\sqrt{6}}{12} \end{bmatrix}$ |
| 195 | symmetry | $-\sqrt{3}xz$ |
|  | $\mathbb{G}_{2,2}^{(a)}(E_u)$ | $\begin{bmatrix} \frac{\sqrt{5}i}{20} & 0 & -\frac{\sqrt{15}i}{20} & 0 & 0 & \frac{\sqrt{5}i}{15} & 0 & -\frac{\sqrt{10}i}{30} & 0 & 0 \\ 0 & -\frac{\sqrt{15}i}{20} & 0 & \frac{\sqrt{5}i}{20} & 0 & 0 & \frac{\sqrt{10}i}{30} & 0 & -\frac{\sqrt{5}i}{15} & 0 \\ 0 & \frac{\sqrt{10}i}{20} & 0 & 0 & \frac{\sqrt{6}i}{12} & 0 & -\frac{\sqrt{15}i}{20} & 0 & 0 & 0 \\ \frac{\sqrt{10}i}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{60} & 0 & -\frac{\sqrt{5}i}{12} & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{10}i}{20} & 0 & 0 & -\frac{\sqrt{5}i}{12} & 0 & -\frac{\sqrt{10}i}{60} & 0 \\ 0 & 0 & -\frac{\sqrt{10}i}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{20} & 0 & \frac{\sqrt{6}i}{12} \end{bmatrix}$ |
| 196 | symmetry | $-\frac{x^2}{2} - \frac{y^2}{2} + z^2$ |
|  | $\mathbb{G}_2^{(1,-1;a)}(A_{1u})$ | $\begin{bmatrix} 0 & -\frac{\sqrt{2}i}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{5} & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{2}i}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{5} & 0 & 0 \\ \frac{i}{10} & 0 & 0 & 0 & 0 & \frac{3i}{10} & 0 & 0 & 0 & 0 \\ 0 & -\frac{i}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{20} & 0 & 0 & 0 \\ 0 & 0 & -\frac{i}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{20} & 0 & 0 \\ 0 & 0 & 0 & \frac{i}{10} & 0 & 0 & 0 & 0 & -\frac{3i}{10} & 0 \end{bmatrix}$ |
| 197 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |

*continued ...*

Table 6

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_2^{(1,-1;a)}(B_{1u})$

$$\begin{pmatrix}
0 & 0 & 0 & -\frac{\sqrt{2}i}{20} & -\frac{\sqrt{10}i}{10} & 0 & 0 & 0 & -\frac{\sqrt{2}i}{10} & 0 \\
\frac{\sqrt{2}i}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{10} & 0 & 0 & 0 & -\frac{\sqrt{10}i}{10} \\
0 & 0 & \frac{i}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{20} & 0 & 0 \\
0 & 0 & 0 & \frac{i}{10} & -\frac{\sqrt{5}i}{10} & 0 & 0 & 0 & \frac{i}{5} & 0 \\
\frac{i}{10} & 0 & 0 & 0 & 0 & -\frac{i}{5} & 0 & 0 & 0 & \frac{\sqrt{5}i}{10} \\
0 & \frac{i}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{20} & 0 & 0 & 0
\end{pmatrix}$$

| 198 | symmetry | $\sqrt{3}xy$ |
|---|---|---|

$\mathbb{G}_2^{(1,-1;a)}(B_{2u})$

$$\begin{pmatrix}
0 & 0 & 0 & -\frac{\sqrt{2}}{20} & \frac{\sqrt{10}}{10} & 0 & 0 & 0 & -\frac{\sqrt{2}}{10} & 0 \\
-\frac{\sqrt{2}}{20} & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{10} & 0 & 0 & 0 & -\frac{\sqrt{10}}{10} \\
0 & 0 & \frac{1}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{20} & 0 & 0 \\
0 & 0 & 0 & \frac{1}{10} & \frac{\sqrt{5}}{10} & 0 & 0 & 0 & \frac{1}{5} & 0 \\
-\frac{1}{10} & 0 & 0 & 0 & 0 & \frac{1}{5} & 0 & 0 & 0 & \frac{\sqrt{5}}{10} \\
0 & -\frac{1}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{20} & 0 & 0 & 0
\end{pmatrix}$$

| 199 | symmetry | $\sqrt{3}yz$ |
|---|---|---|

$\mathbb{G}_{2,1}^{(1,-1;a)}(E_u)$

$$\begin{pmatrix}
-\frac{\sqrt{2}}{40} & 0 & -\frac{\sqrt{6}}{40} & 0 & 0 & -\frac{\sqrt{2}}{5} & 0 & -\frac{1}{5} & 0 & 0 \\
0 & \frac{\sqrt{6}}{40} & 0 & \frac{\sqrt{2}}{40} & 0 & 0 & -\frac{1}{5} & 0 & -\frac{\sqrt{2}}{5} & 0 \\
0 & \frac{1}{10} & 0 & 0 & \frac{\sqrt{15}}{20} & 0 & \frac{3\sqrt{6}}{40} & 0 & 0 & 0 \\
-\frac{1}{10} & 0 & 0 & 0 & 0 & -\frac{1}{20} & 0 & \frac{\sqrt{2}}{8} & 0 & 0 \\
0 & 0 & 0 & -\frac{1}{10} & 0 & 0 & -\frac{\sqrt{2}}{8} & 0 & \frac{1}{20} & 0 \\
0 & 0 & \frac{1}{10} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{6}}{40} & 0 & -\frac{\sqrt{15}}{20}
\end{pmatrix}$$

| 200 | symmetry | $-\sqrt{3}xz$ |
|---|---|---|

$\mathbb{G}_{2,2}^{(1,-1;a)}(E_u)$

$$\begin{pmatrix}
-\frac{\sqrt{2}i}{40} & 0 & \frac{\sqrt{6}i}{40} & 0 & 0 & -\frac{\sqrt{2}i}{5} & 0 & \frac{i}{5} & 0 & 0 \\
0 & \frac{\sqrt{6}i}{40} & 0 & -\frac{\sqrt{2}i}{40} & 0 & 0 & -\frac{i}{5} & 0 & \frac{\sqrt{2}i}{5} & 0 \\
0 & -\frac{i}{10} & 0 & 0 & \frac{\sqrt{15}i}{20} & 0 & -\frac{3\sqrt{6}i}{40} & 0 & 0 & 0 \\
-\frac{i}{10} & 0 & 0 & 0 & 0 & -\frac{i}{20} & 0 & -\frac{\sqrt{2}i}{8} & 0 & 0 \\
0 & 0 & 0 & \frac{i}{10} & 0 & 0 & -\frac{\sqrt{2}i}{8} & 0 & -\frac{i}{20} & 0 \\
0 & 0 & \frac{i}{10} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{6}i}{40} & 0 & \frac{\sqrt{15}i}{20}
\end{pmatrix}$$

| 201 | symmetry | $\frac{\sqrt{21}\left(x^4-3x^2y^2-3x^2z^2+y^4-3y^2z^2+z^4\right)}{6}$ |
|---|---|---|

Table 6

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_4^{(1,-1;a)}(A_{1u},1)$

$$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{12} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{12} \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{4} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{4} & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{12} & 0 & 0 & 0 & \frac{\sqrt{3}i}{12} & 0 \end{pmatrix}$$

**202**    symmetry    $-\frac{\sqrt{15}\left(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4\right)}{12}$

$\mathbb{G}_4^{(1,-1;a)}(A_{1u},2)$

$$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}i}{84} & 0 & 0 & 0 & \frac{\sqrt{21}i}{12} \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{28} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{28} & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{12} & 0 & 0 & 0 & \frac{\sqrt{105}i}{84} & 0 \end{pmatrix}$$

**203**    symmetry    $\frac{\sqrt{35}xy(x-y)(x+y)}{2}$

$\mathbb{G}_4^{(1,-1;a)}(A_{2u})$

$$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{2} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{1}{2} & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

**204**    symmetry    $\frac{\sqrt{5}(x-y)(x+y)\left(x^2+y^2-6z^2\right)}{4}$

$\mathbb{G}_4^{(1,-1;a)}(B_{1u})$

$$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{28} & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{105}i}{28} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}i}{28} & 0 & 0 & 0 & \frac{\sqrt{21}i}{28} \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{28} & 0 & 0 & 0 \end{pmatrix}$$

**205**    symmetry    $-\frac{\sqrt{5}xy\left(x^2+y^2-6z^2\right)}{2}$

Table 6

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{G}_4^{(1,-1;a)}(B_{2u}) \quad \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{28} & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{21}}{28} & 0 & 0 & 0 & \frac{\sqrt{105}}{28} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}}{28} & 0 & 0 & 0 & -\frac{\sqrt{21}}{28} \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{28} & 0 & 0 & 0 \end{bmatrix}$$

| 206 | symmetry | $\dfrac{\sqrt{35}yz(y-z)(y+z)}{2}$ |
|---|---|---|

$$\mathbb{G}_{4,1}^{(1,-1;a)}(E_u,1) \quad \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{1}{16} & 0 & \frac{\sqrt{10}}{16} & 0 & \frac{\sqrt{5}}{16} & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{16} & 0 & -\frac{\sqrt{30}}{16} & 0 & -\frac{\sqrt{3}}{16} \\ 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{16} & 0 & \frac{\sqrt{30}}{16} & 0 & \frac{\sqrt{15}}{16} & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}}{16} & 0 & -\frac{\sqrt{10}}{16} & 0 & -\frac{1}{16} \end{bmatrix}$$

| 207 | symmetry | $-\dfrac{\sqrt{35}xz(x-z)(x+z)}{2}$ |
|---|---|---|

$$\mathbb{G}_{4,2}^{(1,-1;a)}(E_u,1) \quad \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{i}{16} & 0 & -\frac{\sqrt{10}i}{16} & 0 & \frac{\sqrt{5}i}{16} & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{16} & 0 & \frac{\sqrt{30}i}{16} & 0 & -\frac{\sqrt{3}i}{16} \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{16} & 0 & \frac{\sqrt{30}i}{16} & 0 & -\frac{\sqrt{15}i}{16} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}i}{16} & 0 & -\frac{\sqrt{10}i}{16} & 0 & \frac{i}{16} \end{bmatrix}$$

| 208 | symmetry | $\dfrac{\sqrt{5}yz\left(6x^2-y^2-z^2\right)}{2}$ |
|---|---|---|

$$\mathbb{G}_{4,1}^{(1,-1;a)}(E_u,2) \quad \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{112} & 0 & \frac{\sqrt{70}}{112} & 0 & -\frac{\sqrt{35}}{16} & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}}{112} & 0 & -\frac{\sqrt{210}}{112} & 0 & \frac{\sqrt{21}}{16} \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{21}}{16} & 0 & \frac{\sqrt{210}}{112} & 0 & \frac{\sqrt{105}}{112} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{35}}{16} & 0 & -\frac{\sqrt{70}}{112} & 0 & -\frac{\sqrt{7}}{112} \end{bmatrix}$$

| 209 | symmetry | $\dfrac{\sqrt{5}xz\left(x^2-6y^2+z^2\right)}{2}$ |
|---|---|---|

Table  6

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{G}_{4,2}^{(1,-1;a)}(E_u,2) = \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{112} & 0 & -\frac{\sqrt{70}i}{112} & 0 & -\frac{\sqrt{35}i}{16} & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}i}{112} & 0 & \frac{\sqrt{210}i}{112} & 0 & \frac{\sqrt{21}i}{16} \\ 0 & 0 & 0 & 0 & \frac{\sqrt{21}i}{16} & 0 & \frac{\sqrt{210}i}{112} & 0 & -\frac{\sqrt{105}i}{112} & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{35}i}{16} & 0 & -\frac{\sqrt{70}i}{112} & 0 & \frac{\sqrt{7}i}{112} \end{pmatrix}$$

**210**  symmetry  $\quad -\frac{x^2}{2} - \frac{y^2}{2} + z^2$

$$\mathbb{G}_{2}^{(1,0;a)}(A_{1u}) = \begin{pmatrix} 0 & \frac{\sqrt{30}i}{60} & 0 & 0 & 0 & -\frac{2\sqrt{5}i}{15} & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{30}i}{60} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{5}i}{15} & 0 \\ -\frac{\sqrt{15}i}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{30} & 0 & 0 & 0 \\ 0 & \frac{\sqrt{15}i}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{60} & 0 & 0 \\ 0 & 0 & \frac{\sqrt{15}i}{15} & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{60} & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{15}i}{15} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{30} \end{pmatrix}$$

**211**  symmetry  $\quad \frac{\sqrt{3}(x-y)(x+y)}{2}$

$$\mathbb{G}_{2}^{(1,0;a)}(B_{1u}) = \begin{pmatrix} 0 & 0 & 0 & \frac{\sqrt{30}i}{60} & -\frac{\sqrt{6}i}{9} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{45} \\ -\frac{\sqrt{30}i}{60} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{45} & 0 & 0 & -\frac{\sqrt{6}i}{9} \\ 0 & 0 & -\frac{\sqrt{15}i}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{60} & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{15}i}{15} & \frac{\sqrt{3}i}{18} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{45} \\ -\frac{\sqrt{15}i}{15} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{45} & 0 & 0 & -\frac{\sqrt{3}i}{18} \\ 0 & -\frac{\sqrt{15}i}{15} & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{60} & 0 & 0 \end{pmatrix}$$

**212**  symmetry  $\quad \sqrt{3}xy$

$$\mathbb{G}_{2}^{(1,0;a)}(B_{2u}) = \begin{pmatrix} 0 & 0 & 0 & \frac{\sqrt{30}}{60} & \frac{\sqrt{6}}{9} & 0 & 0 & 0 & -\frac{\sqrt{30}}{45} \\ \frac{\sqrt{30}}{60} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{45} & 0 & 0 & -\frac{\sqrt{6}}{9} \\ 0 & 0 & -\frac{\sqrt{15}}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{60} & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{15}}{15} & -\frac{\sqrt{3}}{18} & 0 & 0 & 0 & -\frac{\sqrt{15}}{45} \\ \frac{\sqrt{15}}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{45} & 0 & 0 & -\frac{\sqrt{3}}{18} \\ 0 & \frac{\sqrt{15}}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{60} & 0 & 0 \end{pmatrix}$$

**213**  symmetry  $\quad \sqrt{3}yz$

Table 6

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{G}_{2,1}^{(1,0;a)}(E_u)$

$$\begin{bmatrix}
\frac{\sqrt{30}}{120} & 0 & \frac{\sqrt{10}}{40} & 0 & 0 & -\frac{2\sqrt{30}}{45} & 0 & -\frac{2\sqrt{15}}{45} & 0 & 0 \\
0 & -\frac{\sqrt{10}}{40} & 0 & -\frac{\sqrt{30}}{120} & 0 & 0 & -\frac{2\sqrt{15}}{45} & 0 & -\frac{2\sqrt{30}}{45} & 0 \\
0 & -\frac{\sqrt{15}}{15} & 0 & 0 & -\frac{1}{12} & 0 & -\frac{\sqrt{10}}{40} & 0 & 0 & 0 \\
\frac{\sqrt{15}}{15} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{180} & 0 & -\frac{\sqrt{30}}{72} & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{15}}{15} & 0 & 0 & \frac{\sqrt{30}}{72} & 0 & -\frac{\sqrt{15}}{180} & 0 \\
0 & 0 & -\frac{\sqrt{15}}{15} & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{40} & 0 & \frac{1}{12}
\end{bmatrix}$$

| 214 | symmetry | $-\sqrt{3}xz$ |

$\mathbb{G}_{2,2}^{(1,0;a)}(E_u)$

$$\begin{bmatrix}
\frac{\sqrt{30}i}{120} & 0 & -\frac{\sqrt{10}i}{40} & 0 & 0 & -\frac{2\sqrt{30}i}{45} & 0 & \frac{2\sqrt{15}i}{45} & 0 & 0 \\
0 & -\frac{\sqrt{10}i}{40} & 0 & \frac{\sqrt{30}i}{120} & 0 & 0 & -\frac{2\sqrt{15}i}{45} & 0 & \frac{2\sqrt{30}i}{45} & 0 \\
0 & \frac{\sqrt{15}i}{15} & 0 & 0 & -\frac{i}{12} & 0 & \frac{\sqrt{10}i}{40} & 0 & 0 & 0 \\
\frac{\sqrt{15}i}{15} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{180} & 0 & \frac{\sqrt{30}i}{72} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{15}i}{15} & 0 & 0 & \frac{\sqrt{30}i}{72} & 0 & \frac{\sqrt{15}i}{180} & 0 \\
0 & 0 & -\frac{\sqrt{15}i}{15} & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{40} & 0 & -\frac{i}{12}
\end{bmatrix}$$

| 215 | symmetry | $1$ |

$\mathbb{G}_0^{(1,1;a)}(A_{1u})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

| 216 | symmetry | $-\frac{x^2}{2} - \frac{y^2}{2} + z^2$ |

$\mathbb{G}_2^{(1,1;a)}(A_{1u})$

$$\begin{bmatrix}
0 & \frac{\sqrt{42}i}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{30} & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{42}i}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{30} & 0 & 0 \\
\frac{\sqrt{21}i}{30} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{21}i}{105} & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{21}i}{30} & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}i}{105} & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{21}i}{30} & 0 & 0 & 0 & 0 & \frac{\sqrt{14}i}{105} & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{21}i}{30} & 0 & 0 & 0 & 0 & \frac{2\sqrt{21}i}{105} & 0
\end{bmatrix}$$

| 217 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |

*continued ...*

Table 6

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{G}_2^{(1,1;a)}(B_{1u}) = \begin{bmatrix} 0 & 0 & 0 & \frac{\sqrt{42}i}{15} & -\frac{\sqrt{210}i}{180} & 0 & 0 & 0 & -\frac{\sqrt{42}i}{180} & 0 \\ -\frac{\sqrt{42}i}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}i}{180} & 0 & 0 & 0 & -\frac{\sqrt{210}i}{180} \\ 0 & 0 & \frac{\sqrt{21}i}{30} & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}i}{105} & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{21}i}{30} & \frac{2\sqrt{105}i}{315} & 0 & 0 & 0 & -\frac{4\sqrt{21}i}{315} & 0 \\ \frac{\sqrt{21}i}{30} & 0 & 0 & 0 & 0 & \frac{4\sqrt{21}i}{315} & 0 & 0 & 0 & -\frac{2\sqrt{105}i}{315} \\ 0 & \frac{\sqrt{21}i}{30} & 0 & 0 & 0 & 0 & \frac{\sqrt{14}i}{105} & 0 & 0 & 0 \end{bmatrix}$$

| 218 | symmetry | $\sqrt{3}xy$ |

$$\mathbb{G}_2^{(1,1;a)}(B_{2u}) = \begin{bmatrix} 0 & 0 & 0 & \frac{\sqrt{42}}{15} & \frac{\sqrt{210}}{180} & 0 & 0 & 0 & -\frac{\sqrt{42}}{180} & 0 \\ \frac{\sqrt{42}}{15} & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{180} & 0 & 0 & 0 & -\frac{\sqrt{210}}{180} \\ 0 & 0 & \frac{\sqrt{21}}{30} & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{105} & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{21}}{30} & -\frac{2\sqrt{105}}{315} & 0 & 0 & 0 & -\frac{4\sqrt{21}}{315} & 0 \\ -\frac{\sqrt{21}}{30} & 0 & 0 & 0 & 0 & -\frac{4\sqrt{21}}{315} & 0 & 0 & 0 & -\frac{2\sqrt{105}}{315} \\ 0 & -\frac{\sqrt{21}}{30} & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{105} & 0 & 0 & 0 \end{bmatrix}$$

| 219 | symmetry | $\sqrt{3}yz$ |

$$\mathbb{G}_{2,1}^{(1,1;a)}(E_u) = \begin{bmatrix} \frac{\sqrt{42}}{30} & 0 & \frac{\sqrt{14}}{10} & 0 & 0 & -\frac{\sqrt{42}}{90} & 0 & -\frac{\sqrt{21}}{90} & 0 & 0 \\ 0 & -\frac{\sqrt{14}}{10} & 0 & -\frac{\sqrt{42}}{30} & 0 & 0 & -\frac{\sqrt{21}}{90} & 0 & -\frac{\sqrt{42}}{90} & 0 \\ 0 & \frac{\sqrt{21}}{30} & 0 & 0 & -\frac{\sqrt{35}}{105} & 0 & -\frac{\sqrt{14}}{70} & 0 & 0 & 0 \\ -\frac{\sqrt{21}}{30} & 0 & 0 & 0 & 0 & \frac{\sqrt{21}}{315} & 0 & -\frac{\sqrt{42}}{126} & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{21}}{30} & 0 & 0 & \frac{\sqrt{42}}{126} & 0 & -\frac{\sqrt{21}}{315} & 0 \\ 0 & 0 & \frac{\sqrt{21}}{30} & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{70} & 0 & \frac{\sqrt{35}}{105} \end{bmatrix}$$

| 220 | symmetry | $-\sqrt{3}xz$ |

$$\mathbb{G}_{2,2}^{(1,1;a)}(E_u) = \begin{bmatrix} \frac{\sqrt{42}i}{30} & 0 & -\frac{\sqrt{14}i}{10} & 0 & 0 & -\frac{\sqrt{42}i}{90} & 0 & \frac{\sqrt{21}i}{90} & 0 & 0 \\ 0 & -\frac{\sqrt{14}i}{10} & 0 & \frac{\sqrt{42}i}{30} & 0 & 0 & -\frac{\sqrt{21}i}{90} & 0 & \frac{\sqrt{42}i}{90} & 0 \\ 0 & -\frac{\sqrt{21}i}{30} & 0 & 0 & -\frac{\sqrt{35}i}{105} & 0 & \frac{\sqrt{14}i}{70} & 0 & 0 & 0 \\ -\frac{\sqrt{21}i}{30} & 0 & 0 & 0 & 0 & \frac{\sqrt{21}i}{315} & 0 & \frac{\sqrt{42}i}{126} & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{21}i}{30} & 0 & 0 & \frac{\sqrt{42}i}{126} & 0 & \frac{\sqrt{21}i}{315} & 0 \\ 0 & 0 & \frac{\sqrt{21}i}{30} & 0 & 0 & 0 & 0 & \frac{\sqrt{14}i}{70} & 0 & -\frac{\sqrt{35}i}{105} \end{bmatrix}$$

| 221 | symmetry | $z$ |

Table 6

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{T}_1^{(a)}(A_{2u})$ | $\begin{pmatrix} 0 & \frac{\sqrt{3}i}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{3}i}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ -\frac{\sqrt{6}i}{20} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{10} & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{6}i}{60} & 0 & 0 & 0 & 0 & \frac{3i}{10} & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{6}i}{60} & 0 & 0 & 0 & 0 & \frac{3i}{10} & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{6}i}{20} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{10} & 0 \end{pmatrix}$ |
| 222 | symmetry | $x$ |
| | $\mathbb{T}_{1,1}^{(a)}(E_u)$ | $\begin{pmatrix} -\frac{i}{4} & 0 & \frac{\sqrt{3}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{3}i}{12} & 0 & \frac{i}{4} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{2}i}{20} & 0 & 0 & -\frac{\sqrt{30}i}{20} & 0 & \frac{\sqrt{3}i}{20} & 0 & 0 & 0 \\ -\frac{\sqrt{2}i}{20} & 0 & -\frac{\sqrt{6}i}{30} & 0 & 0 & -\frac{3\sqrt{2}i}{20} & 0 & \frac{3i}{20} & 0 & 0 \\ 0 & -\frac{\sqrt{6}i}{30} & 0 & -\frac{\sqrt{2}i}{20} & 0 & 0 & -\frac{3i}{20} & 0 & \frac{3\sqrt{2}i}{20} & 0 \\ 0 & 0 & -\frac{\sqrt{2}i}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{20} & 0 & \frac{\sqrt{30}i}{20} \end{pmatrix}$ |
| 223 | symmetry | $y$ |
| | $\mathbb{T}_{1,2}^{(a)}(E_u)$ | $\begin{pmatrix} \frac{1}{4} & 0 & \frac{\sqrt{3}}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{3}}{12} & 0 & \frac{1}{4} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{2}}{20} & 0 & 0 & \frac{\sqrt{30}}{20} & 0 & \frac{\sqrt{3}}{20} & 0 & 0 & 0 \\ \frac{\sqrt{2}}{20} & 0 & -\frac{\sqrt{6}}{30} & 0 & 0 & \frac{3\sqrt{2}}{20} & 0 & \frac{3}{20} & 0 & 0 \\ 0 & \frac{\sqrt{6}}{30} & 0 & -\frac{\sqrt{2}}{20} & 0 & 0 & \frac{3}{20} & 0 & \frac{3\sqrt{2}}{20} & 0 \\ 0 & 0 & \frac{\sqrt{2}}{20} & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{20} & 0 & \frac{\sqrt{30}}{20} \end{pmatrix}$ |
| 224 | symmetry | $-\frac{z\left(3x^2+3y^2-2z^2\right)}{2}$ |
| | $\mathbb{T}_3^{(a)}(A_{2u})$ | $\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{6} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{6} & 0 & 0 \\ \frac{i}{10} & 0 & 0 & 0 & 0 & -\frac{i}{5} & 0 & 0 & 0 & 0 \\ 0 & -\frac{3i}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{15} & 0 & 0 & 0 \\ 0 & 0 & \frac{3i}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{15} & 0 & 0 \\ 0 & 0 & 0 & -\frac{i}{10} & 0 & 0 & 0 & 0 & -\frac{i}{5} & 0 \end{pmatrix}$ |
| 225 | symmetry | $\sqrt{15}xyz$ |

Table 6

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{T}_3^{(a)}(B_{1u}) \quad \begin{bmatrix} 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{12} & 0 & 0 & 0 & -\frac{\sqrt{10}}{12} & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{12} & 0 & 0 & 0 & \frac{\sqrt{2}}{12} \\ 0 & 0 & \frac{\sqrt{5}}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{30} & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{5}}{10} & -\frac{1}{6} & 0 & 0 & 0 & -\frac{\sqrt{5}}{30} & 0 \\ -\frac{\sqrt{5}}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{30} & 0 & 0 & 0 & \frac{1}{6} \\ 0 & \frac{\sqrt{5}}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{30} & 0 & 0 & 0 \end{bmatrix}$$

**226**   symmetry   $\dfrac{\sqrt{15}z(x-y)(x+y)}{2}$

$$\mathbb{T}_3^{(a)}(B_{2u}) \quad \begin{bmatrix} 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{12} & 0 & 0 & 0 & -\frac{\sqrt{10}i}{12} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{12} & 0 & 0 & 0 & \frac{\sqrt{2}i}{12} \\ 0 & 0 & \frac{\sqrt{5}i}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{30} & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{5}i}{10} & \frac{i}{6} & 0 & 0 & 0 & -\frac{\sqrt{5}i}{30} & 0 \\ \frac{\sqrt{5}i}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}i}{30} & 0 & 0 & 0 & \frac{i}{6} \\ 0 & -\frac{\sqrt{5}i}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{30} & 0 & 0 & 0 \end{bmatrix}$$

**227**   symmetry   $\dfrac{x\left(2x^2-3y^2-3z^2\right)}{2}$

$$\mathbb{T}_{3,1}^{(a)}(E_u,1) \quad \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{24} & 0 & \frac{\sqrt{3}i}{12} & 0 & -\frac{\sqrt{30}i}{24} \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{24} & 0 & \frac{\sqrt{3}i}{12} & 0 & -\frac{\sqrt{6}i}{24} & 0 \\ 0 & -\frac{\sqrt{3}i}{20} & 0 & \frac{i}{4} & -\frac{\sqrt{5}i}{40} & 0 & \frac{3\sqrt{2}i}{40} & 0 & -\frac{i}{8} & 0 \\ -\frac{\sqrt{3}i}{20} & 0 & \frac{3i}{20} & 0 & 0 & \frac{7\sqrt{3}i}{120} & 0 & -\frac{\sqrt{6}i}{120} & 0 & -\frac{\sqrt{15}i}{24} \\ 0 & \frac{3i}{20} & 0 & -\frac{\sqrt{3}i}{20} & \frac{\sqrt{15}i}{24} & 0 & \frac{\sqrt{6}i}{120} & 0 & -\frac{7\sqrt{3}i}{120} & 0 \\ \frac{i}{4} & 0 & -\frac{\sqrt{3}i}{20} & 0 & 0 & \frac{i}{8} & 0 & -\frac{3\sqrt{2}i}{40} & 0 & \frac{\sqrt{5}i}{40} \end{bmatrix}$$

**228**   symmetry   $-\dfrac{y\left(3x^2-2y^2+3z^2\right)}{2}$

$$\mathbb{T}_{3,2}^{(a)}(E_u,1) \quad \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{24} & 0 & \frac{\sqrt{3}}{12} & 0 & \frac{\sqrt{30}}{24} \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{24} & 0 & -\frac{\sqrt{3}}{12} & 0 & -\frac{\sqrt{6}}{24} & 0 \\ 0 & -\frac{\sqrt{3}}{20} & 0 & -\frac{1}{4} & \frac{\sqrt{5}}{40} & 0 & \frac{3\sqrt{2}}{40} & 0 & \frac{1}{8} & 0 \\ \frac{\sqrt{3}}{20} & 0 & \frac{3}{20} & 0 & 0 & -\frac{7\sqrt{3}}{120} & 0 & -\frac{\sqrt{6}}{120} & 0 & \frac{\sqrt{15}}{24} \\ 0 & -\frac{3}{20} & 0 & -\frac{\sqrt{3}}{20} & \frac{\sqrt{15}}{24} & 0 & -\frac{\sqrt{6}}{120} & 0 & -\frac{7\sqrt{3}}{120} & 0 \\ \frac{1}{4} & 0 & \frac{\sqrt{3}}{20} & 0 & 0 & \frac{1}{8} & 0 & \frac{3\sqrt{2}}{40} & 0 & \frac{\sqrt{5}}{40} \end{bmatrix}$$

**229**   symmetry   $\dfrac{\sqrt{15}x(y-z)(y+z)}{2}$

*continued ...*

Table 6

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_{3,1}^{(a)}(E_u,2)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{24} & 0 & \frac{\sqrt{5}i}{12} & 0 & \frac{\sqrt{2}i}{8} \\
0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{8} & 0 & \frac{\sqrt{5}i}{12} & 0 & -\frac{\sqrt{10}i}{24} & 0 \\
0 & -\frac{\sqrt{5}i}{20} & 0 & -\frac{\sqrt{15}i}{20} & -\frac{\sqrt{3}i}{24} & 0 & \frac{\sqrt{30}i}{40} & 0 & \frac{\sqrt{15}i}{40} & 0 \\
-\frac{\sqrt{5}i}{20} & 0 & \frac{\sqrt{15}i}{20} & 0 & 0 & \frac{7\sqrt{5}i}{120} & 0 & -\frac{\sqrt{10}i}{120} & 0 & \frac{i}{8} \\
0 & \frac{\sqrt{15}i}{20} & 0 & -\frac{\sqrt{5}i}{20} & -\frac{i}{8} & 0 & \frac{\sqrt{10}i}{120} & 0 & -\frac{7\sqrt{5}i}{120} & 0 \\
-\frac{\sqrt{15}i}{20} & 0 & -\frac{\sqrt{5}i}{20} & 0 & 0 & -\frac{\sqrt{15}i}{40} & 0 & -\frac{\sqrt{30}i}{40} & 0 & \frac{\sqrt{3}i}{24}
\end{pmatrix}$$

| 230 | symmetry | $\dfrac{\sqrt{15}y(x-z)(x+z)}{2}$ |
|---|---|---|

$\mathbb{T}_{3,2}^{(a)}(E_u,2)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{24} & 0 & \frac{\sqrt{5}}{12} & 0 & -\frac{\sqrt{2}}{8} \\
0 & 0 & 0 & 0 & \frac{\sqrt{2}}{8} & 0 & -\frac{\sqrt{5}}{12} & 0 & -\frac{\sqrt{10}}{24} & 0 \\
0 & -\frac{\sqrt{5}}{20} & 0 & \frac{\sqrt{15}}{20} & \frac{\sqrt{3}}{24} & 0 & \frac{\sqrt{30}}{40} & 0 & -\frac{\sqrt{15}}{40} & 0 \\
\frac{\sqrt{5}}{20} & 0 & \frac{\sqrt{15}}{20} & 0 & 0 & -\frac{7\sqrt{5}}{120} & 0 & -\frac{\sqrt{10}}{120} & 0 & -\frac{1}{8} \\
0 & -\frac{\sqrt{15}}{20} & 0 & -\frac{\sqrt{5}}{20} & -\frac{1}{8} & 0 & -\frac{\sqrt{10}}{120} & 0 & -\frac{7\sqrt{5}}{120} & 0 \\
-\frac{\sqrt{15}}{20} & 0 & \frac{\sqrt{5}}{20} & 0 & 0 & -\frac{\sqrt{15}}{40} & 0 & \frac{\sqrt{30}}{40} & 0 & \frac{\sqrt{3}}{24}
\end{pmatrix}$$

| 231 | symmetry | $-\dfrac{z\left(3x^2+3y^2-2z^2\right)}{2}$ |
|---|---|---|

$\mathbb{T}_3^{(1,-1;a)}(A_{2u})$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{6} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{6} & 0 & 0 \\
\frac{\sqrt{6}i}{60} & 0 & 0 & 0 & 0 & \frac{2\sqrt{6}i}{15} & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{6}i}{20} & 0 & 0 & 0 & 0 & -\frac{4i}{15} & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{6}i}{20} & 0 & 0 & 0 & 0 & -\frac{4i}{15} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{6}i}{60} & 0 & 0 & 0 & 0 & \frac{2\sqrt{6}i}{15} & 0
\end{pmatrix}$$

| 232 | symmetry | $\sqrt{15}xyz$ |
|---|---|---|

$\mathbb{T}_3^{(1,-1;a)}(B_{1u})$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & \frac{\sqrt{3}}{18} & 0 & 0 & 0 & -\frac{\sqrt{15}}{18} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{18} & 0 & 0 & 0 & \frac{\sqrt{3}}{18} \\
0 & 0 & \frac{\sqrt{30}}{60} & 0 & 0 & 0 & 0 & \frac{2\sqrt{5}}{15} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{30}}{60} & \frac{\sqrt{6}}{9} & 0 & 0 & 0 & \frac{\sqrt{30}}{45} & 0 \\
-\frac{\sqrt{30}}{60} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{45} & 0 & 0 & 0 & -\frac{\sqrt{6}}{9} \\
0 & \frac{\sqrt{30}}{60} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{5}}{15} & 0 & 0 & 0
\end{pmatrix}$$

| 233 | symmetry | $\dfrac{\sqrt{15}z(x-y)(x+y)}{2}$ |
|---|---|---|

*continued ...*

Table 6

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{T}_3^{(1,-1;a)}(B_{2u})$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{18} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{18} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{18} & 0 & 0 & 0 & \frac{\sqrt{3}i}{18} \\ 0 & 0 & \frac{\sqrt{30}i}{60} & 0 & 0 & 0 & 0 & \frac{2\sqrt{5}i}{15} & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{30}i}{60} & -\frac{\sqrt{6}i}{9} & 0 & 0 & 0 & \frac{\sqrt{30}i}{45} & 0 \\ \frac{\sqrt{30}i}{60} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{45} & 0 & 0 & 0 & -\frac{\sqrt{6}i}{9} \\ 0 & -\frac{\sqrt{30}i}{60} & 0 & 0 & 0 & 0 & \frac{2\sqrt{5}i}{15} & 0 & 0 & 0 \end{bmatrix}$$

| 234 | symmetry | $\frac{x\left(2x^2-3y^2-3z^2\right)}{2}$ |

$\mathbb{T}_{3,1}^{(1,-1;a)}(E_u,1)$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & -\frac{i}{12} & 0 & \frac{\sqrt{2}i}{12} & 0 & -\frac{\sqrt{5}i}{12} \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{5}i}{12} & 0 & \frac{\sqrt{2}i}{12} & 0 & -\frac{i}{12} & 0 \\ 0 & -\frac{\sqrt{2}i}{40} & 0 & \frac{\sqrt{6}i}{24} & \frac{\sqrt{30}i}{60} & 0 & -\frac{\sqrt{3}i}{10} & 0 & \frac{\sqrt{6}i}{12} & 0 \\ -\frac{\sqrt{2}i}{40} & 0 & \frac{\sqrt{6}i}{40} & 0 & 0 & -\frac{7\sqrt{2}i}{60} & 0 & \frac{i}{30} & 0 & \frac{\sqrt{10}i}{12} \\ 0 & \frac{\sqrt{6}i}{40} & 0 & -\frac{\sqrt{2}i}{40} & -\frac{\sqrt{10}i}{12} & 0 & -\frac{i}{30} & 0 & \frac{7\sqrt{2}i}{60} & 0 \\ \frac{\sqrt{6}i}{24} & 0 & -\frac{\sqrt{2}i}{40} & 0 & 0 & -\frac{\sqrt{6}i}{12} & 0 & \frac{\sqrt{3}i}{10} & 0 & -\frac{\sqrt{30}i}{60} \end{bmatrix}$$

| 235 | symmetry | $-\frac{y\left(3x^2-2y^2+3z^2\right)}{2}$ |

$\mathbb{T}_{3,2}^{(1,-1;a)}(E_u,1)$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & \frac{1}{12} & 0 & \frac{\sqrt{2}}{12} & 0 & \frac{\sqrt{5}}{12} \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{5}}{12} & 0 & -\frac{\sqrt{2}}{12} & 0 & -\frac{1}{12} & 0 \\ 0 & -\frac{\sqrt{2}}{40} & 0 & -\frac{\sqrt{6}}{24} & -\frac{\sqrt{30}}{60} & 0 & -\frac{\sqrt{3}}{10} & 0 & -\frac{\sqrt{6}}{12} & 0 \\ \frac{\sqrt{2}}{40} & 0 & \frac{\sqrt{6}}{40} & 0 & 0 & \frac{7\sqrt{2}}{60} & 0 & \frac{1}{30} & 0 & -\frac{\sqrt{10}}{12} \\ 0 & -\frac{\sqrt{6}}{40} & 0 & -\frac{\sqrt{2}}{40} & -\frac{\sqrt{10}}{12} & 0 & \frac{1}{30} & 0 & \frac{7\sqrt{2}}{60} & 0 \\ \frac{\sqrt{6}}{24} & 0 & \frac{\sqrt{2}}{40} & 0 & 0 & -\frac{\sqrt{6}}{12} & 0 & -\frac{\sqrt{3}}{10} & 0 & -\frac{\sqrt{30}}{60} \end{bmatrix}$$

| 236 | symmetry | $\frac{\sqrt{15}x(y-z)(y+z)}{2}$ |

$\mathbb{T}_{3,1}^{(1,-1;a)}(E_u,2)$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{36} & 0 & \frac{\sqrt{30}i}{36} & 0 & \frac{\sqrt{3}i}{12} \\ 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{12} & 0 & \frac{\sqrt{30}i}{36} & 0 & -\frac{\sqrt{15}i}{36} & 0 \\ 0 & -\frac{\sqrt{30}i}{120} & 0 & -\frac{\sqrt{10}i}{40} & \frac{\sqrt{2}i}{12} & 0 & -\frac{\sqrt{5}i}{10} & 0 & -\frac{\sqrt{10}i}{20} & 0 \\ -\frac{\sqrt{30}i}{120} & 0 & \frac{\sqrt{10}i}{40} & 0 & 0 & -\frac{7\sqrt{30}i}{180} & 0 & \frac{\sqrt{15}i}{90} & 0 & -\frac{\sqrt{6}i}{12} \\ 0 & \frac{\sqrt{10}i}{40} & 0 & -\frac{\sqrt{30}i}{120} & \frac{\sqrt{6}i}{12} & 0 & -\frac{\sqrt{15}i}{90} & 0 & \frac{7\sqrt{30}i}{180} & 0 \\ -\frac{\sqrt{10}i}{40} & 0 & -\frac{\sqrt{30}i}{120} & 0 & 0 & \frac{\sqrt{10}i}{20} & 0 & \frac{\sqrt{5}i}{10} & 0 & -\frac{\sqrt{2}i}{12} \end{bmatrix}$$

| 237 | symmetry | $\frac{\sqrt{15}y(x-z)(x+z)}{2}$ |

continued ...

Table 6

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_{3,2}^{(1,-1;a)}(E_u, 2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{36} & 0 & \frac{\sqrt{30}}{36} & 0 & -\frac{\sqrt{3}}{12} \\
0 & 0 & 0 & 0 & \frac{\sqrt{3}}{12} & 0 & -\frac{\sqrt{30}}{36} & 0 & -\frac{\sqrt{15}}{36} & 0 \\
0 & -\frac{\sqrt{30}}{120} & 0 & \frac{\sqrt{10}}{40} & -\frac{\sqrt{2}}{12} & 0 & -\frac{\sqrt{5}}{10} & 0 & \frac{\sqrt{10}}{20} & 0 \\
\frac{\sqrt{30}}{120} & 0 & \frac{\sqrt{10}}{40} & 0 & 0 & \frac{7\sqrt{30}}{180} & 0 & \frac{\sqrt{15}}{90} & 0 & \frac{\sqrt{6}}{12} \\
0 & -\frac{\sqrt{10}}{40} & 0 & -\frac{\sqrt{30}}{120} & \frac{\sqrt{6}}{12} & 0 & \frac{\sqrt{15}}{90} & 0 & \frac{7\sqrt{30}}{180} & 0 \\
-\frac{\sqrt{10}}{40} & 0 & \frac{\sqrt{30}}{120} & 0 & 0 & \frac{\sqrt{10}}{20} & 0 & -\frac{\sqrt{5}}{10} & 0 & -\frac{\sqrt{2}}{12}
\end{bmatrix}$$

| 238 | symmetry | $z$ |
|---|---|---|

$\mathbb{T}_1^{(1,0;a)}(A_{2u})$

$$\begin{bmatrix}
0 & \frac{\sqrt{6}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{6}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{3}i}{5} & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{10} & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{3}i}{15} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{2}i}{20} & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{3}i}{15} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{2}i}{20} & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{3}i}{5} & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{10} & 0
\end{bmatrix}$$

| 239 | symmetry | $x$ |
|---|---|---|

$\mathbb{T}_{1,1}^{(1,0;a)}(E_u)$

$$\begin{bmatrix}
-\frac{\sqrt{2}i}{8} & 0 & \frac{\sqrt{6}i}{24} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{6}i}{24} & 0 & \frac{\sqrt{2}i}{8} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{i}{5} & 0 & 0 & \frac{\sqrt{15}i}{20} & 0 & -\frac{\sqrt{6}i}{40} & 0 & 0 & 0 \\
-\frac{i}{5} & 0 & -\frac{2\sqrt{3}i}{15} & 0 & 0 & \frac{3i}{20} & 0 & -\frac{3\sqrt{2}i}{40} & 0 & 0 \\
0 & -\frac{2\sqrt{3}i}{15} & 0 & -\frac{i}{5} & 0 & 0 & \frac{3\sqrt{2}i}{40} & 0 & -\frac{3i}{20} & 0 \\
0 & 0 & -\frac{i}{5} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{40} & 0 & -\frac{\sqrt{15}i}{20}
\end{bmatrix}$$

| 240 | symmetry | $y$ |
|---|---|---|

$\mathbb{T}_{1,2}^{(1,0;a)}(E_u)$

$$\begin{bmatrix}
\frac{\sqrt{2}}{8} & 0 & \frac{\sqrt{6}}{24} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{6}}{24} & 0 & \frac{\sqrt{2}}{8} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{1}{5} & 0 & 0 & -\frac{\sqrt{15}}{20} & 0 & -\frac{\sqrt{6}}{40} & 0 & 0 & 0 \\
\frac{1}{5} & 0 & -\frac{2\sqrt{3}}{15} & 0 & 0 & -\frac{3}{20} & 0 & -\frac{3\sqrt{2}}{40} & 0 & 0 \\
0 & \frac{2\sqrt{3}}{15} & 0 & -\frac{1}{5} & 0 & 0 & -\frac{3\sqrt{2}}{40} & 0 & -\frac{3}{20} & 0 \\
0 & 0 & \frac{1}{5} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{40} & 0 & -\frac{\sqrt{15}}{20}
\end{bmatrix}$$

| 241 | symmetry | $-\frac{z\left(3x^2+3y^2-2z^2\right)}{2}$ |
|---|---|---|

*continued ...*

Table 6

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_3^{(1,0;a)}(A_{2u})$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & \frac{i}{3} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{i}{3} & 0 & 0 \\ \frac{\sqrt{3}i}{15} & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{30} & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{3}i}{5} & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{30} & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{3}i}{5} & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{30} & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{3}i}{15} & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{30} & 0 \end{bmatrix}$$

**242**  symmetry  $\sqrt{15}xyz$

$\mathbb{T}_3^{(1,0;a)}(B_{1u})$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{18} & 0 & 0 & 0 & \frac{\sqrt{30}}{18} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{18} & 0 & 0 & 0 & -\frac{\sqrt{6}}{18} \\ 0 & 0 & \frac{\sqrt{15}}{15} & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{60} & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{15}}{15} & \frac{\sqrt{3}}{36} & 0 & 0 & 0 & \frac{\sqrt{15}}{180} & 0 \\ -\frac{\sqrt{15}}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{180} & 0 & 0 & 0 & -\frac{\sqrt{3}}{36} \\ 0 & \frac{\sqrt{15}}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{60} & 0 & 0 & 0 \end{bmatrix}$$

**243**  symmetry  $\frac{\sqrt{15}z(x-y)(x+y)}{2}$

$\mathbb{T}_3^{(1,0;a)}(B_{2u})$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{18} & 0 & 0 & 0 & \frac{\sqrt{30}i}{18} & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{18} & 0 & 0 & 0 & -\frac{\sqrt{6}i}{18} \\ 0 & 0 & \frac{\sqrt{15}i}{15} & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{60} & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{15}i}{15} & -\frac{\sqrt{3}i}{36} & 0 & 0 & 0 & \frac{\sqrt{15}i}{180} & 0 \\ \frac{\sqrt{15}i}{15} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{180} & 0 & 0 & 0 & -\frac{\sqrt{3}i}{36} \\ 0 & -\frac{\sqrt{15}i}{15} & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{60} & 0 & 0 & 0 \end{bmatrix}$$

**244**  symmetry  $\frac{x\left(2x^2-3y^2-3z^2\right)}{2}$

$\mathbb{T}_{3,1}^{(1,0;a)}(E_u,1)$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{12} & 0 & -\frac{i}{6} & 0 & \frac{\sqrt{10}i}{12} \\ 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{12} & 0 & -\frac{i}{6} & 0 & \frac{\sqrt{2}i}{12} & 0 \\ 0 & -\frac{i}{10} & 0 & \frac{\sqrt{3}i}{6} & \frac{\sqrt{15}i}{240} & 0 & -\frac{\sqrt{6}i}{80} & 0 & \frac{\sqrt{3}i}{48} & 0 \\ -\frac{i}{10} & 0 & \frac{\sqrt{3}i}{10} & 0 & 0 & -\frac{7i}{240} & 0 & \frac{\sqrt{2}i}{240} & 0 & \frac{\sqrt{5}i}{48} \\ 0 & \frac{\sqrt{3}i}{10} & 0 & -\frac{i}{10} & -\frac{\sqrt{5}i}{48} & 0 & -\frac{\sqrt{2}i}{240} & 0 & \frac{7i}{240} & 0 \\ \frac{\sqrt{3}i}{6} & 0 & -\frac{i}{10} & 0 & 0 & -\frac{\sqrt{3}i}{48} & 0 & \frac{\sqrt{6}i}{80} & 0 & -\frac{\sqrt{15}i}{240} \end{bmatrix}$$

**245**  symmetry  $-\frac{y\left(3x^2-2y^2+3z^2\right)}{2}$

Table 6

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_{3,2}^{(1,0;a)}(E_u,1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{12} & 0 & -\frac{1}{6} & 0 & -\frac{\sqrt{10}}{12} \\
0 & 0 & 0 & 0 & \frac{\sqrt{10}}{12} & 0 & \frac{1}{6} & 0 & \frac{\sqrt{2}}{12} & 0 \\
0 & -\frac{1}{10} & 0 & -\frac{\sqrt{3}}{6} & -\frac{\sqrt{15}}{240} & 0 & -\frac{\sqrt{6}}{80} & 0 & -\frac{\sqrt{3}}{48} & 0 \\
\frac{1}{10} & 0 & \frac{\sqrt{3}}{10} & 0 & 0 & \frac{7}{240} & 0 & \frac{\sqrt{2}}{240} & 0 & -\frac{\sqrt{5}}{48} \\
0 & -\frac{\sqrt{3}}{10} & 0 & -\frac{1}{10} & -\frac{\sqrt{5}}{48} & 0 & \frac{\sqrt{2}}{240} & 0 & \frac{7}{240} & 0 \\
\frac{\sqrt{3}}{6} & 0 & \frac{1}{10} & 0 & 0 & -\frac{\sqrt{3}}{48} & 0 & -\frac{\sqrt{6}}{80} & 0 & -\frac{\sqrt{15}}{240}
\end{bmatrix}$$

**246** symmetry $\quad \frac{\sqrt{15}x(y-z)(y+z)}{2}$

$\mathbb{T}_{3,1}^{(1,0;a)}(E_u,2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{36} & 0 & -\frac{\sqrt{15}i}{18} & 0 & -\frac{\sqrt{6}i}{12} \\
0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{12} & 0 & -\frac{\sqrt{15}i}{18} & 0 & \frac{\sqrt{30}i}{36} & 0 \\
0 & -\frac{\sqrt{15}i}{30} & 0 & -\frac{\sqrt{5}i}{10} & \frac{i}{48} & 0 & -\frac{\sqrt{10}i}{80} & 0 & -\frac{\sqrt{5}i}{80} & 0 \\
-\frac{\sqrt{15}i}{30} & 0 & \frac{\sqrt{5}i}{10} & 0 & 0 & -\frac{7\sqrt{15}i}{720} & 0 & \frac{\sqrt{30}i}{720} & 0 & -\frac{\sqrt{3}i}{48} \\
0 & \frac{\sqrt{5}i}{10} & 0 & -\frac{\sqrt{15}i}{30} & \frac{\sqrt{3}i}{48} & 0 & -\frac{\sqrt{30}i}{720} & 0 & \frac{7\sqrt{15}i}{720} & 0 \\
-\frac{\sqrt{5}i}{10} & 0 & -\frac{\sqrt{15}i}{30} & 0 & 0 & \frac{\sqrt{5}i}{80} & 0 & \frac{\sqrt{10}i}{80} & 0 & -\frac{i}{48}
\end{bmatrix}$$

**247** symmetry $\quad \frac{\sqrt{15}y(x-z)(x+z)}{2}$

$\mathbb{T}_{3,2}^{(1,0;a)}(E_u,2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{36} & 0 & -\frac{\sqrt{15}}{18} & 0 & \frac{\sqrt{6}}{12} \\
0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{12} & 0 & \frac{\sqrt{15}}{18} & 0 & \frac{\sqrt{30}}{36} & 0 \\
0 & -\frac{\sqrt{15}}{30} & 0 & \frac{\sqrt{5}}{10} & -\frac{1}{48} & 0 & -\frac{\sqrt{10}}{80} & 0 & \frac{\sqrt{5}}{80} & 0 \\
\frac{\sqrt{15}}{30} & 0 & \frac{\sqrt{5}}{10} & 0 & 0 & \frac{7\sqrt{15}}{720} & 0 & \frac{\sqrt{30}}{720} & 0 & \frac{\sqrt{3}}{48} \\
0 & -\frac{\sqrt{5}}{10} & 0 & -\frac{\sqrt{15}}{30} & \frac{\sqrt{3}}{48} & 0 & \frac{\sqrt{30}}{720} & 0 & \frac{7\sqrt{15}}{720} & 0 \\
-\frac{\sqrt{5}}{10} & 0 & \frac{\sqrt{15}}{30} & 0 & 0 & \frac{\sqrt{5}}{80} & 0 & -\frac{\sqrt{10}}{80} & 0 & -\frac{1}{48}
\end{bmatrix}$$

**248** symmetry $\quad z$

$\mathbb{T}_1^{(1,1;a)}(A_{2u})$

$$\begin{bmatrix}
0 & -\frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{3i}{10} & 0 & 0 & 0 & 0 & \frac{i}{10} & 0 & 0 & 0 & 0 \\
0 & -\frac{i}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{20} & 0 & 0 & 0 \\
0 & 0 & \frac{i}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{20} & 0 & 0 \\
0 & 0 & 0 & \frac{3i}{10} & 0 & 0 & 0 & 0 & \frac{i}{10} & 0
\end{bmatrix}$$

**249** symmetry $\quad x$

Table 6

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{T}_{1,1}^{(1,1;a)}(E_u) \quad
\begin{bmatrix}
\frac{\sqrt{6}i}{8} & 0 & -\frac{\sqrt{2}i}{8} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{2}i}{8} & 0 & -\frac{\sqrt{6}i}{8} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{3}i}{10} & 0 & 0 & -\frac{\sqrt{5}i}{20} & 0 & \frac{\sqrt{2}i}{40} & 0 & 0 & 0 \\
-\frac{\sqrt{3}i}{10} & 0 & -\frac{i}{5} & 0 & 0 & -\frac{\sqrt{3}i}{20} & 0 & \frac{\sqrt{6}i}{40} & 0 & 0 \\
0 & -\frac{i}{5} & 0 & -\frac{\sqrt{3}i}{10} & 0 & 0 & -\frac{\sqrt{6}i}{40} & 0 & \frac{\sqrt{3}i}{20} & 0 \\
0 & 0 & -\frac{\sqrt{3}i}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{40} & 0 & \frac{\sqrt{5}i}{20}
\end{bmatrix}$$

| 250 | symmetry | $y$ |

$$\mathbb{T}_{1,2}^{(1,1;a)}(E_u) \quad
\begin{bmatrix}
-\frac{\sqrt{6}}{8} & 0 & -\frac{\sqrt{2}}{8} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{2}}{8} & 0 & -\frac{\sqrt{6}}{8} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{3}}{10} & 0 & 0 & \frac{\sqrt{5}}{20} & 0 & \frac{\sqrt{2}}{40} & 0 & 0 & 0 \\
\frac{\sqrt{3}}{10} & 0 & -\frac{1}{5} & 0 & 0 & \frac{\sqrt{3}}{20} & 0 & \frac{\sqrt{6}}{40} & 0 & 0 \\
0 & \frac{1}{5} & 0 & -\frac{\sqrt{3}}{10} & 0 & 0 & \frac{\sqrt{6}}{40} & 0 & \frac{\sqrt{3}}{20} & 0 \\
0 & 0 & \frac{\sqrt{3}}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{40} & 0 & \frac{\sqrt{5}}{20}
\end{bmatrix}$$

| 251 | symmetry | $-\frac{x^2}{2} - \frac{y^2}{2} + z^2$ |

$$\mathbb{M}_2^{(a)}(A_{1u}) \quad
\begin{bmatrix}
0 & \frac{\sqrt{5}}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{30} & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{5}}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{30} & 0 & 0 \\
-\frac{\sqrt{10}}{20} & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{10} & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{10}}{20} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{30} & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{10}}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{30} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{10}}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{10} & 0
\end{bmatrix}$$

| 252 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |

$$\mathbb{M}_2^{(a)}(B_{1u}) \quad
\begin{bmatrix}
0 & 0 & 0 & \frac{\sqrt{5}}{10} & \frac{1}{6} & 0 & 0 & 0 & \frac{\sqrt{5}}{30} & 0 \\
-\frac{\sqrt{5}}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{30} & 0 & 0 & 0 & \frac{1}{6} \\
0 & 0 & -\frac{\sqrt{10}}{20} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{30} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{10}}{20} & -\frac{\sqrt{2}}{6} & 0 & 0 & 0 & \frac{\sqrt{10}}{15} & 0 \\
-\frac{\sqrt{10}}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{15} & 0 & 0 & 0 & \frac{\sqrt{2}}{6} \\
0 & -\frac{\sqrt{10}}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{30} & 0 & 0 & 0
\end{bmatrix}$$

| 253 | symmetry | $\sqrt{3}xy$ |

*continued …*

47

Table  6

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_2^{(a)}(B_{2u}) = \begin{bmatrix}
0 & 0 & 0 & -\frac{\sqrt{5}i}{10} & \frac{i}{6} & 0 & 0 & 0 & -\frac{\sqrt{5}i}{30} & 0 \\[4pt]
-\frac{\sqrt{5}i}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{5}i}{30} & 0 & 0 & 0 & -\frac{i}{6} \\[4pt]
0 & 0 & \frac{\sqrt{10}i}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{30} & 0 & 0 \\[4pt]
0 & 0 & 0 & \frac{\sqrt{10}i}{20} & -\frac{\sqrt{2}i}{6} & 0 & 0 & 0 & -\frac{\sqrt{10}i}{15} & 0 \\[4pt]
-\frac{\sqrt{10}i}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{15} & 0 & 0 & 0 & -\frac{\sqrt{2}i}{6} \\[4pt]
0 & -\frac{\sqrt{10}i}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{30} & 0 & 0 & 0
\end{bmatrix}$$

| 254 | symmetry | $\sqrt{3}yz$ |
|---|---|---|

$$\mathbb{M}_{2,1}^{(a)}(E_u) = \begin{bmatrix}
-\frac{\sqrt{5}i}{20} & 0 & -\frac{\sqrt{15}i}{20} & 0 & 0 & -\frac{\sqrt{5}i}{15} & 0 & -\frac{\sqrt{10}i}{30} & 0 & 0 \\[4pt]
0 & \frac{\sqrt{15}i}{20} & 0 & \frac{\sqrt{5}i}{20} & 0 & 0 & -\frac{\sqrt{10}i}{30} & 0 & -\frac{\sqrt{5}i}{15} & 0 \\[4pt]
0 & \frac{\sqrt{10}i}{20} & 0 & 0 & -\frac{\sqrt{6}i}{12} & 0 & -\frac{\sqrt{15}i}{20} & 0 & 0 & 0 \\[4pt]
-\frac{\sqrt{10}i}{20} & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{60} & 0 & -\frac{\sqrt{5}i}{12} & 0 & 0 \\[4pt]
0 & 0 & 0 & -\frac{\sqrt{10}i}{20} & 0 & 0 & \frac{\sqrt{5}i}{12} & 0 & -\frac{\sqrt{10}i}{60} & 0 \\[4pt]
0 & 0 & \frac{\sqrt{10}i}{20} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{20} & 0 & \frac{\sqrt{6}i}{12}
\end{bmatrix}$$

| 255 | symmetry | $-\sqrt{3}xz$ |
|---|---|---|

$$\mathbb{M}_{2,2}^{(a)}(E_u) = \begin{bmatrix}
\frac{\sqrt{5}}{20} & 0 & -\frac{\sqrt{15}}{20} & 0 & 0 & \frac{\sqrt{5}}{15} & 0 & -\frac{\sqrt{10}}{30} & 0 & 0 \\[4pt]
0 & -\frac{\sqrt{15}}{20} & 0 & \frac{\sqrt{5}}{20} & 0 & 0 & \frac{\sqrt{10}}{30} & 0 & -\frac{\sqrt{5}}{15} & 0 \\[4pt]
0 & \frac{\sqrt{10}}{20} & 0 & 0 & \frac{\sqrt{6}}{12} & 0 & -\frac{\sqrt{15}}{20} & 0 & 0 & 0 \\[4pt]
\frac{\sqrt{10}}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{60} & 0 & -\frac{\sqrt{5}}{12} & 0 & 0 \\[4pt]
0 & 0 & 0 & -\frac{\sqrt{10}}{20} & 0 & 0 & -\frac{\sqrt{5}}{12} & 0 & -\frac{\sqrt{10}}{60} & 0 \\[4pt]
0 & 0 & -\frac{\sqrt{10}}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{20} & 0 & \frac{\sqrt{6}}{12}
\end{bmatrix}$$

| 256 | symmetry | $-\frac{x^2}{2} - \frac{y^2}{2} + z^2$ |
|---|---|---|

$$\mathbb{M}_2^{(1,-1;a)}(A_{1u}) = \begin{bmatrix}
0 & -\frac{\sqrt{2}}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{5} & 0 & 0 & 0 \\[4pt]
0 & 0 & \frac{\sqrt{2}}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{5} & 0 & 0 \\[4pt]
\frac{1}{10} & 0 & 0 & 0 & 0 & \frac{3}{10} & 0 & 0 & 0 & 0 \\[4pt]
0 & -\frac{1}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{20} & 0 & 0 & 0 \\[4pt]
0 & 0 & -\frac{1}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{20} & 0 & 0 \\[4pt]
0 & 0 & 0 & \frac{1}{10} & 0 & 0 & 0 & 0 & -\frac{3}{10} & 0
\end{bmatrix}$$

| 257 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |
|---|---|---|

Table  6

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_2^{(1,-1;a)}(B_{1u})$$

$$\begin{bmatrix}
0 & 0 & 0 & -\frac{\sqrt{2}}{20} & -\frac{\sqrt{10}}{10} & 0 & 0 & 0 & -\frac{\sqrt{2}}{10} & 0 \\
\frac{\sqrt{2}}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{10} & 0 & 0 & 0 & -\frac{\sqrt{10}}{10} \\
0 & 0 & \frac{1}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{20} & 0 & 0 \\
0 & 0 & 0 & \frac{1}{10} & -\frac{\sqrt{5}}{10} & 0 & 0 & 0 & \frac{1}{5} & 0 \\
\frac{1}{10} & 0 & 0 & 0 & 0 & -\frac{1}{5} & 0 & 0 & 0 & \frac{\sqrt{5}}{10} \\
0 & \frac{1}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{20} & 0 & 0 & 0
\end{bmatrix}$$

| 258 | symmetry | $\sqrt{3}xy$ |

$$\mathbb{M}_2^{(1,-1;a)}(B_{2u})$$

$$\begin{bmatrix}
0 & 0 & 0 & \frac{\sqrt{2}i}{20} & -\frac{\sqrt{10}i}{10} & 0 & 0 & 0 & \frac{\sqrt{2}i}{10} & 0 \\
\frac{\sqrt{2}i}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{10} & 0 & 0 & 0 & \frac{\sqrt{10}i}{10} \\
0 & 0 & -\frac{i}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{20} & 0 & 0 \\
0 & 0 & 0 & -\frac{i}{10} & -\frac{\sqrt{5}i}{10} & 0 & 0 & 0 & -\frac{i}{5} & 0 \\
\frac{i}{10} & 0 & 0 & 0 & 0 & -\frac{i}{5} & 0 & 0 & 0 & -\frac{\sqrt{5}i}{10} \\
0 & \frac{i}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{20} & 0 & 0 & 0
\end{bmatrix}$$

| 259 | symmetry | $\sqrt{3}yz$ |

$$\mathbb{M}_{2,1}^{(1,-1;a)}(E_{u})$$

$$\begin{bmatrix}
\frac{\sqrt{2}i}{40} & 0 & \frac{\sqrt{6}i}{40} & 0 & 0 & \frac{\sqrt{2}i}{5} & 0 & \frac{i}{5} & 0 & 0 \\
0 & -\frac{\sqrt{6}i}{40} & 0 & -\frac{\sqrt{2}i}{40} & 0 & 0 & \frac{i}{5} & 0 & \frac{\sqrt{2}i}{5} & 0 \\
0 & -\frac{i}{10} & 0 & 0 & -\frac{\sqrt{15}i}{20} & 0 & -\frac{3\sqrt{6}i}{40} & 0 & 0 & 0 \\
\frac{i}{10} & 0 & 0 & 0 & 0 & \frac{i}{20} & 0 & -\frac{\sqrt{2}i}{8} & 0 & 0 \\
0 & 0 & 0 & \frac{i}{10} & 0 & 0 & \frac{\sqrt{2}i}{8} & 0 & -\frac{i}{20} & 0 \\
0 & 0 & -\frac{i}{10} & 0 & 0 & 0 & 0 & \frac{3\sqrt{6}i}{40} & 0 & \frac{\sqrt{15}i}{20}
\end{bmatrix}$$

| 260 | symmetry | $-\sqrt{3}xz$ |

$$\mathbb{M}_{2,2}^{(1,-1;a)}(E_{u})$$

$$\begin{bmatrix}
-\frac{\sqrt{2}}{40} & 0 & \frac{\sqrt{6}}{40} & 0 & 0 & -\frac{\sqrt{2}}{5} & 0 & \frac{1}{5} & 0 & 0 \\
0 & \frac{\sqrt{6}}{40} & 0 & -\frac{\sqrt{2}}{40} & 0 & 0 & -\frac{1}{5} & 0 & \frac{\sqrt{2}}{5} & 0 \\
0 & -\frac{1}{10} & 0 & 0 & \frac{\sqrt{15}}{20} & 0 & -\frac{3\sqrt{6}}{40} & 0 & 0 & 0 \\
-\frac{1}{10} & 0 & 0 & 0 & 0 & -\frac{1}{20} & 0 & -\frac{\sqrt{2}}{8} & 0 & 0 \\
0 & 0 & 0 & \frac{1}{10} & 0 & 0 & -\frac{\sqrt{2}}{8} & 0 & -\frac{1}{20} & 0 \\
0 & 0 & \frac{1}{10} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{6}}{40} & 0 & \frac{\sqrt{15}}{20}
\end{bmatrix}$$

| 261 | symmetry | $\frac{\sqrt{21}\left(x^4-3x^2y^2-3x^2z^2+y^4-3y^2z^2+z^4\right)}{6}$ |

Table 6

| No. | multipole | matrix |
|-----|-----------|--------|
| | $\mathbb{M}_4^{(1,-1;a)}(A_{1u},1)$ | $\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{12} & 0 & 0 & 0 & -\frac{\sqrt{15}}{12} \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{4} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{4} & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{12} & 0 & 0 & 0 & \frac{\sqrt{3}}{12} & 0 \end{pmatrix}$ |
| 262 | symmetry | $-\frac{\sqrt{15}\left(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4\right)}{12}$ |
| | $\mathbb{M}_4^{(1,-1;a)}(A_{1u},2)$ | $\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}}{84} & 0 & 0 & 0 & \frac{\sqrt{21}}{12} \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{28} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{28} & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{21}}{12} & 0 & 0 & 0 & \frac{\sqrt{105}}{84} & 0 \end{pmatrix}$ |
| 263 | symmetry | $\frac{\sqrt{35}xy(x-y)(x+y)}{2}$ |
| | $\mathbb{M}_4^{(1,-1;a)}(A_{2u})$ | $\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{i}{2} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{i}{2} & 0 & 0 & 0 & 0 \end{pmatrix}$ |
| 264 | symmetry | $\frac{\sqrt{5}(x-y)(x+y)\left(x^2+y^2-6z^2\right)}{4}$ |
| | $\mathbb{M}_4^{(1,-1;a)}(B_{1u})$ | $\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{28} & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{21}}{28} & 0 & 0 & 0 & -\frac{\sqrt{105}}{28} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}}{28} & 0 & 0 & 0 & \frac{\sqrt{21}}{28} \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{28} & 0 & 0 & 0 \end{pmatrix}$ |
| 265 | symmetry | $-\frac{\sqrt{5}xy\left(x^2+y^2-6z^2\right)}{2}$ |

Table 6

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_4^{(1,-1;a)}(B_{2u})$$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{28} & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{21}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{105}i}{28} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}i}{28} & 0 & 0 & 0 & \frac{\sqrt{21}i}{28} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{28} & 0 & 0 & 0
\end{bmatrix}$$

266    symmetry    $\dfrac{\sqrt{35}yz(y-z)(y+z)}{2}$

$$\mathbb{M}_{4,1}^{(1,-1;a)}(E_u,1)$$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{i}{16} & 0 & -\frac{\sqrt{10}i}{16} & 0 & -\frac{\sqrt{5}i}{16} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{16} & 0 & \frac{\sqrt{30}i}{16} & 0 & \frac{\sqrt{3}i}{16} \\
0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{16} & 0 & -\frac{\sqrt{30}i}{16} & 0 & -\frac{\sqrt{15}i}{16} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}i}{16} & 0 & \frac{\sqrt{10}i}{16} & 0 & \frac{i}{16}
\end{bmatrix}$$

267    symmetry    $-\dfrac{\sqrt{35}xz(x-z)(x+z)}{2}$

$$\mathbb{M}_{4,2}^{(1,-1;a)}(E_u,1)$$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{1}{16} & 0 & -\frac{\sqrt{10}}{16} & 0 & \frac{\sqrt{5}}{16} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{16} & 0 & \frac{\sqrt{30}}{16} & 0 & -\frac{\sqrt{3}}{16} \\
0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{16} & 0 & \frac{\sqrt{30}}{16} & 0 & -\frac{\sqrt{15}}{16} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{16} & 0 & -\frac{\sqrt{10}}{16} & 0 & \frac{1}{16}
\end{bmatrix}$$

268    symmetry    $\dfrac{\sqrt{5}yz\left(6x^2-y^2-z^2\right)}{2}$

$$\mathbb{M}_{4,1}^{(1,-1;a)}(E_u,2)$$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{112} & 0 & -\frac{\sqrt{70}i}{112} & 0 & \frac{\sqrt{35}i}{16} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}i}{112} & 0 & \frac{\sqrt{210}i}{112} & 0 & -\frac{\sqrt{21}i}{16} \\
0 & 0 & 0 & 0 & \frac{\sqrt{21}i}{16} & 0 & -\frac{\sqrt{210}i}{112} & 0 & -\frac{\sqrt{105}i}{112} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{35}i}{16} & 0 & \frac{\sqrt{70}i}{112} & 0 & \frac{\sqrt{7}i}{112}
\end{bmatrix}$$

269    symmetry    $\dfrac{\sqrt{5}xz\left(x^2-6y^2+z^2\right)}{2}$

*continued ...*

Table 6

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_{4,2}^{(1,-1;a)}(E_u,2)$$

$$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{112} & 0 & -\frac{\sqrt{70}}{112} & 0 & -\frac{\sqrt{35}}{16} & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}}{112} & 0 & \frac{\sqrt{210}}{112} & 0 & \frac{\sqrt{21}}{16} \\ 0 & 0 & 0 & 0 & \frac{\sqrt{21}}{16} & 0 & \frac{\sqrt{210}}{112} & 0 & -\frac{\sqrt{105}}{112} & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{35}}{16} & 0 & -\frac{\sqrt{70}}{112} & 0 & \frac{\sqrt{7}}{112} \end{pmatrix}$$

**270**  symmetry  $-\frac{x^2}{2} - \frac{y^2}{2} + z^2$

$$\mathbb{M}_2^{(1,0;a)}(A_{1u})$$

$$\begin{pmatrix} 0 & -\frac{\sqrt{30}}{60} & 0 & 0 & 0 & 0 & \frac{2\sqrt{5}}{15} & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{30}}{60} & 0 & 0 & 0 & 0 & \frac{2\sqrt{5}}{15} & 0 & 0 \\ \frac{\sqrt{15}}{15} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{30} & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{15}}{15} & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{60} & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{15}}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{60} & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{15}}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{30} & 0 \end{pmatrix}$$

**271**  symmetry  $\frac{\sqrt{3}(x-y)(x+y)}{2}$

$$\mathbb{M}_2^{(1,0;a)}(B_{1u})$$

$$\begin{pmatrix} 0 & 0 & 0 & -\frac{\sqrt{30}}{60} & \frac{\sqrt{6}}{9} & 0 & 0 & 0 & \frac{\sqrt{30}}{45} & 0 \\ \frac{\sqrt{30}}{60} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{45} & 0 & 0 & 0 & \frac{\sqrt{6}}{9} \\ 0 & 0 & \frac{\sqrt{15}}{15} & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{60} & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{15}}{15} & -\frac{\sqrt{3}}{18} & 0 & 0 & 0 & \frac{\sqrt{15}}{45} & 0 \\ \frac{\sqrt{15}}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{45} & 0 & 0 & 0 & \frac{\sqrt{3}}{18} \\ 0 & \frac{\sqrt{15}}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{60} & 0 & 0 & 0 \end{pmatrix}$$

**272**  symmetry  $\sqrt{3}xy$

$$\mathbb{M}_2^{(1,0;a)}(B_{2u})$$

$$\begin{pmatrix} 0 & 0 & 0 & \frac{\sqrt{30}i}{60} & \frac{\sqrt{6}i}{9} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{45} & 0 \\ \frac{\sqrt{30}i}{60} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{45} & 0 & 0 & 0 & -\frac{\sqrt{6}i}{9} \\ 0 & 0 & -\frac{\sqrt{15}i}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{60} & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{15}i}{15} & -\frac{\sqrt{3}i}{18} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{45} & 0 \\ \frac{\sqrt{15}i}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{45} & 0 & 0 & 0 & -\frac{\sqrt{3}i}{18} \\ 0 & \frac{\sqrt{15}i}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{60} & 0 & 0 & 0 \end{pmatrix}$$

**273**  symmetry  $\sqrt{3}yz$

*continued ...*

Table 6

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_{2,1}^{(1,0;a)}(E_u)\quad\begin{bmatrix} \frac{\sqrt{30}i}{120} & 0 & \frac{\sqrt{10}i}{40} & 0 & 0 & -\frac{2\sqrt{30}i}{45} & 0 & -\frac{2\sqrt{15}i}{45} & 0 & 0 \\ 0 & -\frac{\sqrt{10}i}{40} & 0 & -\frac{\sqrt{30}i}{120} & 0 & 0 & -\frac{2\sqrt{15}i}{45} & 0 & -\frac{2\sqrt{30}i}{45} & 0 \\ 0 & -\frac{\sqrt{15}i}{15} & 0 & 0 & -\frac{i}{12} & 0 & -\frac{\sqrt{10}i}{40} & 0 & 0 & 0 \\ \frac{\sqrt{15}i}{15} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{180} & 0 & -\frac{\sqrt{30}i}{72} & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{15}i}{15} & 0 & 0 & \frac{\sqrt{30}i}{72} & 0 & -\frac{\sqrt{15}i}{180} & 0 \\ 0 & 0 & -\frac{\sqrt{15}i}{15} & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{40} & 0 & \frac{i}{12} \end{bmatrix}$$

| 274 | symmetry | $-\sqrt{3}xz$ |

$$\mathbb{M}_{2,2}^{(1,0;a)}(E_u)\quad\begin{bmatrix} -\frac{\sqrt{30}}{120} & 0 & \frac{\sqrt{10}}{40} & 0 & 0 & \frac{2\sqrt{30}}{45} & 0 & -\frac{2\sqrt{15}}{45} & 0 & 0 \\ 0 & \frac{\sqrt{10}}{40} & 0 & -\frac{\sqrt{30}}{120} & 0 & 0 & \frac{2\sqrt{15}}{45} & 0 & -\frac{2\sqrt{30}}{45} & 0 \\ 0 & -\frac{\sqrt{15}}{15} & 0 & 0 & \frac{1}{12} & 0 & -\frac{\sqrt{10}}{40} & 0 & 0 & 0 \\ -\frac{\sqrt{15}}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{180} & 0 & -\frac{\sqrt{30}}{72} & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{15}}{15} & 0 & 0 & -\frac{\sqrt{30}}{72} & 0 & -\frac{\sqrt{15}}{180} & 0 \\ 0 & 0 & \frac{\sqrt{15}}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{40} & 0 & \frac{1}{12} \end{bmatrix}$$

| 275 | symmetry | $1$ |

$$\mathbb{M}_{0}^{(1,1;a)}(A_{1u})\quad\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ -\frac{\sqrt{2}}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{2}}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{2}}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{2}}{4} & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

| 276 | symmetry | $-\frac{x^2}{2}-\frac{y^2}{2}+z^2$ |

$$\mathbb{M}_{2}^{(1,1;a)}(A_{1u})\quad\begin{bmatrix} 0 & \frac{\sqrt{42}}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{30} & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{42}}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{30} & 0 & 0 \\ \frac{\sqrt{21}}{30} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{21}}{105} & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{21}}{30} & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{105} & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{21}}{30} & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{105} & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{21}}{30} & 0 & 0 & 0 & 0 & \frac{2\sqrt{21}}{105} & 0 \end{bmatrix}$$

| 277 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |

*continued ...*

Table 6

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_2^{(1,1;a)}(B_{1u})$

$$\begin{bmatrix} 0 & 0 & 0 & \frac{\sqrt{42}}{15} & -\frac{\sqrt{210}}{180} & 0 & 0 & 0 & -\frac{\sqrt{42}}{180} & 0 \\ -\frac{\sqrt{42}}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}}{180} & 0 & 0 & 0 & -\frac{\sqrt{210}}{180} \\ 0 & 0 & \frac{\sqrt{21}}{30} & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{105} & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{21}}{30} & \frac{2\sqrt{105}}{315} & 0 & 0 & 0 & -\frac{4\sqrt{21}}{315} & 0 \\ \frac{\sqrt{21}}{30} & 0 & 0 & 0 & 0 & \frac{4\sqrt{21}}{315} & 0 & 0 & 0 & -\frac{2\sqrt{105}}{315} \\ 0 & \frac{\sqrt{21}}{30} & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{105} & 0 & 0 & 0 \end{bmatrix}$$

| 278 | symmetry | $\sqrt{3}xy$ |

$\mathbb{M}_2^{(1,1;a)}(B_{2u})$

$$\begin{bmatrix} 0 & 0 & 0 & -\frac{\sqrt{42}i}{15} & -\frac{\sqrt{210}i}{180} & 0 & 0 & 0 & \frac{\sqrt{42}i}{180} & 0 \\ -\frac{\sqrt{42}i}{15} & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}i}{180} & 0 & 0 & 0 & \frac{\sqrt{210}i}{180} \\ 0 & 0 & -\frac{\sqrt{21}i}{30} & 0 & 0 & 0 & 0 & \frac{\sqrt{14}i}{105} & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{21}i}{30} & \frac{2\sqrt{105}i}{315} & 0 & 0 & 0 & \frac{4\sqrt{21}i}{315} & 0 \\ \frac{\sqrt{21}i}{30} & 0 & 0 & 0 & 0 & \frac{4\sqrt{21}i}{315} & 0 & 0 & 0 & \frac{2\sqrt{105}i}{315} \\ 0 & \frac{\sqrt{21}i}{30} & 0 & 0 & 0 & 0 & \frac{\sqrt{14}i}{105} & 0 & 0 & 0 \end{bmatrix}$$

| 279 | symmetry | $\sqrt{3}yz$ |

$\mathbb{M}_{2,1}^{(1,1;a)}(E_u)$

$$\begin{bmatrix} -\frac{\sqrt{42}i}{30} & 0 & -\frac{\sqrt{14}i}{10} & 0 & 0 & \frac{\sqrt{42}i}{90} & 0 & \frac{\sqrt{21}i}{90} & 0 & 0 \\ 0 & \frac{\sqrt{14}i}{10} & 0 & \frac{\sqrt{42}i}{30} & 0 & 0 & \frac{\sqrt{21}i}{90} & 0 & \frac{\sqrt{42}i}{90} & 0 \\ 0 & -\frac{\sqrt{21}i}{30} & 0 & 0 & \frac{\sqrt{35}i}{105} & 0 & \frac{\sqrt{14}i}{70} & 0 & 0 & 0 \\ \frac{\sqrt{21}i}{30} & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{315} & 0 & \frac{\sqrt{42}i}{126} & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{21}i}{30} & 0 & 0 & -\frac{\sqrt{42}i}{126} & 0 & \frac{\sqrt{21}i}{315} & 0 \\ 0 & 0 & -\frac{\sqrt{21}i}{30} & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}i}{70} & 0 & -\frac{\sqrt{35}i}{105} \end{bmatrix}$$

| 280 | symmetry | $-\sqrt{3}xz$ |

$\mathbb{M}_{2,2}^{(1,1;a)}(E_u)$

$$\begin{bmatrix} \frac{\sqrt{42}}{30} & 0 & -\frac{\sqrt{14}}{10} & 0 & 0 & -\frac{\sqrt{42}}{90} & 0 & \frac{\sqrt{21}}{90} & 0 & 0 \\ 0 & -\frac{\sqrt{14}}{10} & 0 & \frac{\sqrt{42}}{30} & 0 & 0 & -\frac{\sqrt{21}}{90} & 0 & \frac{\sqrt{42}}{90} & 0 \\ 0 & -\frac{\sqrt{21}}{30} & 0 & 0 & -\frac{\sqrt{35}}{105} & 0 & \frac{\sqrt{14}}{70} & 0 & 0 & 0 \\ -\frac{\sqrt{21}}{30} & 0 & 0 & 0 & 0 & \frac{\sqrt{21}}{315} & 0 & \frac{\sqrt{42}}{126} & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{21}}{30} & 0 & 0 & \frac{\sqrt{42}}{126} & 0 & \frac{\sqrt{21}}{315} & 0 \\ 0 & 0 & \frac{\sqrt{21}}{30} & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{70} & 0 & -\frac{\sqrt{35}}{105} \end{bmatrix}$$

bra: $= \langle\tfrac{1}{2},\tfrac{1}{2};p|,\langle\tfrac{1}{2},-\tfrac{1}{2};p|,\langle\tfrac{3}{2},\tfrac{3}{2};p|,\langle\tfrac{3}{2},\tfrac{1}{2};p|,\langle\tfrac{3}{2},-\tfrac{1}{2};p|,\langle\tfrac{3}{2},-\tfrac{3}{2};p|$

ket: $= |\tfrac{5}{2},\tfrac{5}{2};f\rangle,|\tfrac{5}{2},\tfrac{3}{2};f\rangle,|\tfrac{5}{2},\tfrac{1}{2};f\rangle,|\tfrac{5}{2},-\tfrac{1}{2};f\rangle,|\tfrac{5}{2},-\tfrac{3}{2};f\rangle,|\tfrac{5}{2},-\tfrac{5}{2};f\rangle,|\tfrac{7}{2},\tfrac{7}{2};f\rangle,|\tfrac{7}{2},\tfrac{5}{2};f\rangle,|\tfrac{7}{2},\tfrac{3}{2};f\rangle,|\tfrac{7}{2},\tfrac{1}{2};f\rangle,|\tfrac{7}{2},-\tfrac{1}{2};f\rangle,|\tfrac{7}{2},-\tfrac{3}{2};f\rangle,|\tfrac{7}{2},-\tfrac{5}{2};f\rangle,|\tfrac{7}{2},-\tfrac{7}{2};f\rangle$

Table 7: (p,f) block.

| No. | multipole | matrix |
|---|---|---|
| 281 | symmetry | $-\frac{x^2}{2}-\frac{y^2}{2}+z^2$ |

$$\mathbb{Q}_2^{(a)}(A_{1g}) = \begin{bmatrix}
0 & 0 & \frac{\sqrt{3}}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{3}}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{1}{7} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{14} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{6}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{2}}{14} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{6}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{2}}{14} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{1}{7} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{14} & 0 & 0
\end{bmatrix}$$

| No. | multipole | matrix |
|---|---|---|
| 282 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |

$$\mathbb{Q}_2^{(a)}(B_{1g}) = \begin{bmatrix}
\frac{\sqrt{10}}{12} & 0 & 0 & 0 & \frac{\sqrt{2}}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{2}}{12} & 0 & 0 & 0 & \frac{\sqrt{10}}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{6}}{42} & 0 & 0 & \frac{\sqrt{70}}{28} & 0 & 0 & 0 & \frac{\sqrt{2}}{28} & 0 & 0 & 0 \\
\frac{\sqrt{5}}{21} & 0 & 0 & 0 & -\frac{2}{21} & 0 & 0 & \frac{\sqrt{30}}{28} & 0 & 0 & 0 & \frac{\sqrt{10}}{28} & 0 & 0 \\
0 & \frac{2}{21} & 0 & 0 & 0 & -\frac{\sqrt{5}}{21} & 0 & 0 & \frac{\sqrt{10}}{28} & 0 & 0 & 0 & \frac{\sqrt{30}}{28} & 0 \\
0 & 0 & \frac{\sqrt{6}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{28} & 0 & 0 & 0 & \frac{\sqrt{70}}{28}
\end{bmatrix}$$

| No. | multipole | matrix |
|---|---|---|
| 283 | symmetry | $\sqrt{3}xy$ |

$$\mathbb{Q}_2^{(a)}(B_{2g}) = \begin{bmatrix}
\frac{\sqrt{10}i}{12} & 0 & 0 & 0 & -\frac{\sqrt{2}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{2}i}{12} & 0 & 0 & 0 & -\frac{\sqrt{10}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{6}i}{42} & 0 & 0 & \frac{\sqrt{70}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{2}i}{28} & 0 & 0 & 0 \\
\frac{\sqrt{5}i}{21} & 0 & 0 & 0 & \frac{2i}{21} & 0 & 0 & \frac{\sqrt{30}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{10}i}{28} & 0 & 0 \\
0 & \frac{2i}{21} & 0 & 0 & 0 & \frac{\sqrt{5}i}{21} & 0 & 0 & \frac{\sqrt{10}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{28} & 0 \\
0 & 0 & \frac{\sqrt{6}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{70}i}{28}
\end{bmatrix}$$

| No. | multipole | matrix |
|---|---|---|
| 284 | symmetry | $\sqrt{3}yz$ |

*continued ...*

55

Table 7

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{2,1}^{(a)}(E_g)$

$$\begin{bmatrix}
0 & -\frac{\sqrt{2}i}{6} & 0 & -\frac{i}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{i}{6} & 0 & -\frac{\sqrt{2}i}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{15}i}{42} & 0 & \frac{\sqrt{6}i}{28} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{14} & 0 & -\frac{\sqrt{2}i}{14} & 0 & 0 & 0 & 0 \\
0 & -\frac{i}{42} & 0 & \frac{5\sqrt{2}i}{84} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{14} & 0 & -\frac{\sqrt{6}i}{14} & 0 & 0 & 0 \\
0 & 0 & -\frac{5\sqrt{2}i}{84} & 0 & \frac{i}{42} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{14} & 0 & -\frac{\sqrt{10}i}{14} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{6}i}{28} & 0 & -\frac{\sqrt{15}i}{42} & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{14} & 0 & -\frac{\sqrt{10}i}{14} & 0
\end{bmatrix}$$

| 285 | symmetry | $\sqrt{3}xz$ |

$\mathbb{Q}_{2,2}^{(a)}(E_g)$

$$\begin{bmatrix}
0 & -\frac{\sqrt{2}}{6} & 0 & \frac{1}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{1}{6} & 0 & \frac{\sqrt{2}}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{15}}{42} & 0 & -\frac{\sqrt{6}}{28} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{14} & 0 & \frac{\sqrt{2}}{14} & 0 & 0 & 0 & 0 \\
0 & -\frac{1}{42} & 0 & -\frac{5\sqrt{2}}{84} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{14} & 0 & \frac{\sqrt{6}}{14} & 0 & 0 & 0 \\
0 & 0 & -\frac{5\sqrt{2}}{84} & 0 & -\frac{1}{42} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{14} & 0 & \frac{\sqrt{10}}{14} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{6}}{28} & 0 & \frac{\sqrt{15}}{42} & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{14} & 0 & \frac{\sqrt{10}}{14} & 0
\end{bmatrix}$$

| 286 | symmetry | $\frac{\sqrt{21}\left(x^4-3x^2y^2-3x^2z^2+y^4-3y^2z^2+z^4\right)}{6}$ |

$\mathbb{Q}_4^{(a)}(A_{1g},1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{12} & 0 & 0 & 0 & -\frac{\sqrt{5}}{12} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{12} & 0 & 0 & 0 & \frac{\sqrt{7}}{12} & 0 & 0 & 0 \\
0 & \frac{\sqrt{7}}{28} & 0 & 0 & 0 & \frac{\sqrt{35}}{28} & 0 & 0 & -\frac{\sqrt{70}}{56} & 0 & 0 & 0 & -\frac{\sqrt{210}}{168} & 0 \\
0 & 0 & -\frac{\sqrt{42}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{14}}{168} & 0 & 0 & 0 & -\frac{\sqrt{10}}{24} \\
0 & 0 & 0 & \frac{\sqrt{42}}{28} & 0 & 0 & -\frac{\sqrt{10}}{24} & 0 & 0 & 0 & \frac{5\sqrt{14}}{168} & 0 & 0 & 0 \\
-\frac{\sqrt{35}}{28} & 0 & 0 & 0 & -\frac{\sqrt{7}}{28} & 0 & 0 & -\frac{\sqrt{210}}{168} & 0 & 0 & 0 & -\frac{\sqrt{70}}{56} & 0 & 0
\end{bmatrix}$$

| 287 | symmetry | $-\frac{\sqrt{15}\left(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4\right)}{12}$ |

$\mathbb{Q}_4^{(a)}(A_{1g},2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}}{12} & 0 & 0 & 0 & \frac{\sqrt{7}}{12} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{12} & 0 & 0 & 0 & \frac{\sqrt{5}}{12} & 0 & 0 & 0 \\
0 & \frac{\sqrt{5}}{28} & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & -\frac{5\sqrt{2}}{56} & 0 & 0 & 0 & \frac{\sqrt{6}}{24} & 0 \\
0 & 0 & -\frac{\sqrt{30}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{10}}{168} & 0 & 0 & 0 & \frac{\sqrt{14}}{24} \\
0 & 0 & 0 & \frac{\sqrt{30}}{28} & 0 & 0 & \frac{\sqrt{14}}{24} & 0 & 0 & 0 & \frac{5\sqrt{10}}{168} & 0 & 0 & 0 \\
\frac{1}{4} & 0 & 0 & 0 & -\frac{\sqrt{5}}{28} & 0 & 0 & \frac{\sqrt{6}}{24} & 0 & 0 & 0 & -\frac{5\sqrt{2}}{56} & 0 & 0
\end{bmatrix}$$

| 288 | symmetry | $\frac{\sqrt{35}xy(x-y)(x+y)}{2}$ |

*continued ...*

Table 7

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_4^{(a)}(A_{2g})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{6} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}i}{28} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{12} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{21}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}i}{28} & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

**289** symmetry

$$\frac{\sqrt{5}(x-y)(x+y)\left(x^2+y^2-6z^2\right)}{4}$$

$\mathbb{Q}_4^{(a)}(B_{1g})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{12} & 0 & 0 & 0 & \frac{1}{4} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & 0 & -\frac{\sqrt{3}}{12} & 0 \\
0 & 0 & 0 & -\frac{\sqrt{30}}{28} & 0 & 0 & \frac{\sqrt{14}}{56} & 0 & 0 & 0 & \frac{3\sqrt{10}}{56} & 0 & 0 & 0 \\
\frac{3}{28} & 0 & 0 & 0 & \frac{3\sqrt{5}}{28} & 0 & 0 & -\frac{11\sqrt{6}}{168} & 0 & 0 & 0 & \frac{\sqrt{2}}{56} & 0 & 0 \\
0 & -\frac{3\sqrt{5}}{28} & 0 & 0 & 0 & -\frac{3}{28} & 0 & 0 & \frac{\sqrt{2}}{56} & 0 & 0 & 0 & -\frac{11\sqrt{6}}{168} & 0 \\
0 & 0 & \frac{\sqrt{30}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{10}}{56} & 0 & 0 & 0 & \frac{\sqrt{14}}{56}
\end{bmatrix}$$

**290** symmetry

$$-\frac{\sqrt{5}xy\left(x^2+y^2-6z^2\right)}{2}$$

$\mathbb{Q}_4^{(a)}(B_{2g})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{12} & 0 & 0 & 0 & \frac{i}{4} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{i}{4} & 0 & 0 & 0 & -\frac{\sqrt{3}i}{12} & 0 \\
0 & 0 & 0 & -\frac{\sqrt{30}i}{28} & 0 & 0 & -\frac{\sqrt{14}i}{56} & 0 & 0 & 0 & \frac{3\sqrt{10}i}{56} & 0 & 0 & 0 \\
-\frac{3i}{28} & 0 & 0 & 0 & \frac{3\sqrt{5}i}{28} & 0 & 0 & \frac{11\sqrt{6}i}{168} & 0 & 0 & 0 & \frac{\sqrt{2}i}{56} & 0 & 0 \\
0 & \frac{3\sqrt{5}i}{28} & 0 & 0 & 0 & -\frac{3i}{28} & 0 & 0 & -\frac{\sqrt{2}i}{56} & 0 & 0 & 0 & -\frac{11\sqrt{6}i}{168} & 0 \\
0 & 0 & -\frac{\sqrt{30}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}i}{56} & 0 & 0 & 0 & \frac{\sqrt{14}i}{56}
\end{bmatrix}$$

**291** symmetry

$$\frac{\sqrt{35}yz(y-z)(y+z)}{2}$$

$\mathbb{Q}_{4,1}^{(a)}(E_g,1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{48} & 0 & -\frac{\sqrt{7}i}{16} & 0 & -\frac{\sqrt{105}i}{48} & 0 & -\frac{\sqrt{21}i}{48} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}i}{48} & 0 & \frac{\sqrt{105}i}{48} & 0 & \frac{\sqrt{7}i}{16} & 0 & \frac{\sqrt{3}i}{48} \\
\frac{\sqrt{21}i}{112} & 0 & \frac{\sqrt{210}i}{112} & 0 & \frac{\sqrt{105}i}{112} & 0 & 0 & -\frac{3\sqrt{14}i}{112} & 0 & -\frac{\sqrt{70}i}{56} & 0 & -\frac{\sqrt{42}i}{112} & 0 & 0 \\
0 & -\frac{3\sqrt{35}i}{112} & 0 & -\frac{3\sqrt{70}i}{112} & 0 & -\frac{3\sqrt{7}i}{112} & \frac{\sqrt{6}i}{48} & 0 & \frac{\sqrt{14}i}{28} & 0 & \frac{\sqrt{210}i}{336} & 0 & -\frac{\sqrt{42}i}{168} & 0 \\
\frac{3\sqrt{7}i}{112} & 0 & \frac{3\sqrt{70}i}{112} & 0 & \frac{3\sqrt{35}i}{112} & 0 & 0 & -\frac{\sqrt{42}i}{168} & 0 & \frac{\sqrt{210}i}{336} & 0 & \frac{\sqrt{14}i}{28} & 0 & \frac{\sqrt{6}i}{48} \\
0 & -\frac{\sqrt{105}i}{112} & 0 & -\frac{\sqrt{210}i}{112} & 0 & -\frac{\sqrt{21}i}{112} & 0 & 0 & -\frac{\sqrt{42}i}{112} & 0 & -\frac{\sqrt{70}i}{56} & 0 & -\frac{3\sqrt{14}i}{112} & 0
\end{bmatrix}$$

**292** symmetry

$$\frac{\sqrt{35}xz(x-z)(x+z)}{2}$$

*continued ...*

Table 7

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{4,2}^{(a)}(E_g,1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{48} & 0 & -\frac{\sqrt{7}}{16} & 0 & \frac{\sqrt{105}}{48} & 0 & -\frac{\sqrt{21}}{48} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}}{48} & 0 & \frac{\sqrt{105}}{48} & 0 & -\frac{\sqrt{7}}{16} & 0 & \frac{\sqrt{3}}{48} \\
\frac{\sqrt{21}}{112} & 0 & -\frac{\sqrt{210}}{112} & 0 & \frac{\sqrt{105}}{112} & 0 & 0 & -\frac{3\sqrt{14}}{112} & 0 & \frac{\sqrt{70}}{56} & 0 & -\frac{\sqrt{42}}{112} & 0 & 0 \\
0 & -\frac{3\sqrt{35}}{112} & 0 & \frac{3\sqrt{70}}{112} & 0 & -\frac{3\sqrt{7}}{112} & -\frac{\sqrt{6}}{48} & 0 & \frac{\sqrt{14}}{28} & 0 & -\frac{\sqrt{210}}{336} & 0 & -\frac{\sqrt{42}}{168} & 0 \\
-\frac{3\sqrt{7}}{112} & 0 & \frac{3\sqrt{70}}{112} & 0 & -\frac{3\sqrt{35}}{112} & 0 & 0 & \frac{\sqrt{42}}{168} & 0 & \frac{\sqrt{210}}{336} & 0 & -\frac{\sqrt{14}}{28} & 0 & \frac{\sqrt{6}}{48} \\
0 & \frac{\sqrt{105}}{112} & 0 & -\frac{\sqrt{210}}{112} & 0 & \frac{\sqrt{21}}{112} & 0 & 0 & \frac{\sqrt{42}}{112} & 0 & -\frac{\sqrt{70}}{56} & 0 & \frac{3\sqrt{14}}{112} & 0
\end{bmatrix}$$

| 293 | symmetry | $\dfrac{\sqrt{5}yz(6x^2-y^2-z^2)}{2}$ |
|---|---|---|

$\mathbb{Q}_{4,1}^{(a)}(E_g,2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}i}{48} & 0 & -\frac{i}{16} & 0 & -\frac{\sqrt{15}i}{48} & 0 & \frac{7\sqrt{3}i}{48} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{7\sqrt{3}i}{48} & 0 & \frac{\sqrt{15}i}{48} & 0 & \frac{i}{16} & 0 & -\frac{\sqrt{21}i}{48} \\
\frac{\sqrt{3}i}{112} & 0 & \frac{\sqrt{30}i}{112} & 0 & -\frac{\sqrt{15}i}{16} & 0 & 0 & -\frac{3\sqrt{2}i}{112} & 0 & -\frac{\sqrt{10}i}{56} & 0 & \frac{\sqrt{6}i}{16} & 0 & 0 \\
0 & -\frac{3\sqrt{5}i}{112} & 0 & -\frac{3\sqrt{10}i}{112} & 0 & \frac{3i}{16} & -\frac{\sqrt{42}i}{48} & 0 & \frac{\sqrt{2}i}{28} & 0 & \frac{\sqrt{30}i}{336} & 0 & \frac{\sqrt{6}i}{24} & 0 \\
-\frac{3i}{16} & 0 & \frac{3\sqrt{10}i}{112} & 0 & \frac{3\sqrt{5}i}{112} & 0 & 0 & \frac{\sqrt{6}i}{24} & 0 & \frac{\sqrt{30}i}{336} & 0 & \frac{\sqrt{2}i}{28} & 0 & -\frac{\sqrt{42}i}{48} \\
0 & \frac{\sqrt{15}i}{16} & 0 & -\frac{\sqrt{30}i}{112} & 0 & -\frac{\sqrt{3}i}{112} & 0 & 0 & \frac{\sqrt{6}i}{16} & 0 & -\frac{\sqrt{10}i}{56} & 0 & -\frac{3\sqrt{2}i}{112} & 0
\end{bmatrix}$$

| 294 | symmetry | $-\dfrac{\sqrt{5}xz(x^2-6y^2+z^2)}{2}$ |
|---|---|---|

$\mathbb{Q}_{4,2}^{(a)}(E_g,2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}}{48} & 0 & -\frac{1}{16} & 0 & \frac{\sqrt{15}}{48} & 0 & \frac{7\sqrt{3}}{48} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{7\sqrt{3}}{48} & 0 & \frac{\sqrt{15}}{48} & 0 & -\frac{1}{16} & 0 & -\frac{\sqrt{21}}{48} \\
\frac{\sqrt{3}}{112} & 0 & -\frac{\sqrt{30}}{112} & 0 & -\frac{\sqrt{15}}{16} & 0 & 0 & -\frac{3\sqrt{2}}{112} & 0 & \frac{\sqrt{10}}{56} & 0 & \frac{\sqrt{6}}{16} & 0 & 0 \\
0 & -\frac{3\sqrt{5}}{112} & 0 & \frac{3\sqrt{10}}{112} & 0 & \frac{3}{16} & \frac{\sqrt{42}}{48} & 0 & \frac{\sqrt{2}}{28} & 0 & -\frac{\sqrt{30}}{336} & 0 & \frac{\sqrt{6}}{24} & 0 \\
\frac{3}{16} & 0 & \frac{3\sqrt{10}}{112} & 0 & -\frac{3\sqrt{5}}{112} & 0 & 0 & -\frac{\sqrt{6}}{24} & 0 & \frac{\sqrt{30}}{336} & 0 & -\frac{\sqrt{2}}{28} & 0 & -\frac{\sqrt{42}}{48} \\
0 & -\frac{\sqrt{15}}{16} & 0 & -\frac{\sqrt{30}}{112} & 0 & \frac{\sqrt{3}}{112} & 0 & 0 & -\frac{\sqrt{6}}{16} & 0 & -\frac{\sqrt{10}}{56} & 0 & \frac{3\sqrt{2}}{112} & 0
\end{bmatrix}$$

| 295 | symmetry | $\dfrac{\sqrt{21}(x^4-3x^2y^2-3x^2z^2+y^4-3y^2z^2+z^4)}{6}$ |
|---|---|---|

$\mathbb{Q}_4^{(1,-1;a)}(A_{1g},1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}}{24} & 0 & 0 & 0 & -\frac{\sqrt{15}}{24} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{24} & 0 & 0 & 0 & \frac{\sqrt{21}}{24} & 0 & 0 & 0 \\
0 & \frac{\sqrt{21}}{168} & 0 & 0 & 0 & \frac{\sqrt{105}}{168} & 0 & 0 & \frac{\sqrt{210}}{56} & 0 & 0 & 0 & \frac{\sqrt{70}}{56} & 0 \\
0 & 0 & -\frac{\sqrt{14}}{56} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{42}}{168} & 0 & 0 & 0 & \frac{\sqrt{30}}{24} \\
0 & 0 & 0 & \frac{\sqrt{14}}{56} & 0 & 0 & \frac{\sqrt{30}}{24} & 0 & 0 & 0 & -\frac{5\sqrt{42}}{168} & 0 & 0 & 0 \\
-\frac{\sqrt{105}}{168} & 0 & 0 & 0 & -\frac{\sqrt{21}}{168} & 0 & 0 & \frac{\sqrt{70}}{56} & 0 & 0 & 0 & \frac{\sqrt{210}}{56} & 0 & 0
\end{bmatrix}$$

| 296 | symmetry | $-\dfrac{\sqrt{15}(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4)}{12}$ |
|---|---|---|

continued ...

Table 7

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_4^{(1,-1;a)}(A_{1g},2)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{24} & 0 & 0 & 0 & \frac{\sqrt{21}}{24} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}}{24} & 0 & 0 & 0 & \frac{\sqrt{15}}{24} & 0 & 0 & 0 \\
0 & \frac{\sqrt{15}}{168} & 0 & 0 & 0 & -\frac{\sqrt{3}}{24} & 0 & 0 & \frac{5\sqrt{6}}{56} & 0 & 0 & 0 & -\frac{\sqrt{2}}{8} & 0 \\
0 & 0 & -\frac{\sqrt{10}}{56} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{30}}{168} & 0 & 0 & 0 & -\frac{\sqrt{42}}{24} \\
0 & 0 & 0 & \frac{\sqrt{10}}{56} & 0 & 0 & -\frac{\sqrt{42}}{24} & 0 & 0 & 0 & -\frac{5\sqrt{30}}{168} & 0 & 0 & 0 \\
\frac{\sqrt{3}}{24} & 0 & 0 & 0 & -\frac{\sqrt{15}}{168} & 0 & 0 & -\frac{\sqrt{2}}{8} & 0 & 0 & 0 & \frac{5\sqrt{6}}{56} & 0 & 0
\end{pmatrix}$$

| 297 | symmetry | $\dfrac{\sqrt{35}xy(x-y)(x+y)}{2}$ |

$\mathbb{Q}_4^{(1,-1;a)}(A_{2g})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{i}{4} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{i}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}i}{28} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{4} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{7}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{28} & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

| 298 | symmetry | $\dfrac{\sqrt{5}(x-y)(x+y)\left(x^2+y^2-6z^2\right)}{4}$ |

$\mathbb{Q}_4^{(1,-1;a)}(B_{1g})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{8} & 0 & 0 & 0 & \frac{\sqrt{3}}{8} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{8} & 0 & 0 & 0 & -\frac{1}{8} & 0 \\
0 & 0 & 0 & -\frac{\sqrt{10}}{56} & 0 & 0 & -\frac{\sqrt{42}}{56} & 0 & 0 & 0 & -\frac{3\sqrt{30}}{56} & 0 & 0 & 0 \\
\frac{\sqrt{3}}{56} & 0 & 0 & 0 & \frac{\sqrt{15}}{56} & 0 & 0 & \frac{11\sqrt{2}}{56} & 0 & 0 & 0 & -\frac{\sqrt{6}}{56} & 0 & 0 \\
0 & -\frac{\sqrt{15}}{56} & 0 & 0 & 0 & -\frac{\sqrt{3}}{56} & 0 & 0 & -\frac{\sqrt{6}}{56} & 0 & 0 & 0 & \frac{11\sqrt{2}}{56} & 0 \\
0 & 0 & \frac{\sqrt{10}}{56} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{30}}{56} & 0 & 0 & 0 & -\frac{\sqrt{42}}{56}
\end{bmatrix}$$

| 299 | symmetry | $-\dfrac{\sqrt{5}xy\left(x^2+y^2-6z^2\right)}{2}$ |

$\mathbb{Q}_4^{(1,-1;a)}(B_{2g})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{i}{8} & 0 & 0 & 0 & \frac{\sqrt{3}i}{8} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{8} & 0 & 0 & 0 & -\frac{i}{8} & 0 \\
0 & 0 & 0 & -\frac{\sqrt{10}i}{56} & 0 & 0 & \frac{\sqrt{42}i}{56} & 0 & 0 & 0 & -\frac{3\sqrt{30}i}{56} & 0 & 0 & 0 \\
-\frac{\sqrt{3}i}{56} & 0 & 0 & 0 & \frac{\sqrt{15}i}{56} & 0 & 0 & -\frac{11\sqrt{2}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{6}i}{56} & 0 & 0 \\
0 & \frac{\sqrt{15}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{3}i}{56} & 0 & 0 & \frac{\sqrt{6}i}{56} & 0 & 0 & 0 & \frac{11\sqrt{2}i}{56} & 0 \\
0 & 0 & -\frac{\sqrt{10}i}{56} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{30}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{42}i}{56}
\end{bmatrix}$$

| 300 | symmetry | $\dfrac{\sqrt{35}yz(y-z)(y+z)}{2}$ |

*continued ...*

Table 7

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{Q}_{4,1}^{(1,-1;a)}(E_g,1) = \begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & -\frac{i}{32} & 0 & -\frac{\sqrt{21}i}{32} & 0 & -\frac{\sqrt{35}i}{32} & 0 & -\frac{\sqrt{7}i}{32} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{32} & 0 & \frac{\sqrt{35}i}{32} & 0 & \frac{\sqrt{21}i}{32} & 0 & \frac{i}{32} \\
\frac{\sqrt{7}i}{224} & 0 & \frac{\sqrt{70}i}{224} & 0 & \frac{\sqrt{35}i}{224} & 0 & 0 & \frac{3\sqrt{42}i}{112} & 0 & \frac{\sqrt{210}i}{56} & 0 & \frac{3\sqrt{14}i}{112} & 0 & 0 \\
0 & -\frac{\sqrt{105}i}{224} & 0 & -\frac{\sqrt{210}i}{224} & 0 & -\frac{\sqrt{21}i}{224} & -\frac{\sqrt{2}i}{16} & 0 & -\frac{\sqrt{42}i}{28} & 0 & -\frac{\sqrt{70}i}{112} & 0 & \frac{\sqrt{14}i}{56} & 0 \\
\frac{\sqrt{21}i}{224} & 0 & \frac{\sqrt{210}i}{224} & 0 & \frac{\sqrt{105}i}{224} & 0 & 0 & \frac{\sqrt{14}i}{56} & 0 & -\frac{\sqrt{70}i}{112} & 0 & -\frac{\sqrt{42}i}{28} & 0 & -\frac{\sqrt{2}i}{16} \\
0 & -\frac{\sqrt{35}i}{224} & 0 & -\frac{\sqrt{70}i}{224} & 0 & -\frac{\sqrt{7}i}{224} & 0 & 0 & \frac{3\sqrt{14}i}{112} & 0 & \frac{\sqrt{210}i}{56} & 0 & \frac{3\sqrt{42}i}{112} & 0
\end{pmatrix}$$

| 301 | symmetry | $\dfrac{\sqrt{35}xz(x-z)(x+z)}{2}$ |
|---|---|---|

$$\mathbb{Q}_{4,2}^{(1,-1;a)}(E_g,1) = \begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{32} & 0 & -\frac{\sqrt{21}}{32} & 0 & \frac{\sqrt{35}}{32} & 0 & -\frac{\sqrt{7}}{32} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{32} & 0 & \frac{\sqrt{35}}{32} & 0 & -\frac{\sqrt{21}}{32} & 0 & \frac{1}{32} \\
\frac{\sqrt{7}}{224} & 0 & -\frac{\sqrt{70}}{224} & 0 & \frac{\sqrt{35}}{224} & 0 & 0 & \frac{3\sqrt{42}}{112} & 0 & -\frac{\sqrt{210}}{56} & 0 & \frac{3\sqrt{14}}{112} & 0 & 0 \\
0 & -\frac{\sqrt{105}}{224} & 0 & \frac{\sqrt{210}}{224} & 0 & -\frac{\sqrt{21}}{224} & \frac{\sqrt{2}}{16} & 0 & -\frac{\sqrt{42}}{28} & 0 & \frac{\sqrt{70}}{112} & 0 & \frac{\sqrt{14}}{56} & 0 \\
-\frac{\sqrt{21}}{224} & 0 & \frac{\sqrt{210}}{224} & 0 & -\frac{\sqrt{105}}{224} & 0 & 0 & -\frac{\sqrt{14}}{56} & 0 & -\frac{\sqrt{70}}{112} & 0 & \frac{\sqrt{42}}{28} & 0 & -\frac{\sqrt{2}}{16} \\
0 & \frac{\sqrt{35}}{224} & 0 & -\frac{\sqrt{70}}{224} & 0 & \frac{\sqrt{7}}{224} & 0 & 0 & -\frac{3\sqrt{14}}{112} & 0 & \frac{\sqrt{210}}{56} & 0 & -\frac{3\sqrt{42}}{112} & 0
\end{pmatrix}$$

| 302 | symmetry | $\dfrac{\sqrt{5}yz\left(6x^2-y^2-z^2\right)}{2}$ |
|---|---|---|

$$\mathbb{Q}_{4,1}^{(1,-1;a)}(E_g,2) = \begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{32} & 0 & -\frac{\sqrt{3}i}{32} & 0 & -\frac{\sqrt{5}i}{32} & 0 & \frac{7i}{32} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{7i}{32} & 0 & \frac{\sqrt{5}i}{32} & 0 & \frac{\sqrt{3}i}{32} & 0 & -\frac{\sqrt{7}i}{32} \\
\frac{i}{224} & 0 & \frac{\sqrt{10}i}{224} & 0 & -\frac{\sqrt{5}i}{32} & 0 & 0 & \frac{3\sqrt{6}i}{112} & 0 & \frac{\sqrt{30}i}{56} & 0 & -\frac{3\sqrt{2}i}{16} & 0 & 0 \\
0 & -\frac{\sqrt{15}i}{224} & 0 & -\frac{\sqrt{30}i}{224} & 0 & \frac{\sqrt{3}i}{32} & \frac{\sqrt{14}i}{16} & 0 & -\frac{\sqrt{6}i}{28} & 0 & -\frac{\sqrt{10}i}{112} & 0 & -\frac{\sqrt{2}i}{8} & 0 \\
-\frac{\sqrt{3}i}{32} & 0 & \frac{\sqrt{30}i}{224} & 0 & \frac{\sqrt{15}i}{224} & 0 & 0 & -\frac{\sqrt{2}i}{8} & 0 & -\frac{\sqrt{10}i}{112} & 0 & -\frac{\sqrt{6}i}{28} & 0 & \frac{\sqrt{14}i}{16} \\
0 & \frac{\sqrt{5}i}{32} & 0 & -\frac{\sqrt{10}i}{224} & 0 & -\frac{i}{224} & 0 & 0 & -\frac{3\sqrt{2}i}{16} & 0 & \frac{\sqrt{30}i}{56} & 0 & \frac{3\sqrt{6}i}{112} & 0
\end{pmatrix}$$

| 303 | symmetry | $-\dfrac{\sqrt{5}xz\left(x^2-6y^2+z^2\right)}{2}$ |
|---|---|---|

$$\mathbb{Q}_{4,2}^{(1,-1;a)}(E_g,2) = \begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{32} & 0 & -\frac{\sqrt{3}}{32} & 0 & \frac{\sqrt{5}}{32} & 0 & \frac{7}{32} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{7}{32} & 0 & \frac{\sqrt{5}}{32} & 0 & -\frac{\sqrt{3}}{32} & 0 & -\frac{\sqrt{7}}{32} \\
\frac{1}{224} & 0 & -\frac{\sqrt{10}}{224} & 0 & -\frac{\sqrt{5}}{32} & 0 & 0 & \frac{3\sqrt{6}}{112} & 0 & -\frac{\sqrt{30}}{56} & 0 & -\frac{3\sqrt{2}}{16} & 0 & 0 \\
0 & -\frac{\sqrt{15}}{224} & 0 & \frac{\sqrt{30}}{224} & 0 & \frac{\sqrt{3}}{32} & -\frac{\sqrt{14}}{16} & 0 & -\frac{\sqrt{6}}{28} & 0 & \frac{\sqrt{10}}{112} & 0 & -\frac{\sqrt{2}}{8} & 0 \\
\frac{\sqrt{3}}{32} & 0 & \frac{\sqrt{30}}{224} & 0 & -\frac{\sqrt{15}}{224} & 0 & 0 & \frac{\sqrt{2}}{8} & 0 & -\frac{\sqrt{10}}{112} & 0 & \frac{\sqrt{6}}{28} & 0 & \frac{\sqrt{14}}{16} \\
0 & -\frac{\sqrt{5}}{32} & 0 & -\frac{\sqrt{10}}{224} & 0 & \frac{1}{224} & 0 & 0 & \frac{3\sqrt{2}}{16} & 0 & \frac{\sqrt{30}}{56} & 0 & -\frac{3\sqrt{6}}{112} & 0
\end{pmatrix}$$

| 304 | symmetry | $-\dfrac{x^2}{2}-\dfrac{y^2}{2}+z^2$ |
|---|---|---|

*continued ...*

Table 7

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_2^{(1,0;a)}(A_{1g})$

$$\begin{bmatrix}
0 & 0 & -\frac{\sqrt{2}}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{2}}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{5\sqrt{6}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{21} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{5}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{7} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{5}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{7} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{5\sqrt{6}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{21} & 0 & 0
\end{bmatrix}$$

305   symmetry   $\frac{\sqrt{3}(x-y)(x+y)}{2}$

$\mathbb{Q}_2^{(1,0;a)}(B_{1g})$

$$\begin{bmatrix}
-\frac{\sqrt{15}}{18} & 0 & 0 & 0 & -\frac{\sqrt{3}}{18} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{3}}{18} & 0 & 0 & 0 & -\frac{\sqrt{15}}{18} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{5}{42} & 0 & 0 & \frac{\sqrt{105}}{42} & 0 & 0 & 0 & \frac{\sqrt{3}}{42} & 0 & 0 & 0 \\
-\frac{5\sqrt{30}}{126} & 0 & 0 & 0 & \frac{5\sqrt{6}}{63} & 0 & 0 & \frac{\sqrt{5}}{14} & 0 & 0 & 0 & \frac{\sqrt{15}}{42} & 0 & 0 \\
0 & -\frac{5\sqrt{6}}{63} & 0 & 0 & 0 & \frac{5\sqrt{30}}{126} & 0 & 0 & \frac{\sqrt{15}}{42} & 0 & 0 & 0 & \frac{\sqrt{5}}{14} & 0 \\
0 & 0 & -\frac{5}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{42} & 0 & 0 & 0 & \frac{\sqrt{105}}{42}
\end{bmatrix}$$

306   symmetry   $\sqrt{3}xy$

$\mathbb{Q}_2^{(1,0;a)}(B_{2g})$

$$\begin{bmatrix}
-\frac{\sqrt{15}i}{18} & 0 & 0 & 0 & \frac{\sqrt{3}i}{18} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{3}i}{18} & 0 & 0 & 0 & \frac{\sqrt{15}i}{18} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{5i}{42} & 0 & 0 & \frac{\sqrt{105}i}{42} & 0 & 0 & 0 & -\frac{\sqrt{3}i}{42} & 0 & 0 & 0 \\
-\frac{5\sqrt{30}i}{126} & 0 & 0 & 0 & -\frac{5\sqrt{6}i}{63} & 0 & 0 & \frac{\sqrt{5}i}{14} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{42} & 0 & 0 \\
0 & -\frac{5\sqrt{6}i}{63} & 0 & 0 & 0 & -\frac{5\sqrt{30}i}{126} & 0 & 0 & \frac{\sqrt{15}i}{42} & 0 & 0 & 0 & -\frac{\sqrt{5}i}{14} & 0 \\
0 & 0 & -\frac{5i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{42} & 0 & 0 & 0 & -\frac{\sqrt{105}i}{42}
\end{bmatrix}$$

307   symmetry   $\sqrt{3}yz$

$\mathbb{Q}_{2,1}^{(1,0;a)}(E_g)$

$$\begin{bmatrix}
0 & \frac{\sqrt{3}i}{9} & 0 & \frac{\sqrt{6}i}{18} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{6}i}{18} & 0 & \frac{\sqrt{3}i}{9} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{5\sqrt{10}i}{84} & 0 & -\frac{5i}{28} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{21} & 0 & -\frac{\sqrt{3}i}{21} & 0 & 0 & 0 & 0 \\
0 & \frac{5\sqrt{6}i}{252} & 0 & -\frac{25\sqrt{3}i}{252} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{21} & 0 & -\frac{i}{7} & 0 & 0 & 0 \\
0 & 0 & \frac{25\sqrt{3}i}{252} & 0 & -\frac{5\sqrt{6}i}{252} & 0 & 0 & 0 & 0 & -\frac{i}{7} & 0 & -\frac{\sqrt{15}i}{21} & 0 & 0 \\
0 & 0 & 0 & \frac{5i}{28} & 0 & \frac{5\sqrt{10}i}{84} & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{21} & 0 & -\frac{\sqrt{15}i}{21} & 0
\end{bmatrix}$$

308   symmetry   $\sqrt{3}xz$

*continued ...*

Table 7

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{2,2}^{(1,0;a)}(E_g)$

$$\begin{bmatrix}
0 & \frac{\sqrt{3}}{9} & 0 & -\frac{\sqrt{6}}{18} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{6}}{18} & 0 & -\frac{\sqrt{3}}{9} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{5\sqrt{10}}{84} & 0 & \frac{5}{28} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{21} & 0 & \frac{\sqrt{3}}{21} & 0 & 0 & 0 & 0 \\
0 & \frac{5\sqrt{6}}{252} & 0 & \frac{25\sqrt{3}}{252} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{21} & 0 & \frac{1}{7} & 0 & 0 & 0 \\
0 & 0 & \frac{25\sqrt{3}}{252} & 0 & \frac{5\sqrt{6}}{252} & 0 & 0 & 0 & 0 & -\frac{1}{7} & 0 & \frac{\sqrt{15}}{21} & 0 & 0 \\
0 & 0 & 0 & \frac{5}{28} & 0 & -\frac{5\sqrt{10}}{84} & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{21} & 0 & \frac{\sqrt{15}}{21} & 0
\end{bmatrix}$$

309    symmetry    $\dfrac{\sqrt{21}\left(x^4-3x^2y^2-3x^2z^2+y^4-3y^2z^2+z^4\right)}{6}$

$\mathbb{Q}_4^{(1,0;a)}(A_{1g},1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{35}}{24} & 0 & 0 & 0 & -\frac{5}{24} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{5}{24} & 0 & 0 & 0 & \frac{\sqrt{35}}{24} & 0 & 0 & 0 \\
0 & -\frac{\sqrt{35}}{56} & 0 & 0 & 0 & -\frac{5\sqrt{7}}{56} & 0 & 0 & -\frac{\sqrt{14}}{56} & 0 & 0 & 0 & -\frac{\sqrt{42}}{168} & 0 \\
0 & 0 & \frac{\sqrt{210}}{56} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{168} & 0 & 0 & 0 & -\frac{\sqrt{2}}{24} \\
0 & 0 & 0 & -\frac{\sqrt{210}}{56} & 0 & 0 & -\frac{\sqrt{2}}{24} & 0 & 0 & 0 & \frac{\sqrt{70}}{168} & 0 & 0 & 0 \\
\frac{5\sqrt{7}}{56} & 0 & 0 & 0 & \frac{\sqrt{35}}{56} & 0 & 0 & -\frac{\sqrt{42}}{168} & 0 & 0 & 0 & -\frac{\sqrt{14}}{56} & 0 & 0
\end{bmatrix}$$

310    symmetry    $-\dfrac{\sqrt{15}\left(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4\right)}{12}$

$\mathbb{Q}_4^{(1,0;a)}(A_{1g},2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5}{24} & 0 & 0 & 0 & \frac{\sqrt{35}}{24} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{35}}{24} & 0 & 0 & 0 & \frac{5}{24} & 0 & 0 & 0 \\
0 & -\frac{5}{56} & 0 & 0 & 0 & \frac{\sqrt{5}}{8} & 0 & 0 & -\frac{\sqrt{10}}{56} & 0 & 0 & 0 & \frac{\sqrt{30}}{120} & 0 \\
0 & 0 & \frac{5\sqrt{6}}{56} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{2}}{168} & 0 & 0 & 0 & \frac{\sqrt{70}}{120} \\
0 & 0 & 0 & -\frac{5\sqrt{6}}{56} & 0 & 0 & \frac{\sqrt{70}}{120} & 0 & 0 & 0 & \frac{5\sqrt{2}}{168} & 0 & 0 & 0 \\
-\frac{\sqrt{5}}{8} & 0 & 0 & 0 & \frac{5}{56} & 0 & 0 & \frac{\sqrt{30}}{120} & 0 & 0 & 0 & -\frac{\sqrt{10}}{56} & 0 & 0
\end{bmatrix}$$

311    symmetry    $\dfrac{\sqrt{35}xy(x-y)(x+y)}{2}$

$\mathbb{Q}_4^{(1,0;a)}(A_{2g})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{12} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{140} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{60} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{60} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{105}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{140} & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

312    symmetry    $\dfrac{\sqrt{5}(x-y)(x+y)\left(x^2+y^2-6z^2\right)}{4}$

*continued ...*

Table 7

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_4^{(1,0;a)}(B_{1g})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{24} & 0 & 0 & 0 & \frac{\sqrt{5}}{8} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}}{8} & 0 & 0 & 0 & -\frac{\sqrt{15}}{24} & 0 \\
0 & 0 & 0 & \frac{5\sqrt{6}}{56} & 0 & 0 & \frac{\sqrt{70}}{280} & 0 & 0 & 0 & \frac{3\sqrt{2}}{56} & 0 & 0 & 0 \\
-\frac{3\sqrt{5}}{56} & 0 & 0 & 0 & -\frac{15}{56} & 0 & 0 & -\frac{11\sqrt{30}}{840} & 0 & 0 & 0 & \frac{\sqrt{10}}{280} & 0 & 0 \\
0 & \frac{15}{56} & 0 & 0 & 0 & \frac{3\sqrt{5}}{56} & 0 & 0 & \frac{\sqrt{10}}{280} & 0 & 0 & 0 & -\frac{11\sqrt{30}}{840} & 0 \\
0 & 0 & -\frac{5\sqrt{6}}{56} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{2}}{56} & 0 & 0 & 0 & \frac{\sqrt{70}}{280}
\end{bmatrix}$$

313    symmetry    $-\frac{\sqrt{5}xy(x^2+y^2-6z^2)}{2}$

$\mathbb{Q}_4^{(1,0;a)}(B_{2g})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{24} & 0 & 0 & 0 & \frac{\sqrt{5}i}{8} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}i}{8} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{24} & 0 \\
0 & 0 & 0 & \frac{5\sqrt{6}i}{56} & 0 & 0 & -\frac{\sqrt{70}i}{280} & 0 & 0 & 0 & \frac{3\sqrt{2}i}{56} & 0 & 0 & 0 \\
\frac{3\sqrt{5}i}{56} & 0 & 0 & 0 & -\frac{15i}{56} & 0 & 0 & \frac{11\sqrt{30}i}{840} & 0 & 0 & 0 & \frac{\sqrt{10}i}{280} & 0 & 0 \\
0 & -\frac{15i}{56} & 0 & 0 & 0 & \frac{3\sqrt{5}i}{56} & 0 & 0 & -\frac{\sqrt{10}i}{280} & 0 & 0 & 0 & -\frac{11\sqrt{30}i}{840} & 0 \\
0 & 0 & \frac{5\sqrt{6}i}{56} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{2}i}{56} & 0 & 0 & 0 & \frac{\sqrt{70}i}{280}
\end{bmatrix}$$

314    symmetry    $\frac{\sqrt{35}yz(y-z)(y+z)}{2}$

$\mathbb{Q}_{4,1}^{(1,0;a)}(E_g,1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{96} & 0 & -\frac{\sqrt{35}i}{32} & 0 & -\frac{5\sqrt{21}i}{96} & 0 & -\frac{\sqrt{105}i}{96} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}i}{96} & 0 & \frac{5\sqrt{21}i}{96} & 0 & \frac{\sqrt{35}i}{32} & 0 & \frac{\sqrt{15}i}{96} \\
-\frac{\sqrt{105}i}{224} & 0 & -\frac{5\sqrt{42}i}{224} & 0 & -\frac{5\sqrt{21}i}{224} & 0 & 0 & -\frac{3\sqrt{70}i}{560} & 0 & -\frac{\sqrt{14}i}{56} & 0 & -\frac{\sqrt{210}i}{560} & 0 & 0 \\
0 & \frac{15\sqrt{7}i}{224} & 0 & \frac{15\sqrt{14}i}{224} & 0 & \frac{3\sqrt{35}i}{224} & \frac{\sqrt{30}i}{240} & 0 & \frac{\sqrt{70}i}{140} & 0 & \frac{\sqrt{42}i}{336} & 0 & -\frac{\sqrt{210}i}{840} & 0 \\
-\frac{3\sqrt{35}i}{224} & 0 & -\frac{15\sqrt{14}i}{224} & 0 & -\frac{15\sqrt{7}i}{224} & 0 & 0 & -\frac{\sqrt{210}i}{840} & 0 & \frac{\sqrt{42}i}{336} & 0 & \frac{\sqrt{70}i}{140} & 0 & \frac{\sqrt{30}i}{240} \\
0 & \frac{5\sqrt{21}i}{224} & 0 & \frac{5\sqrt{42}i}{224} & 0 & \frac{\sqrt{105}i}{224} & 0 & 0 & -\frac{\sqrt{210}i}{560} & 0 & -\frac{\sqrt{14}i}{56} & 0 & -\frac{3\sqrt{70}i}{560} & 0
\end{bmatrix}$$

315    symmetry    $\frac{\sqrt{35}xz(x-z)(x+z)}{2}$

$\mathbb{Q}_{4,2}^{(1,0;a)}(E_g,1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{96} & 0 & -\frac{\sqrt{35}}{32} & 0 & \frac{5\sqrt{21}}{96} & 0 & -\frac{\sqrt{105}}{96} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}}{96} & 0 & \frac{5\sqrt{21}}{96} & 0 & -\frac{\sqrt{35}}{32} & 0 & \frac{\sqrt{15}}{96} \\
-\frac{\sqrt{105}}{224} & 0 & \frac{5\sqrt{42}}{224} & 0 & -\frac{5\sqrt{21}}{224} & 0 & 0 & -\frac{3\sqrt{70}}{560} & 0 & \frac{\sqrt{14}}{56} & 0 & -\frac{\sqrt{210}}{560} & 0 & 0 \\
0 & \frac{15\sqrt{7}}{224} & 0 & -\frac{15\sqrt{14}}{224} & 0 & \frac{3\sqrt{35}}{224} & -\frac{\sqrt{30}}{240} & 0 & \frac{\sqrt{70}}{140} & 0 & -\frac{\sqrt{42}}{336} & 0 & -\frac{\sqrt{210}}{840} & 0 \\
\frac{3\sqrt{35}}{224} & 0 & -\frac{15\sqrt{14}}{224} & 0 & \frac{15\sqrt{7}}{224} & 0 & 0 & \frac{\sqrt{210}}{840} & 0 & \frac{\sqrt{42}}{336} & 0 & -\frac{\sqrt{70}}{140} & 0 & \frac{\sqrt{30}}{240} \\
0 & -\frac{5\sqrt{21}}{224} & 0 & \frac{5\sqrt{42}}{224} & 0 & -\frac{\sqrt{105}}{224} & 0 & 0 & \frac{\sqrt{210}}{560} & 0 & -\frac{\sqrt{14}}{56} & 0 & \frac{3\sqrt{70}}{560} & 0
\end{bmatrix}$$

316    symmetry    $\frac{\sqrt{5}yz(6x^2-y^2-z^2)}{2}$

*continued ...*

Table 7

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{Q}_{4,1}^{(1,0;a)}(E_g,2)$$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}i}{96} & 0 & -\frac{\sqrt5 i}{32} & 0 & -\frac{5\sqrt3 i}{96} & 0 & \frac{7\sqrt{15}i}{96} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{7\sqrt{15}i}{96} & 0 & \frac{5\sqrt3 i}{96} & 0 & \frac{\sqrt5 i}{32} & 0 & -\frac{\sqrt{105}i}{96} \\
-\frac{\sqrt{15}i}{224} & 0 & -\frac{5\sqrt6 i}{224} & 0 & \frac{5\sqrt3 i}{32} & 0 & 0 & -\frac{3\sqrt{10}i}{560} & 0 & -\frac{\sqrt2 i}{56} & 0 & \frac{\sqrt{30}i}{80} & 0 & 0 \\
0 & \frac{15i}{224} & 0 & \frac{15\sqrt2 i}{224} & 0 & -\frac{3\sqrt5 i}{32} & -\frac{\sqrt{210}i}{240} & 0 & \frac{\sqrt{10}i}{140} & 0 & \frac{\sqrt6 i}{336} & 0 & \frac{\sqrt{30}i}{120} & 0 \\
\frac{3\sqrt5 i}{32} & 0 & -\frac{15\sqrt2 i}{224} & 0 & -\frac{15i}{224} & 0 & 0 & \frac{\sqrt{30}i}{120} & 0 & \frac{\sqrt6 i}{336} & 0 & \frac{\sqrt{10}i}{140} & 0 & -\frac{\sqrt{210}i}{240} \\
0 & -\frac{5\sqrt3 i}{32} & 0 & \frac{5\sqrt6 i}{224} & 0 & \frac{\sqrt{15}i}{224} & 0 & 0 & \frac{\sqrt{30}i}{80} & 0 & -\frac{\sqrt2 i}{56} & 0 & -\frac{3\sqrt{10}i}{560} & 0
\end{bmatrix}$$

| 317 | symmetry | $-\frac{\sqrt5 xz(x^2-6y^2+z^2)}{2}$ |

$$\mathbb{Q}_{4,2}^{(1,0;a)}(E_g,2)$$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}}{96} & 0 & -\frac{\sqrt5}{32} & 0 & \frac{5\sqrt3}{96} & 0 & \frac{7\sqrt{15}}{96} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{7\sqrt{15}}{96} & 0 & \frac{5\sqrt3}{96} & 0 & -\frac{\sqrt5}{32} & 0 & -\frac{\sqrt{105}}{96} \\
-\frac{\sqrt{15}}{224} & 0 & \frac{5\sqrt6}{224} & 0 & \frac{5\sqrt3}{32} & 0 & 0 & -\frac{3\sqrt{10}}{560} & 0 & \frac{\sqrt2}{56} & 0 & \frac{\sqrt{30}}{80} & 0 & 0 \\
0 & \frac{15}{224} & 0 & -\frac{15\sqrt2}{224} & 0 & -\frac{3\sqrt5}{32} & \frac{\sqrt{210}}{240} & 0 & \frac{\sqrt{10}}{140} & 0 & -\frac{\sqrt6}{336} & 0 & \frac{\sqrt{30}}{120} & 0 \\
-\frac{3\sqrt5}{32} & 0 & -\frac{15\sqrt2}{224} & 0 & \frac{15}{224} & 0 & 0 & -\frac{\sqrt{30}}{120} & 0 & \frac{\sqrt6}{336} & 0 & -\frac{\sqrt{10}}{140} & 0 & -\frac{\sqrt{210}}{240} \\
0 & \frac{5\sqrt3}{32} & 0 & \frac{5\sqrt6}{224} & 0 & -\frac{\sqrt{15}}{224} & 0 & 0 & -\frac{\sqrt{30}}{80} & 0 & -\frac{\sqrt2}{56} & 0 & \frac{3\sqrt{10}}{560} & 0
\end{bmatrix}$$

| 318 | symmetry | $-\frac{x^2}{2}-\frac{y^2}{2}+z^2$ |

$$\mathbb{Q}_2^{(1,1;a)}(A_{1g})$$

$$\begin{bmatrix}
0 & 0 & -\frac{1}{3} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{1}{3} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{4\sqrt3}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{84} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{2\sqrt2}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt6}{28} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{2\sqrt2}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt6}{28} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{4\sqrt3}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{84} & 0 & 0 & 0
\end{bmatrix}$$

| 319 | symmetry | $\frac{\sqrt3(x-y)(x+y)}{2}$ |

$$\mathbb{Q}_2^{(1,1;a)}(B_{1g})$$

$$\begin{bmatrix}
-\frac{\sqrt{30}}{18} & 0 & 0 & 0 & -\frac{\sqrt6}{18} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt6}{18} & 0 & 0 & 0 & -\frac{\sqrt{30}}{18} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{2\sqrt2}{21} & 0 & 0 & \frac{\sqrt{210}}{168} & 0 & 0 & 0 & \frac{\sqrt6}{168} & 0 & 0 \\
\frac{4\sqrt{15}}{63} & 0 & 0 & 0 & -\frac{8\sqrt3}{63} & 0 & 0 & \frac{\sqrt{10}}{56} & 0 & 0 & 0 & \frac{\sqrt{30}}{168} & 0 \\
0 & \frac{8\sqrt3}{63} & 0 & 0 & 0 & -\frac{4\sqrt{15}}{63} & 0 & 0 & \frac{\sqrt{30}}{168} & 0 & 0 & 0 & \frac{\sqrt{10}}{56} \\
0 & 0 & \frac{2\sqrt2}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt6}{168} & 0 & 0 & 0 & \frac{\sqrt{210}}{168}
\end{bmatrix}$$

| 320 | symmetry | $\sqrt3 xy$ |

*continued …*

Table 7

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{Q}_2^{(1,1;a)}(B_{2g})$$

$$\begin{pmatrix}
-\frac{\sqrt{30}i}{18} & 0 & 0 & 0 & \frac{\sqrt{6}i}{18} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{6}i}{18} & 0 & 0 & 0 & \frac{\sqrt{30}i}{18} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{2\sqrt{2}i}{21} & 0 & 0 & \frac{\sqrt{210}i}{168} & 0 & 0 & 0 & -\frac{\sqrt{6}i}{168} & 0 & 0 \\
\frac{4\sqrt{15}i}{63} & 0 & 0 & 0 & \frac{8\sqrt{3}i}{63} & 0 & 0 & \frac{\sqrt{10}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{168} & 0 \\
0 & \frac{8\sqrt{3}i}{63} & 0 & 0 & 0 & \frac{4\sqrt{15}i}{63} & 0 & 0 & \frac{\sqrt{30}i}{168} & 0 & 0 & 0 & -\frac{\sqrt{10}i}{56} \\
0 & 0 & \frac{2\sqrt{2}i}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{168} & 0 & 0 & -\frac{\sqrt{210}i}{168}
\end{pmatrix}$$

| 321 | symmetry | $\sqrt{3}yz$ |

$$\mathbb{Q}_{2,1}^{(1,1;a)}(E_g)$$

$$\begin{pmatrix}
0 & \frac{\sqrt{6}i}{9} & 0 & \frac{\sqrt{3}i}{9} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{3}i}{9} & 0 & \frac{\sqrt{6}i}{9} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{2\sqrt{5}i}{21} & 0 & \frac{\sqrt{2}i}{7} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{84} & 0 & -\frac{\sqrt{6}i}{84} & 0 & 0 & 0 & 0 \\
0 & -\frac{2\sqrt{3}i}{63} & 0 & \frac{5\sqrt{6}i}{63} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{84} & 0 & -\frac{\sqrt{2}i}{28} & 0 & 0 & 0 \\
0 & 0 & -\frac{5\sqrt{6}i}{63} & 0 & \frac{2\sqrt{3}i}{63} & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{28} & 0 & -\frac{\sqrt{30}i}{84} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{2}i}{7} & 0 & -\frac{2\sqrt{5}i}{21} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{84} & 0 & -\frac{\sqrt{30}i}{84} & 0
\end{pmatrix}$$

| 322 | symmetry | $\sqrt{3}xz$ |

$$\mathbb{Q}_{2,2}^{(1,1;a)}(E_g)$$

$$\begin{pmatrix}
0 & \frac{\sqrt{6}}{9} & 0 & -\frac{\sqrt{3}}{9} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{3}}{9} & 0 & -\frac{\sqrt{6}}{9} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{2\sqrt{5}}{21} & 0 & -\frac{\sqrt{2}}{7} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{84} & 0 & \frac{\sqrt{6}}{84} & 0 & 0 & 0 & 0 \\
0 & -\frac{2\sqrt{3}}{63} & 0 & -\frac{5\sqrt{6}}{63} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{84} & 0 & \frac{\sqrt{2}}{28} & 0 & 0 & 0 \\
0 & 0 & -\frac{5\sqrt{6}}{63} & 0 & -\frac{2\sqrt{3}}{63} & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{28} & 0 & \frac{\sqrt{30}}{84} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{2}}{7} & 0 & \frac{2\sqrt{5}}{21} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{84} & 0 & \frac{\sqrt{30}}{84} & 0
\end{pmatrix}$$

| 323 | symmetry | $-\frac{z(3x^2+3y^2-2z^2)}{2}$ |

$$\mathbb{G}_3^{(a)}(A_{2g})$$

$$\begin{pmatrix}
0 & 0 & \frac{\sqrt{21}i}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{14} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{21}i}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{14} & 0 & 0 & 0 \\
0 & -\frac{\sqrt{7}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{28} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{42}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}i}{28} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{42}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}i}{28} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{28} & 0 & 0
\end{pmatrix}$$

| 324 | symmetry | $\sqrt{15}xyz$ |

*continued ...*

Table 7

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{G}_3^{(a)}(B_{1g}) = \begin{bmatrix}
-\frac{\sqrt{14}}{42} & 0 & 0 & 0 & \frac{\sqrt{70}}{42} & 0 & 0 & -\frac{\sqrt{21}}{28} & 0 & 0 & 0 & \frac{\sqrt{7}}{28} & 0 & 0 \\
0 & \frac{\sqrt{70}}{42} & 0 & 0 & 0 & -\frac{\sqrt{14}}{42} & 0 & 0 & -\frac{\sqrt{7}}{28} & 0 & 0 & 0 & \frac{\sqrt{21}}{28} & 0 \\
0 & 0 & 0 & -\frac{\sqrt{210}}{84} & 0 & 0 & -\frac{\sqrt{2}}{8} & 0 & 0 & 0 & \frac{\sqrt{70}}{56} & 0 & 0 & 0 \\
-\frac{5\sqrt{7}}{84} & 0 & 0 & 0 & -\frac{\sqrt{35}}{84} & 0 & 0 & \frac{\sqrt{42}}{56} & 0 & 0 & 0 & \frac{3\sqrt{14}}{56} & 0 & 0 \\
0 & \frac{\sqrt{35}}{84} & 0 & 0 & 0 & \frac{5\sqrt{7}}{84} & 0 & 0 & \frac{3\sqrt{14}}{56} & 0 & 0 & 0 & \frac{\sqrt{42}}{56} & 0 \\
0 & 0 & \frac{\sqrt{210}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{56} & 0 & 0 & 0 & -\frac{\sqrt{2}}{8}
\end{bmatrix}$$

**325**   symmetry   $\dfrac{\sqrt{15}z(x-y)(x+y)}{2}$

$$\mathbb{G}_3^{(a)}(B_{2g}) = \begin{bmatrix}
\frac{\sqrt{14}i}{42} & 0 & 0 & 0 & \frac{\sqrt{70}i}{42} & 0 & 0 & \frac{\sqrt{21}i}{28} & 0 & 0 & 0 & \frac{\sqrt{7}i}{28} & 0 & 0 \\
0 & -\frac{\sqrt{70}i}{42} & 0 & 0 & 0 & -\frac{\sqrt{14}i}{42} & 0 & 0 & \frac{\sqrt{7}i}{28} & 0 & 0 & 0 & \frac{\sqrt{21}i}{28} & 0 \\
0 & 0 & 0 & -\frac{\sqrt{210}i}{84} & 0 & 0 & \frac{\sqrt{2}i}{8} & 0 & 0 & 0 & \frac{\sqrt{70}i}{56} & 0 & 0 & 0 \\
\frac{5\sqrt{7}i}{84} & 0 & 0 & 0 & -\frac{\sqrt{35}i}{84} & 0 & 0 & -\frac{\sqrt{42}i}{56} & 0 & 0 & 0 & \frac{3\sqrt{14}i}{56} & 0 & 0 \\
0 & -\frac{\sqrt{35}i}{84} & 0 & 0 & 0 & \frac{5\sqrt{7}i}{84} & 0 & 0 & -\frac{3\sqrt{14}i}{56} & 0 & 0 & 0 & \frac{\sqrt{42}i}{56} & 0 \\
0 & 0 & -\frac{\sqrt{210}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{2}i}{8}
\end{bmatrix}$$

**326**   symmetry   $\dfrac{x\left(2x^2-3y^2-3z^2\right)}{2}$

$$\mathbb{G}_{3,1}^{(a)}(E_g,1) = \begin{bmatrix}
0 & \frac{\sqrt{42}i}{84} & 0 & -\frac{\sqrt{21}i}{42} & 0 & \frac{\sqrt{210}i}{84} & -\frac{\sqrt{5}i}{16} & 0 & \frac{\sqrt{105}i}{112} & 0 & -\frac{3\sqrt{7}i}{112} & 0 & \frac{\sqrt{35}i}{112} & 0 \\
\frac{\sqrt{210}i}{84} & 0 & -\frac{\sqrt{21}i}{42} & 0 & \frac{\sqrt{42}i}{84} & 0 & 0 & -\frac{\sqrt{35}i}{112} & 0 & \frac{3\sqrt{7}i}{112} & 0 & -\frac{\sqrt{105}i}{112} & 0 & \frac{\sqrt{5}i}{16} \\
-\frac{\sqrt{35}i}{112} & 0 & \frac{3\sqrt{14}i}{112} & 0 & -\frac{5\sqrt{7}i}{112} & 0 & 0 & \frac{\sqrt{210}i}{112} & 0 & -\frac{\sqrt{42}i}{56} & 0 & \frac{\sqrt{70}i}{112} & 0 & 0 \\
0 & \frac{\sqrt{21}i}{48} & 0 & -\frac{\sqrt{42}i}{336} & 0 & -\frac{5\sqrt{105}i}{336} & \frac{\sqrt{10}i}{16} & 0 & 0 & 0 & -\frac{3\sqrt{14}i}{112} & 0 & \frac{\sqrt{70}i}{56} & 0 \\
\frac{5\sqrt{105}i}{336} & 0 & \frac{\sqrt{42}i}{336} & 0 & -\frac{\sqrt{21}i}{48} & 0 & 0 & \frac{\sqrt{70}i}{56} & 0 & -\frac{3\sqrt{14}i}{112} & 0 & 0 & 0 & \frac{\sqrt{10}i}{16} \\
0 & \frac{5\sqrt{7}i}{112} & 0 & -\frac{3\sqrt{14}i}{112} & 0 & \frac{\sqrt{35}i}{112} & 0 & 0 & \frac{\sqrt{70}i}{112} & 0 & -\frac{\sqrt{42}i}{56} & 0 & \frac{\sqrt{210}i}{112} & 0
\end{bmatrix}$$

**327**   symmetry   $\dfrac{y\left(3x^2-2y^2+3z^2\right)}{2}$

$$\mathbb{G}_{3,2}^{(a)}(E_g,1) = \begin{bmatrix}
0 & \frac{\sqrt{42}}{84} & 0 & \frac{\sqrt{21}}{42} & 0 & \frac{\sqrt{210}}{84} & \frac{\sqrt{5}}{16} & 0 & \frac{\sqrt{105}}{112} & 0 & \frac{3\sqrt{7}}{112} & 0 & \frac{\sqrt{35}}{112} & 0 \\
-\frac{\sqrt{210}}{84} & 0 & -\frac{\sqrt{21}}{42} & 0 & -\frac{\sqrt{42}}{84} & 0 & 0 & \frac{\sqrt{35}}{112} & 0 & \frac{3\sqrt{7}}{112} & 0 & \frac{\sqrt{105}}{112} & 0 & \frac{\sqrt{5}}{16} \\
-\frac{\sqrt{35}}{112} & 0 & -\frac{3\sqrt{14}}{112} & 0 & -\frac{5\sqrt{7}}{112} & 0 & 0 & \frac{\sqrt{210}}{112} & 0 & \frac{\sqrt{42}}{56} & 0 & \frac{\sqrt{70}}{112} & 0 & 0 \\
0 & \frac{\sqrt{21}}{48} & 0 & \frac{\sqrt{42}}{336} & 0 & -\frac{5\sqrt{105}}{336} & -\frac{\sqrt{10}}{16} & 0 & 0 & 0 & \frac{3\sqrt{14}}{112} & 0 & \frac{\sqrt{70}}{56} & 0 \\
-\frac{5\sqrt{105}}{336} & 0 & \frac{\sqrt{42}}{336} & 0 & \frac{\sqrt{21}}{48} & 0 & 0 & -\frac{\sqrt{70}}{56} & 0 & -\frac{3\sqrt{14}}{112} & 0 & 0 & 0 & \frac{\sqrt{10}}{16} \\
0 & -\frac{5\sqrt{7}}{112} & 0 & -\frac{3\sqrt{14}}{112} & 0 & -\frac{\sqrt{35}}{112} & 0 & 0 & -\frac{\sqrt{70}}{112} & 0 & -\frac{\sqrt{42}}{56} & 0 & -\frac{\sqrt{210}}{112} & 0
\end{bmatrix}$$

**328**   symmetry   $\dfrac{\sqrt{15}x(y-z)(y+z)}{2}$

continued ...

Table 7

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{G}_{3,1}^{(a)}(E_g, 2)$

$$\begin{bmatrix}
0 & \frac{\sqrt{70}i}{84} & 0 & -\frac{\sqrt{35}i}{42} & 0 & -\frac{\sqrt{14}i}{28} & \frac{\sqrt{3}i}{16} & 0 & \frac{5\sqrt{7}i}{112} & 0 & -\frac{\sqrt{105}i}{112} & 0 & -\frac{\sqrt{21}i}{112} & 0 \\
-\frac{\sqrt{14}i}{28} & 0 & -\frac{\sqrt{35}i}{42} & 0 & \frac{\sqrt{70}i}{84} & 0 & 0 & \frac{\sqrt{21}i}{112} & 0 & \frac{\sqrt{105}i}{112} & 0 & -\frac{5\sqrt{7}i}{112} & 0 & -\frac{\sqrt{3}i}{16} \\
-\frac{5\sqrt{21}i}{336} & 0 & \frac{\sqrt{210}i}{112} & 0 & \frac{\sqrt{105}i}{112} & 0 & 0 & \frac{5\sqrt{14}i}{112} & 0 & -\frac{\sqrt{70}i}{56} & 0 & -\frac{\sqrt{42}i}{112} & 0 & 0 \\
0 & \frac{\sqrt{35}i}{48} & 0 & -\frac{\sqrt{70}i}{336} & 0 & \frac{5\sqrt{7}i}{112} & -\frac{\sqrt{6}i}{16} & 0 & 0 & 0 & -\frac{\sqrt{210}i}{112} & 0 & -\frac{\sqrt{42}i}{56} & 0 \\
-\frac{5\sqrt{7}i}{112} & 0 & \frac{\sqrt{70}i}{336} & 0 & -\frac{\sqrt{35}i}{48} & 0 & 0 & -\frac{\sqrt{42}i}{56} & 0 & -\frac{\sqrt{210}i}{112} & 0 & 0 & 0 & -\frac{\sqrt{6}i}{16} \\
0 & -\frac{\sqrt{105}i}{112} & 0 & -\frac{\sqrt{210}i}{112} & 0 & \frac{5\sqrt{21}i}{336} & 0 & 0 & -\frac{\sqrt{42}i}{112} & 0 & -\frac{\sqrt{70}i}{56} & 0 & \frac{5\sqrt{14}i}{112} & 0
\end{bmatrix}$$

**329  symmetry**

$$-\frac{\sqrt{15}\,y(x-z)(x+z)}{2}$$

$\mathbb{G}_{3,2}^{(a)}(E_g, 2)$

$$\begin{bmatrix}
0 & \frac{\sqrt{70}}{84} & 0 & \frac{\sqrt{35}}{42} & 0 & -\frac{\sqrt{14}}{28} & -\frac{\sqrt{3}}{16} & 0 & \frac{5\sqrt{7}}{112} & 0 & \frac{\sqrt{105}}{112} & 0 & -\frac{\sqrt{21}}{112} & 0 \\
\frac{\sqrt{14}}{28} & 0 & -\frac{\sqrt{35}}{42} & 0 & -\frac{\sqrt{70}}{84} & 0 & 0 & -\frac{\sqrt{21}}{112} & 0 & \frac{\sqrt{105}}{112} & 0 & \frac{5\sqrt{7}}{112} & 0 & -\frac{\sqrt{3}}{16} \\
-\frac{5\sqrt{21}}{336} & 0 & -\frac{\sqrt{210}}{112} & 0 & \frac{\sqrt{105}}{112} & 0 & 0 & \frac{5\sqrt{14}}{112} & 0 & \frac{\sqrt{70}}{56} & 0 & -\frac{\sqrt{42}}{112} & 0 & 0 \\
0 & \frac{\sqrt{35}}{48} & 0 & \frac{\sqrt{70}}{336} & 0 & \frac{5\sqrt{7}}{112} & \frac{\sqrt{6}}{16} & 0 & 0 & 0 & \frac{\sqrt{210}}{112} & 0 & -\frac{\sqrt{42}}{56} & 0 \\
\frac{5\sqrt{7}}{112} & 0 & \frac{\sqrt{70}}{336} & 0 & \frac{\sqrt{35}}{48} & 0 & 0 & \frac{\sqrt{42}}{56} & 0 & -\frac{\sqrt{210}}{112} & 0 & 0 & 0 & -\frac{\sqrt{6}}{16} \\
0 & \frac{\sqrt{105}}{112} & 0 & -\frac{\sqrt{210}}{112} & 0 & -\frac{5\sqrt{21}}{336} & 0 & 0 & \frac{\sqrt{42}}{112} & 0 & -\frac{\sqrt{70}}{56} & 0 & -\frac{5\sqrt{14}}{112} & 0
\end{bmatrix}$$

**330  symmetry**

$$-\frac{z\left(3x^2+3y^2-2z^2\right)}{2}$$

$\mathbb{G}_3^{(1,-1;a)}(A_{2g})$

$$\begin{bmatrix}
0 & 0 & -\frac{\sqrt{5}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{15}i}{21} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{5}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{15}i}{21} & 0 & 0 & 0 \\
0 & \frac{2\sqrt{15}i}{105} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{6}i}{42} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{2\sqrt{10}i}{105} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{42} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{2\sqrt{10}i}{105} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{42} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{2\sqrt{15}i}{105} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{6}i}{42} & 0 & 0
\end{bmatrix}$$

**331  symmetry**

$$\sqrt{15}\,xyz$$

$\mathbb{G}_3^{(1,-1;a)}(B_{1g})$

$$\begin{bmatrix}
\frac{\sqrt{30}}{252} & 0 & 0 & 0 & -\frac{5\sqrt{6}}{252} & 0 & 0 & \frac{\sqrt{5}}{7} & 0 & 0 & 0 & -\frac{\sqrt{15}}{21} & 0 & 0 \\
0 & -\frac{5\sqrt{6}}{252} & 0 & 0 & 0 & \frac{\sqrt{30}}{252} & 0 & 0 & \frac{\sqrt{15}}{21} & 0 & 0 & 0 & -\frac{\sqrt{5}}{7} & 0 \\
0 & 0 & 0 & \frac{\sqrt{2}}{21} & 0 & 0 & -\frac{\sqrt{210}}{84} & 0 & 0 & 0 & \frac{5\sqrt{6}}{84} & 0 & 0 & 0 \\
\frac{\sqrt{15}}{63} & 0 & 0 & 0 & \frac{\sqrt{3}}{63} & 0 & 0 & \frac{\sqrt{10}}{28} & 0 & 0 & 0 & \frac{\sqrt{30}}{28} & 0 & 0 \\
0 & -\frac{\sqrt{3}}{63} & 0 & 0 & 0 & -\frac{\sqrt{15}}{63} & 0 & 0 & \frac{\sqrt{30}}{28} & 0 & 0 & 0 & \frac{\sqrt{10}}{28} & 0 \\
0 & 0 & -\frac{\sqrt{2}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{6}}{84} & 0 & 0 & 0 & -\frac{\sqrt{210}}{84}
\end{bmatrix}$$

**332  symmetry**

$$\frac{\sqrt{15}\,z(x-y)(x+y)}{2}$$

*continued ...*

Table 7

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_3^{(1,-1;a)}(B_{2g})$

$$
\begin{bmatrix}
-\frac{\sqrt{30}i}{252} & 0 & 0 & 0 & -\frac{5\sqrt{6}i}{252} & 0 & 0 & -\frac{\sqrt{5}i}{7} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{21} & 0 & 0 \\
0 & \frac{5\sqrt{6}i}{252} & 0 & 0 & 0 & \frac{\sqrt{30}i}{252} & 0 & 0 & -\frac{\sqrt{15}i}{21} & 0 & 0 & 0 & -\frac{\sqrt{5}i}{7} & 0 \\
0 & 0 & 0 & \frac{\sqrt{2}i}{21} & 0 & 0 & \frac{\sqrt{210}i}{84} & 0 & 0 & 0 & \frac{5\sqrt{6}i}{84} & 0 & 0 & 0 \\
-\frac{\sqrt{15}i}{63} & 0 & 0 & 0 & \frac{\sqrt{3}i}{63} & 0 & 0 & -\frac{\sqrt{10}i}{28} & 0 & 0 & 0 & \frac{\sqrt{30}i}{28} & 0 & 0 \\
0 & \frac{\sqrt{3}i}{63} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{63} & 0 & 0 & -\frac{\sqrt{30}i}{28} & 0 & 0 & 0 & \frac{\sqrt{10}i}{28} & 0 \\
0 & 0 & \frac{\sqrt{2}i}{21} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{6}i}{84} & 0 & 0 & 0 & -\frac{\sqrt{210}i}{84}
\end{bmatrix}
$$

333   symmetry   $\dfrac{x\left(2x^2-3y^2-3z^2\right)}{2}$

$\mathbb{G}_{3,1}^{(1,-1;a)}(E_g,1)$

$$
\begin{bmatrix}
0 & -\frac{\sqrt{10}i}{168} & 0 & \frac{\sqrt{5}i}{84} & 0 & -\frac{5\sqrt{2}i}{168} & \frac{5\sqrt{21}i}{84} & 0 & -\frac{5i}{28} & 0 & \frac{\sqrt{15}i}{28} & 0 & -\frac{5\sqrt{3}i}{84} & 0 \\
-\frac{5\sqrt{2}i}{168} & 0 & \frac{\sqrt{5}i}{84} & 0 & -\frac{\sqrt{10}i}{168} & 0 & 0 & \frac{5\sqrt{3}i}{84} & 0 & -\frac{\sqrt{15}i}{28} & 0 & \frac{5i}{28} & 0 & -\frac{5\sqrt{21}i}{84} \\
\frac{\sqrt{3}i}{84} & 0 & -\frac{\sqrt{30}i}{140} & 0 & \frac{\sqrt{15}i}{84} & 0 & 0 & \frac{5\sqrt{2}i}{56} & 0 & -\frac{\sqrt{10}i}{28} & 0 & \frac{5\sqrt{6}i}{168} & 0 & 0 \\
0 & -\frac{\sqrt{5}i}{60} & 0 & \frac{\sqrt{10}i}{420} & 0 & \frac{5i}{84} & \frac{5\sqrt{42}i}{168} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{56} & 0 & \frac{5\sqrt{6}i}{84} & 0 \\
-\frac{5i}{84} & 0 & -\frac{\sqrt{10}i}{420} & 0 & \frac{\sqrt{5}i}{60} & 0 & 0 & \frac{5\sqrt{6}i}{84} & 0 & -\frac{\sqrt{30}i}{56} & 0 & 0 & 0 & \frac{5\sqrt{42}i}{168} \\
0 & -\frac{\sqrt{15}i}{84} & 0 & \frac{\sqrt{30}i}{140} & 0 & -\frac{\sqrt{3}i}{84} & 0 & 0 & \frac{5\sqrt{6}i}{168} & 0 & -\frac{\sqrt{10}i}{28} & 0 & \frac{5\sqrt{2}i}{56} & 0
\end{bmatrix}
$$

334   symmetry   $\dfrac{y\left(3x^2-2y^2+3z^2\right)}{2}$

$\mathbb{G}_{3,2}^{(1,-1;a)}(E_g,1)$

$$
\begin{bmatrix}
0 & -\frac{\sqrt{10}}{168} & 0 & -\frac{\sqrt{5}}{84} & 0 & -\frac{5\sqrt{2}}{168} & -\frac{5\sqrt{21}}{84} & 0 & -\frac{5}{28} & 0 & -\frac{\sqrt{15}}{28} & 0 & -\frac{5\sqrt{3}}{84} & 0 \\
\frac{5\sqrt{2}}{168} & 0 & \frac{\sqrt{5}}{84} & 0 & \frac{\sqrt{10}}{168} & 0 & 0 & -\frac{5\sqrt{3}}{84} & 0 & -\frac{\sqrt{15}}{28} & 0 & -\frac{5}{28} & 0 & -\frac{5\sqrt{21}}{84} \\
\frac{\sqrt{3}}{84} & 0 & \frac{\sqrt{30}}{140} & 0 & \frac{\sqrt{15}}{84} & 0 & 0 & \frac{5\sqrt{2}}{56} & 0 & \frac{\sqrt{10}}{28} & 0 & \frac{5\sqrt{6}}{168} & 0 & 0 \\
0 & -\frac{\sqrt{5}}{60} & 0 & -\frac{\sqrt{10}}{420} & 0 & \frac{5}{84} & -\frac{5\sqrt{42}}{168} & 0 & 0 & 0 & \frac{\sqrt{30}}{56} & 0 & \frac{5\sqrt{6}}{84} & 0 \\
\frac{5}{84} & 0 & -\frac{\sqrt{10}}{420} & 0 & -\frac{\sqrt{5}}{60} & 0 & 0 & -\frac{5\sqrt{6}}{84} & 0 & -\frac{\sqrt{30}}{56} & 0 & 0 & 0 & \frac{5\sqrt{42}}{168} \\
0 & \frac{\sqrt{15}}{84} & 0 & \frac{\sqrt{30}}{140} & 0 & \frac{\sqrt{3}}{84} & 0 & 0 & -\frac{5\sqrt{6}}{168} & 0 & -\frac{\sqrt{10}}{28} & 0 & -\frac{5\sqrt{2}}{56} & 0
\end{bmatrix}
$$

335   symmetry   $\dfrac{\sqrt{15}x(y-z)(y+z)}{2}$

$\mathbb{G}_{3,1}^{(1,-1;a)}(E_g,2)$

$$
\begin{bmatrix}
0 & -\frac{5\sqrt{6}i}{504} & 0 & \frac{5\sqrt{3}i}{252} & 0 & \frac{\sqrt{30}i}{168} & -\frac{\sqrt{35}i}{28} & 0 & -\frac{5\sqrt{15}i}{84} & 0 & \frac{5i}{28} & 0 & \frac{\sqrt{5}i}{28} & 0 \\
\frac{\sqrt{30}i}{168} & 0 & \frac{5\sqrt{3}i}{252} & 0 & -\frac{5\sqrt{6}i}{504} & 0 & 0 & -\frac{\sqrt{5}i}{28} & 0 & -\frac{5i}{28} & 0 & \frac{5\sqrt{15}i}{84} & 0 & \frac{\sqrt{35}i}{28} \\
\frac{\sqrt{5}i}{84} & 0 & -\frac{\sqrt{2}i}{28} & 0 & -\frac{i}{28} & 0 & 0 & \frac{5\sqrt{30}i}{168} & 0 & -\frac{5\sqrt{6}i}{84} & 0 & -\frac{\sqrt{10}i}{56} & 0 & 0 \\
0 & -\frac{\sqrt{3}i}{36} & 0 & \frac{\sqrt{6}i}{252} & 0 & -\frac{\sqrt{15}i}{84} & -\frac{\sqrt{70}i}{56} & 0 & 0 & 0 & -\frac{5\sqrt{2}i}{56} & 0 & -\frac{\sqrt{10}i}{28} & 0 \\
\frac{\sqrt{15}i}{84} & 0 & -\frac{\sqrt{6}i}{252} & 0 & \frac{\sqrt{3}i}{36} & 0 & 0 & -\frac{\sqrt{10}i}{28} & 0 & -\frac{5\sqrt{2}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{70}i}{56} \\
0 & \frac{i}{28} & 0 & \frac{\sqrt{2}i}{28} & 0 & -\frac{\sqrt{5}i}{84} & 0 & 0 & -\frac{\sqrt{10}i}{56} & 0 & -\frac{5\sqrt{6}i}{84} & 0 & \frac{5\sqrt{30}i}{168} & 0
\end{bmatrix}
$$

336   symmetry   $-\dfrac{\sqrt{15}y(x-z)(x+z)}{2}$

Table 7

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_{3,2}^{(1,-1;a)}(E_g, 2)$

$$\begin{bmatrix}
0 & -\frac{5\sqrt{6}}{504} & 0 & -\frac{5\sqrt{3}}{252} & 0 & \frac{\sqrt{30}}{168} & \frac{\sqrt{35}}{28} & 0 & -\frac{5\sqrt{15}}{84} & 0 & -\frac{5}{28} & 0 & \frac{\sqrt{5}}{28} & 0 \\
-\frac{\sqrt{30}}{168} & 0 & \frac{5\sqrt{3}}{252} & 0 & \frac{5\sqrt{6}}{504} & 0 & 0 & \frac{\sqrt{5}}{28} & 0 & -\frac{5}{28} & 0 & -\frac{5\sqrt{15}}{84} & 0 & \frac{\sqrt{35}}{28} \\
\frac{\sqrt{5}}{84} & 0 & \frac{\sqrt{2}}{28} & 0 & -\frac{1}{28} & 0 & 0 & \frac{5\sqrt{30}}{168} & 0 & \frac{5\sqrt{6}}{84} & 0 & -\frac{\sqrt{10}}{56} & 0 & 0 \\
0 & -\frac{\sqrt{3}}{36} & 0 & -\frac{\sqrt{6}}{252} & 0 & -\frac{\sqrt{15}}{84} & \frac{\sqrt{70}}{56} & 0 & 0 & 0 & \frac{5\sqrt{2}}{56} & 0 & -\frac{\sqrt{10}}{28} & 0 \\
-\frac{\sqrt{15}}{84} & 0 & -\frac{\sqrt{6}}{252} & 0 & -\frac{\sqrt{3}}{36} & 0 & 0 & \frac{\sqrt{10}}{28} & 0 & -\frac{5\sqrt{2}}{56} & 0 & 0 & 0 & -\frac{\sqrt{70}}{56} \\
0 & -\frac{1}{28} & 0 & \frac{\sqrt{2}}{28} & 0 & \frac{\sqrt{5}}{84} & 0 & 0 & \frac{\sqrt{10}}{56} & 0 & -\frac{5\sqrt{6}}{84} & 0 & -\frac{5\sqrt{30}}{168} & 0
\end{bmatrix}$$

| 337 | symmetry | $\frac{3\sqrt{35}xyz(x-y)(x+y)}{2}$ |

$\mathbb{G}_5^{(1,-1;a)}(A_{1g})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{20} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{20} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{20} & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

| 338 | symmetry | $\frac{z\left(15x^4+30x^2y^2-40x^2z^2+15y^4-40y^2z^2+8z^4\right)}{8}$ |

$\mathbb{G}_5^{(1,-1;a)}(A_{2g}, 1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{12} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{12} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{12} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{12} & 0 & 0
\end{bmatrix}$$

| 339 | symmetry | $\frac{3\sqrt{35}z\left(x^2-2xy-y^2\right)\left(x^2+2xy-y^2\right)}{8}$ |

$\mathbb{G}_5^{(1,-1;a)}(A_{2g}, 2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{20} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{20} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{20} & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

| 340 | symmetry | $\frac{\sqrt{105}xyz\left(x^2+y^2-2z^2\right)}{2}$ |

*continued ...*

Table 7

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_5^{(1,-1;a)}(B_{1g})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{120} & 0 & 0 & 0 & \frac{\sqrt{42}}{24} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{40} & 0 & 0 & 0 & -\frac{\sqrt{210}}{40} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{40} & 0 & 0 & 0 & \frac{\sqrt{70}}{40} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{24} & 0 & 0 & 0 & -\frac{\sqrt{30}}{120}
\end{bmatrix}$$

341    symmetry
$$-\frac{\sqrt{105}\,z(x-y)(x+y)\left(x^2+y^2-2z^2\right)}{4}$$

$\mathbb{G}_5^{(1,-1;a)}(B_{2g})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{120} & 0 & 0 & 0 & -\frac{\sqrt{42}i}{24} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{40} & 0 & 0 & 0 & \frac{\sqrt{210}i}{40} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{40} & 0 & 0 & 0 & -\frac{\sqrt{70}i}{40} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{24} & 0 & 0 & 0 & \frac{\sqrt{30}i}{120}
\end{bmatrix}$$

342    symmetry
$$\frac{x\left(8x^4-40x^2y^2-40x^2z^2+15y^4+30y^2z^2+15z^4\right)}{8}$$

$\mathbb{G}_{5,1}^{(1,-1;a)}(E_g,1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{32} & 0 & -\frac{\sqrt{10}i}{32} & 0 & \frac{7\sqrt{6}i}{96} & 0 & -\frac{3\sqrt{14}i}{32} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{96} & 0 & -\frac{3\sqrt{2}i}{32} & 0 & \frac{\sqrt{30}i}{32} & 0 & -\frac{7\sqrt{6}i}{96} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{7\sqrt{6}i}{96} & 0 & \frac{\sqrt{30}i}{32} & 0 & -\frac{3\sqrt{2}i}{32} & 0 & \frac{\sqrt{42}i}{96} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{14}i}{32} & 0 & \frac{7\sqrt{6}i}{96} & 0 & -\frac{\sqrt{10}i}{32} & 0 & \frac{\sqrt{2}i}{32} & 0
\end{bmatrix}$$

343    symmetry
$$-\frac{y\left(15x^4-40x^2y^2+30x^2z^2+8y^4-40y^2z^2+15z^4\right)}{8}$$

$\mathbb{G}_{5,2}^{(1,-1;a)}(E_g,1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{32} & 0 & \frac{\sqrt{10}}{32} & 0 & \frac{7\sqrt{6}}{96} & 0 & \frac{3\sqrt{14}}{32} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}}{96} & 0 & -\frac{3\sqrt{2}}{32} & 0 & -\frac{\sqrt{30}}{32} & 0 & -\frac{7\sqrt{6}}{96} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{7\sqrt{6}}{96} & 0 & \frac{\sqrt{30}}{32} & 0 & \frac{3\sqrt{2}}{32} & 0 & \frac{\sqrt{42}}{96} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{14}}{32} & 0 & -\frac{7\sqrt{6}}{96} & 0 & -\frac{\sqrt{10}}{32} & 0 & -\frac{\sqrt{2}}{32} & 0
\end{bmatrix}$$

344    symmetry
$$\frac{3\sqrt{35}\,x\left(y^2-2yz-z^2\right)\left(y^2+2yz-z^2\right)}{8}$$

*continued ...*

Table 7

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{G}_{5,1}^{(1,-1;a)}(E_g,2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{160} & 0 & -\frac{\sqrt{14}i}{32} & 0 & -\frac{3\sqrt{210}i}{160} & 0 & -\frac{\sqrt{10}i}{32} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{30}i}{160} & 0 & -\frac{3\sqrt{70}i}{160} & 0 & \frac{\sqrt{42}i}{32} & 0 & \frac{3\sqrt{210}i}{160} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{210}i}{160} & 0 & \frac{\sqrt{42}i}{32} & 0 & -\frac{3\sqrt{70}i}{160} & 0 & -\frac{3\sqrt{30}i}{160} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{32} & 0 & -\frac{3\sqrt{210}i}{160} & 0 & -\frac{\sqrt{14}i}{32} & 0 & \frac{\sqrt{70}i}{160} & 0
\end{bmatrix}$$

| 345 | symmetry | $-\dfrac{3\sqrt{35}y\left(x^2-2xz-z^2\right)\left(x^2+2xz-z^2\right)}{8}$ |

$\mathbb{G}_{5,2}^{(1,-1;a)}(E_g,2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{160} & 0 & \frac{\sqrt{14}}{32} & 0 & -\frac{3\sqrt{210}}{160} & 0 & \frac{\sqrt{10}}{32} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{30}}{160} & 0 & -\frac{3\sqrt{70}}{160} & 0 & -\frac{\sqrt{42}}{32} & 0 & \frac{3\sqrt{210}}{160} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{210}}{160} & 0 & \frac{\sqrt{42}}{32} & 0 & \frac{3\sqrt{70}}{160} & 0 & -\frac{3\sqrt{30}}{160} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{32} & 0 & \frac{3\sqrt{210}}{160} & 0 & -\frac{\sqrt{14}}{32} & 0 & -\frac{\sqrt{70}}{160} & 0
\end{bmatrix}$$

| 346 | symmetry | $\dfrac{\sqrt{105}x(y-z)(y+z)\left(2x^2-y^2-z^2\right)}{4}$ |

$\mathbb{G}_{5,1}^{(1,-1;a)}(E_g,3)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{240} & 0 & -\frac{\sqrt{42}i}{48} & 0 & \frac{\sqrt{70}i}{80} & 0 & \frac{\sqrt{30}i}{16} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{80} & 0 & -\frac{\sqrt{210}i}{80} & 0 & \frac{\sqrt{14}i}{16} & 0 & -\frac{\sqrt{70}i}{80} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{80} & 0 & \frac{\sqrt{14}i}{16} & 0 & -\frac{\sqrt{210}i}{80} & 0 & \frac{\sqrt{10}i}{80} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{16} & 0 & \frac{\sqrt{70}i}{80} & 0 & -\frac{\sqrt{42}i}{48} & 0 & \frac{\sqrt{210}i}{240} & 0
\end{bmatrix}$$

| 347 | symmetry | $\dfrac{\sqrt{105}y(x-z)(x+z)\left(x^2-2y^2+z^2\right)}{4}$ |

$\mathbb{G}_{5,2}^{(1,-1;a)}(E_g,3)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{240} & 0 & \frac{\sqrt{42}}{48} & 0 & \frac{\sqrt{70}}{80} & 0 & -\frac{\sqrt{30}}{16} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{80} & 0 & -\frac{\sqrt{210}}{80} & 0 & -\frac{\sqrt{14}}{16} & 0 & -\frac{\sqrt{70}}{80} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{80} & 0 & \frac{\sqrt{14}}{16} & 0 & \frac{\sqrt{210}}{80} & 0 & \frac{\sqrt{10}}{80} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{16} & 0 & -\frac{\sqrt{70}}{80} & 0 & -\frac{\sqrt{42}}{48} & 0 & -\frac{\sqrt{210}}{240} & 0
\end{bmatrix}$$

| 348 | symmetry | $-\dfrac{z\left(3x^2+3y^2-2z^2\right)}{2}$ |

*continued ...*

Table 7

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_3^{(1,0;a)}(A_{2g})$

$$\begin{bmatrix}
0 & 0 & \frac{\sqrt{7}i}{21} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{21}i}{84} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{7}i}{21} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{21}i}{84} & 0 & 0 & 0 \\
0 & -\frac{5\sqrt{21}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{84} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{5\sqrt{14}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}i}{84} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{5\sqrt{14}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{84} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{5\sqrt{21}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{84} & 0 & 0
\end{bmatrix}$$

349    symmetry    $\sqrt{15}xyz$

$\mathbb{G}_3^{(1,0;a)}(B_{1g})$

$$\begin{bmatrix}
-\frac{\sqrt{42}}{126} & 0 & 0 & 0 & \frac{\sqrt{210}}{126} & 0 & 0 & \frac{5\sqrt{7}}{56} & 0 & 0 & 0 & -\frac{5\sqrt{21}}{168} & 0 & 0 \\
0 & \frac{\sqrt{210}}{126} & 0 & 0 & 0 & -\frac{\sqrt{42}}{126} & 0 & 0 & \frac{5\sqrt{21}}{168} & 0 & 0 & 0 & -\frac{5\sqrt{7}}{56} & 0 \\
0 & 0 & 0 & -\frac{5\sqrt{70}}{168} & 0 & 0 & \frac{\sqrt{6}}{24} & 0 & 0 & 0 & -\frac{\sqrt{210}}{168} & 0 & 0 & 0 \\
-\frac{25\sqrt{21}}{504} & 0 & 0 & 0 & -\frac{5\sqrt{105}}{504} & 0 & 0 & -\frac{\sqrt{14}}{56} & 0 & 0 & 0 & -\frac{\sqrt{42}}{56} & 0 & 0 \\
0 & \frac{5\sqrt{105}}{504} & 0 & 0 & 0 & \frac{25\sqrt{21}}{504} & 0 & 0 & -\frac{\sqrt{42}}{56} & 0 & 0 & 0 & -\frac{\sqrt{14}}{56} & 0 \\
0 & 0 & \frac{5\sqrt{70}}{168} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{168} & 0 & 0 & 0 & \frac{\sqrt{6}}{24}
\end{bmatrix}$$

350    symmetry    $\dfrac{\sqrt{15}z(x-y)(x+y)}{2}$

$\mathbb{G}_3^{(1,0;a)}(B_{2g})$

$$\begin{bmatrix}
\frac{\sqrt{42}i}{126} & 0 & 0 & 0 & \frac{\sqrt{210}i}{126} & 0 & 0 & -\frac{5\sqrt{7}i}{56} & 0 & 0 & 0 & -\frac{5\sqrt{21}i}{168} & 0 & 0 \\
0 & -\frac{\sqrt{210}i}{126} & 0 & 0 & 0 & -\frac{\sqrt{42}i}{126} & 0 & 0 & -\frac{5\sqrt{21}i}{168} & 0 & 0 & 0 & -\frac{5\sqrt{7}i}{56} & 0 \\
0 & 0 & 0 & -\frac{5\sqrt{70}i}{168} & 0 & 0 & -\frac{\sqrt{6}i}{24} & 0 & 0 & 0 & -\frac{\sqrt{210}i}{168} & 0 & 0 & 0 \\
\frac{25\sqrt{21}i}{504} & 0 & 0 & 0 & -\frac{5\sqrt{105}i}{504} & 0 & 0 & \frac{\sqrt{14}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{42}i}{56} & 0 & 0 \\
0 & -\frac{5\sqrt{105}i}{504} & 0 & 0 & 0 & \frac{25\sqrt{21}i}{504} & 0 & 0 & \frac{\sqrt{42}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{14}i}{56} & 0 \\
0 & 0 & -\frac{5\sqrt{70}i}{168} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{168} & 0 & 0 & 0 & \frac{\sqrt{6}i}{24}
\end{bmatrix}$$

351    symmetry    $\dfrac{x\left(2x^2-3y^2-3z^2\right)}{2}$

$\mathbb{G}_{3,1}^{(1,0;a)}(E_g,1)$

$$\begin{bmatrix}
0 & \frac{\sqrt{14}i}{84} & 0 & -\frac{\sqrt{7}i}{42} & 0 & \frac{\sqrt{70}i}{84} & \frac{5\sqrt{15}i}{96} & 0 & -\frac{5\sqrt{35}i}{224} & 0 & \frac{5\sqrt{21}i}{224} & 0 & -\frac{5\sqrt{105}i}{672} & 0 \\
\frac{\sqrt{70}i}{84} & 0 & -\frac{\sqrt{7}i}{42} & 0 & \frac{\sqrt{14}i}{84} & 0 & 0 & \frac{5\sqrt{105}i}{672} & 0 & -\frac{5\sqrt{21}i}{224} & 0 & \frac{5\sqrt{35}i}{224} & 0 & -\frac{5\sqrt{15}i}{96} \\
-\frac{5\sqrt{105}i}{672} & 0 & \frac{5\sqrt{42}i}{224} & 0 & -\frac{25\sqrt{21}i}{672} & 0 & 0 & -\frac{\sqrt{70}i}{112} & 0 & \frac{\sqrt{14}i}{56} & 0 & -\frac{\sqrt{210}i}{336} & 0 & 0 \\
0 & \frac{5\sqrt{7}i}{96} & 0 & -\frac{5\sqrt{14}i}{672} & 0 & -\frac{25\sqrt{35}i}{672} & -\frac{\sqrt{30}i}{48} & 0 & 0 & 0 & \frac{\sqrt{42}i}{112} & 0 & -\frac{\sqrt{210}i}{168} & 0 \\
\frac{25\sqrt{35}i}{672} & 0 & \frac{5\sqrt{14}i}{672} & 0 & -\frac{5\sqrt{7}i}{96} & 0 & 0 & -\frac{\sqrt{210}i}{168} & 0 & \frac{\sqrt{42}i}{112} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{48} \\
0 & \frac{25\sqrt{21}i}{672} & 0 & -\frac{5\sqrt{42}i}{224} & 0 & \frac{5\sqrt{105}i}{672} & 0 & 0 & -\frac{\sqrt{210}i}{336} & 0 & \frac{\sqrt{14}i}{56} & 0 & -\frac{\sqrt{70}i}{112} & 0
\end{bmatrix}$$

352    symmetry    $\dfrac{y\left(3x^2-2y^2+3z^2\right)}{2}$

Table 7

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{G}_{3,2}^{(1,0;a)}(E_g,1)$$

$$\begin{bmatrix}
0 & \frac{\sqrt{14}}{84} & 0 & \frac{\sqrt{7}}{42} & 0 & \frac{\sqrt{70}}{84} & -\frac{5\sqrt{15}}{96} & 0 & -\frac{5\sqrt{35}}{224} & 0 & -\frac{5\sqrt{21}}{224} & 0 & -\frac{5\sqrt{105}}{672} & 0 \\
-\frac{\sqrt{70}}{84} & 0 & -\frac{\sqrt{7}}{42} & 0 & -\frac{\sqrt{14}}{84} & 0 & 0 & -\frac{5\sqrt{105}}{672} & 0 & -\frac{5\sqrt{21}}{224} & 0 & -\frac{5\sqrt{35}}{224} & 0 & -\frac{5\sqrt{15}}{96} \\
-\frac{5\sqrt{105}}{672} & 0 & -\frac{5\sqrt{42}}{224} & 0 & -\frac{25\sqrt{21}}{672} & 0 & 0 & -\frac{\sqrt{70}}{112} & 0 & -\frac{\sqrt{14}}{56} & 0 & -\frac{\sqrt{210}}{336} & 0 & 0 \\
0 & \frac{5\sqrt{7}}{96} & 0 & \frac{5\sqrt{14}}{672} & 0 & -\frac{25\sqrt{35}}{672} & \frac{\sqrt{30}}{48} & 0 & 0 & 0 & -\frac{\sqrt{42}}{112} & 0 & -\frac{\sqrt{210}}{168} & 0 \\
-\frac{25\sqrt{35}}{672} & 0 & \frac{5\sqrt{14}}{672} & 0 & \frac{5\sqrt{7}}{96} & 0 & 0 & \frac{\sqrt{210}}{168} & 0 & \frac{\sqrt{42}}{112} & 0 & 0 & 0 & -\frac{\sqrt{30}}{48} \\
0 & -\frac{25\sqrt{21}}{672} & 0 & -\frac{5\sqrt{42}}{224} & 0 & -\frac{5\sqrt{105}}{672} & 0 & 0 & \frac{\sqrt{210}}{336} & 0 & \frac{\sqrt{14}}{56} & 0 & \frac{\sqrt{70}}{112} & 0
\end{bmatrix}$$

**353** symmetry $\qquad \frac{\sqrt{15}x(y-z)(y+z)}{2}$

$$\mathbb{G}_{3,1}^{(1,0;a)}(E_g,2)$$

$$\begin{bmatrix}
0 & \frac{\sqrt{210}i}{252} & 0 & -\frac{\sqrt{105}i}{126} & 0 & -\frac{\sqrt{42}i}{84} & -\frac{5i}{32} & 0 & -\frac{25\sqrt{21}i}{672} & 0 & \frac{5\sqrt{35}i}{224} & 0 & \frac{5\sqrt{7}i}{224} & 0 \\
-\frac{\sqrt{42}i}{84} & 0 & -\frac{\sqrt{105}i}{126} & 0 & \frac{\sqrt{210}i}{252} & 0 & 0 & -\frac{5\sqrt{7}i}{224} & 0 & -\frac{5\sqrt{35}i}{224} & 0 & \frac{25\sqrt{21}i}{672} & 0 & \frac{5i}{32} \\
-\frac{25\sqrt{7}i}{672} & 0 & \frac{5\sqrt{70}i}{224} & 0 & \frac{5\sqrt{35}i}{224} & 0 & 0 & -\frac{5\sqrt{42}i}{336} & 0 & \frac{\sqrt{210}i}{168} & 0 & \frac{\sqrt{14}i}{112} & 0 & 0 \\
0 & \frac{5\sqrt{105}i}{288} & 0 & -\frac{5\sqrt{210}i}{2016} & 0 & \frac{25\sqrt{21}i}{672} & \frac{\sqrt{2}i}{16} & 0 & 0 & 0 & \frac{\sqrt{70}i}{112} & 0 & \frac{\sqrt{14}i}{56} & 0 \\
-\frac{25\sqrt{21}i}{672} & 0 & \frac{5\sqrt{210}i}{2016} & 0 & -\frac{5\sqrt{105}i}{288} & 0 & 0 & \frac{\sqrt{14}i}{56} & 0 & \frac{\sqrt{70}i}{112} & 0 & 0 & 0 & \frac{\sqrt{2}i}{16} \\
0 & -\frac{5\sqrt{35}i}{224} & 0 & -\frac{5\sqrt{70}i}{224} & 0 & \frac{25\sqrt{7}i}{672} & 0 & 0 & \frac{\sqrt{14}i}{112} & 0 & \frac{\sqrt{210}i}{168} & 0 & -\frac{5\sqrt{42}i}{336} & 0
\end{bmatrix}$$

**354** symmetry $\qquad -\frac{\sqrt{15}y(x-z)(x+z)}{2}$

$$\mathbb{G}_{3,2}^{(1,0;a)}(E_g,2)$$

$$\begin{bmatrix}
0 & \frac{\sqrt{210}}{252} & 0 & \frac{\sqrt{105}}{126} & 0 & -\frac{\sqrt{42}}{84} & \frac{5}{32} & 0 & -\frac{25\sqrt{21}}{672} & 0 & -\frac{5\sqrt{35}}{224} & 0 & \frac{5\sqrt{7}}{224} & 0 \\
\frac{\sqrt{42}}{84} & 0 & -\frac{\sqrt{105}}{126} & 0 & -\frac{\sqrt{210}}{252} & 0 & 0 & \frac{5\sqrt{7}}{224} & 0 & -\frac{5\sqrt{35}}{224} & 0 & -\frac{25\sqrt{21}}{672} & 0 & \frac{5}{32} \\
-\frac{25\sqrt{7}}{672} & 0 & -\frac{5\sqrt{70}}{224} & 0 & \frac{5\sqrt{35}}{224} & 0 & 0 & -\frac{5\sqrt{42}}{336} & 0 & -\frac{\sqrt{210}}{168} & 0 & \frac{\sqrt{14}}{112} & 0 & 0 \\
0 & \frac{5\sqrt{105}}{288} & 0 & \frac{5\sqrt{210}}{2016} & 0 & \frac{25\sqrt{21}}{672} & -\frac{\sqrt{2}}{16} & 0 & 0 & 0 & -\frac{\sqrt{70}}{112} & 0 & \frac{\sqrt{14}}{56} & 0 \\
\frac{25\sqrt{21}}{672} & 0 & \frac{5\sqrt{210}}{2016} & 0 & \frac{5\sqrt{105}}{288} & 0 & 0 & -\frac{\sqrt{14}}{56} & 0 & \frac{\sqrt{70}}{112} & 0 & 0 & 0 & \frac{\sqrt{2}}{16} \\
0 & \frac{5\sqrt{35}}{224} & 0 & -\frac{5\sqrt{70}}{224} & 0 & -\frac{5\sqrt{7}}{672} & 0 & 0 & -\frac{\sqrt{14}}{112} & 0 & \frac{\sqrt{210}}{168} & 0 & \frac{5\sqrt{42}}{336} & 0
\end{bmatrix}$$

**355** symmetry $\qquad z$

$$\mathbb{G}_{1}^{(1,1;a)}(A_{2g})$$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{10}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{15}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{15}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

**356** symmetry $\qquad x$

Table 7

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_{1,1}^{(1,1;a)}(E_g)$

$$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \frac{\sqrt{2}i}{4} & 0 & -\frac{\sqrt{5}i}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{30}i}{20} & 0 & -\frac{\sqrt{15}i}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{15}i}{20} & 0 & -\frac{\sqrt{30}i}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{5}i}{20} & 0 & -\frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

| 357 | symmetry | $-y$ |

$\mathbb{G}_{1,2}^{(1,1;a)}(E_g)$

$$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \frac{\sqrt{2}}{4} & 0 & \frac{\sqrt{5}}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{30}}{20} & 0 & \frac{\sqrt{15}}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{15}}{20} & 0 & \frac{\sqrt{30}}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{5}}{20} & 0 & \frac{\sqrt{2}}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

| 358 | symmetry | $-\dfrac{z\left(3x^2+3y^2-2z^2\right)}{2}$ |

$\mathbb{G}_{3}^{(1,1;a)}(A_{2g})$

$$\begin{pmatrix} 0 & 0 & \frac{3i}{7} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{28} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{3i}{7} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{28} & 0 & 0 & 0 \\ 0 & \frac{3\sqrt{3}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{84} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{3\sqrt{2}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{84} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{3\sqrt{2}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{84} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{3\sqrt{3}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{84} & 0 & 0 \end{pmatrix}$$

| 359 | symmetry | $\sqrt{15}xyz$ |

$\mathbb{G}_{3}^{(1,1;a)}(B_{1g})$

$$\begin{pmatrix} -\frac{\sqrt{6}}{14} & 0 & 0 & 0 & \frac{\sqrt{30}}{14} & 0 & 0 & \frac{3}{56} & 0 & 0 & 0 & -\frac{\sqrt{3}}{56} & 0 & 0 \\ 0 & \frac{\sqrt{30}}{14} & 0 & 0 & 0 & -\frac{\sqrt{6}}{14} & 0 & 0 & \frac{\sqrt{3}}{56} & 0 & 0 & 0 & -\frac{3}{56} & 0 \\ 0 & 0 & 0 & \frac{3\sqrt{10}}{56} & 0 & 0 & \frac{\sqrt{42}}{168} & 0 & 0 & 0 & -\frac{\sqrt{30}}{168} & 0 & 0 & 0 \\ \frac{5\sqrt{3}}{56} & 0 & 0 & 0 & \frac{\sqrt{15}}{56} & 0 & 0 & -\frac{\sqrt{2}}{56} & 0 & 0 & 0 & -\frac{\sqrt{6}}{56} & 0 & 0 \\ 0 & -\frac{\sqrt{15}}{56} & 0 & 0 & 0 & -\frac{5\sqrt{3}}{56} & 0 & 0 & -\frac{\sqrt{6}}{56} & 0 & 0 & 0 & -\frac{\sqrt{2}}{56} & 0 \\ 0 & 0 & -\frac{3\sqrt{10}}{56} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{168} & 0 & 0 & 0 & \frac{\sqrt{42}}{168} \end{pmatrix}$$

| 360 | symmetry | $\dfrac{\sqrt{15}z(x-y)(x+y)}{2}$ |

Table 7

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{G}_3^{(1,1;a)}(B_{2g})$$

$$
\begin{bmatrix}
\frac{\sqrt6 i}{14} & 0 & 0 & 0 & \frac{\sqrt{30}i}{14} & 0 & 0 & -\frac{3i}{56} & 0 & 0 & 0 & -\frac{\sqrt3 i}{56} & 0 & 0 \\
0 & -\frac{\sqrt{30}i}{14} & 0 & 0 & 0 & -\frac{\sqrt6 i}{14} & 0 & 0 & -\frac{\sqrt3 i}{56} & 0 & 0 & 0 & -\frac{3i}{56} & 0 \\
0 & 0 & 0 & \frac{3\sqrt{10}i}{56} & 0 & 0 & -\frac{\sqrt{42}i}{168} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{168} & 0 & 0 & 0 \\
-\frac{5\sqrt3 i}{56} & 0 & 0 & 0 & \frac{\sqrt{15}i}{56} & 0 & 0 & \frac{\sqrt2 i}{56} & 0 & 0 & 0 & -\frac{\sqrt6 i}{56} & 0 & 0 \\
0 & \frac{\sqrt{15}i}{56} & 0 & 0 & 0 & -\frac{5\sqrt3 i}{56} & 0 & 0 & \frac{\sqrt6 i}{56} & 0 & 0 & 0 & -\frac{\sqrt2 i}{56} & 0 \\
0 & 0 & \frac{3\sqrt{10}i}{56} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{168} & 0 & 0 & 0 & \frac{\sqrt{42}i}{168}
\end{bmatrix}
$$

**361  symmetry**

$$\frac{x(2x^2-3y^2-3z^2)}{2}$$

$$\mathbb{G}_{3,1}^{(1,1;a)}(E_g,1)$$

$$
\begin{bmatrix}
0 & \frac{3\sqrt2 i}{28} & 0 & -\frac{3i}{14} & 0 & \frac{3\sqrt{10}i}{28} & \frac{\sqrt{105}i}{224} & 0 & -\frac{3\sqrt5 i}{224} & 0 & \frac{3\sqrt3 i}{224} & 0 & -\frac{\sqrt{15}i}{224} & 0 \\
\frac{3\sqrt{10}i}{28} & 0 & -\frac{3i}{14} & 0 & \frac{3\sqrt2 i}{28} & 0 & 0 & \frac{\sqrt{15}i}{224} & 0 & -\frac{3\sqrt3 i}{224} & 0 & \frac{3\sqrt5 i}{224} & 0 & -\frac{\sqrt{105}i}{224} \\
\frac{3\sqrt{15}i}{224} & 0 & -\frac{9\sqrt6 i}{224} & 0 & \frac{15\sqrt3 i}{224} & 0 & 0 & -\frac{\sqrt{10}i}{112} & 0 & \frac{\sqrt2 i}{56} & 0 & -\frac{\sqrt{30}i}{336} & 0 & 0 \\
0 & -\frac{3i}{32} & 0 & \frac{3\sqrt2 i}{224} & 0 & \frac{15\sqrt5 i}{224} & -\frac{\sqrt{210}i}{336} & 0 & 0 & 0 & \frac{\sqrt6 i}{112} & 0 & -\frac{\sqrt{30}i}{168} & 0 \\
-\frac{15\sqrt5 i}{224} & 0 & -\frac{3\sqrt2 i}{224} & 0 & \frac{3i}{32} & 0 & 0 & -\frac{\sqrt{30}i}{168} & 0 & \frac{\sqrt6 i}{112} & 0 & 0 & 0 & -\frac{\sqrt{210}i}{336} \\
0 & -\frac{15\sqrt3 i}{224} & 0 & \frac{9\sqrt6 i}{224} & 0 & -\frac{3\sqrt{15}i}{224} & 0 & 0 & -\frac{\sqrt{30}i}{336} & 0 & \frac{\sqrt2 i}{56} & 0 & -\frac{\sqrt{10}i}{112} & 0
\end{bmatrix}
$$

**362  symmetry**

$$\frac{y(3x^2-2y^2+3z^2)}{2}$$

$$\mathbb{G}_{3,2}^{(1,1;a)}(E_g,1)$$

$$
\begin{bmatrix}
0 & \frac{3\sqrt2}{28} & 0 & \frac{3}{14} & 0 & \frac{3\sqrt{10}}{28} & -\frac{\sqrt{105}}{224} & 0 & -\frac{3\sqrt5}{224} & 0 & -\frac{3\sqrt3}{224} & 0 & -\frac{\sqrt{15}}{224} & 0 \\
-\frac{3\sqrt{10}}{28} & 0 & -\frac{3}{14} & 0 & -\frac{3\sqrt2}{28} & 0 & 0 & -\frac{\sqrt{15}}{224} & 0 & -\frac{3\sqrt3}{224} & 0 & -\frac{3\sqrt5}{224} & 0 & -\frac{\sqrt{105}}{224} \\
\frac{3\sqrt{15}}{224} & 0 & \frac{9\sqrt6}{224} & 0 & \frac{15\sqrt3}{224} & 0 & 0 & -\frac{\sqrt{10}}{112} & 0 & -\frac{\sqrt2}{56} & 0 & -\frac{\sqrt{30}}{336} & 0 & 0 \\
0 & -\frac{3}{32} & 0 & -\frac{3\sqrt2}{224} & 0 & \frac{15\sqrt5}{224} & \frac{\sqrt{210}}{336} & 0 & 0 & 0 & -\frac{\sqrt6}{112} & 0 & -\frac{\sqrt{30}}{168} & 0 \\
\frac{15\sqrt5}{224} & 0 & -\frac{3\sqrt2}{224} & 0 & -\frac{3}{32} & 0 & 0 & \frac{\sqrt{30}}{168} & 0 & \frac{\sqrt6}{112} & 0 & 0 & 0 & -\frac{\sqrt{210}}{336} \\
0 & \frac{15\sqrt3}{224} & 0 & \frac{9\sqrt6}{224} & 0 & \frac{3\sqrt{15}}{224} & 0 & 0 & \frac{\sqrt{30}}{336} & 0 & \frac{\sqrt2}{56} & 0 & \frac{\sqrt{10}}{112} & 0
\end{bmatrix}
$$

**363  symmetry**

$$\frac{\sqrt{15}x(y-z)(y+z)}{2}$$

$$\mathbb{G}_{3,1}^{(1,1;a)}(E_g,2)$$

$$
\begin{bmatrix}
0 & \frac{\sqrt{30}i}{28} & 0 & -\frac{\sqrt{15}i}{14} & 0 & -\frac{3\sqrt6 i}{28} & -\frac{3\sqrt7 i}{224} & 0 & -\frac{5\sqrt3 i}{224} & 0 & \frac{3\sqrt5 i}{224} & 0 & \frac{3i}{224} & 0 \\
-\frac{3\sqrt6 i}{28} & 0 & -\frac{\sqrt{15}i}{14} & 0 & \frac{\sqrt{30}i}{28} & 0 & 0 & -\frac{3i}{224} & 0 & -\frac{3\sqrt5 i}{224} & 0 & \frac{5\sqrt3 i}{224} & 0 & \frac{3\sqrt7 i}{224} \\
\frac{15i}{224} & 0 & -\frac{9\sqrt{10}i}{224} & 0 & -\frac{9\sqrt5 i}{224} & 0 & 0 & -\frac{5\sqrt6 i}{336} & 0 & \frac{\sqrt{30}i}{168} & 0 & \frac{\sqrt2 i}{112} & 0 & 0 \\
0 & -\frac{\sqrt{15}i}{32} & 0 & \frac{\sqrt{30}i}{224} & 0 & -\frac{15\sqrt3 i}{224} & \frac{\sqrt{14}i}{112} & 0 & 0 & 0 & \frac{\sqrt{10}i}{112} & 0 & \frac{\sqrt2 i}{56} & 0 \\
\frac{15\sqrt3 i}{224} & 0 & -\frac{\sqrt{30}i}{224} & 0 & \frac{\sqrt{15}i}{32} & 0 & 0 & \frac{\sqrt2 i}{56} & 0 & \frac{\sqrt{10}i}{112} & 0 & 0 & 0 & \frac{\sqrt{14}i}{112} \\
0 & \frac{9\sqrt5 i}{224} & 0 & \frac{9\sqrt{10}i}{224} & 0 & -\frac{15i}{224} & 0 & 0 & \frac{\sqrt2 i}{112} & 0 & \frac{\sqrt{30}i}{168} & 0 & -\frac{5\sqrt6 i}{336} & 0
\end{bmatrix}
$$

**364  symmetry**

$$-\frac{\sqrt{15}y(x-z)(x+z)}{2}$$

Table 7

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_{3,2}^{(1,1;a)}(E_g,2)$

$$\begin{pmatrix}
0 & \frac{\sqrt{30}}{28} & 0 & \frac{\sqrt{15}}{14} & 0 & -\frac{3\sqrt{6}}{28} & \frac{3\sqrt{7}}{224} & 0 & -\frac{5\sqrt{3}}{224} & 0 & -\frac{3\sqrt{5}}{224} & 0 & \frac{3}{224} & 0 \\
\frac{3\sqrt{6}}{28} & 0 & -\frac{\sqrt{15}}{14} & 0 & -\frac{\sqrt{30}}{28} & 0 & 0 & \frac{3}{224} & 0 & -\frac{3\sqrt{5}}{224} & 0 & -\frac{5\sqrt{3}}{224} & 0 & \frac{3\sqrt{7}}{224} \\
\frac{15}{224} & 0 & \frac{9\sqrt{10}}{224} & 0 & -\frac{9\sqrt{5}}{224} & 0 & 0 & -\frac{5\sqrt{6}}{336} & 0 & -\frac{\sqrt{30}}{168} & 0 & \frac{\sqrt{2}}{112} & 0 & 0 \\
0 & -\frac{\sqrt{15}}{32} & 0 & -\frac{\sqrt{30}}{224} & 0 & -\frac{15\sqrt{3}}{224} & -\frac{\sqrt{14}}{112} & 0 & 0 & 0 & -\frac{\sqrt{10}}{112} & 0 & \frac{\sqrt{2}}{56} & 0 \\
-\frac{15\sqrt{3}}{224} & 0 & -\frac{\sqrt{30}}{224} & 0 & -\frac{\sqrt{15}}{32} & 0 & 0 & -\frac{\sqrt{2}}{56} & 0 & \frac{\sqrt{10}}{112} & 0 & 0 & 0 & \frac{\sqrt{14}}{112} \\
0 & -\frac{9\sqrt{5}}{224} & 0 & \frac{9\sqrt{10}}{224} & 0 & \frac{15}{224} & 0 & 0 & -\frac{\sqrt{2}}{112} & 0 & \frac{\sqrt{30}}{168} & 0 & \frac{5\sqrt{6}}{336} & 0
\end{pmatrix}$$

**365** symmetry $-\frac{x^2}{2} - \frac{y^2}{2} + z^2$

$\mathbb{T}_2^{(a)}(A_{1g})$

$$\begin{pmatrix}
0 & 0 & \frac{\sqrt{3}i}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{3}i}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{i}{7} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{14} & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{6}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{2}i}{14} & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{6}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{2}i}{14} & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{i}{7} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{14} & 0 & 0
\end{pmatrix}$$

**366** symmetry $\frac{\sqrt{3}(x-y)(x+y)}{2}$

$\mathbb{T}_2^{(a)}(B_{1g})$

$$\begin{pmatrix}
\frac{\sqrt{10}i}{12} & 0 & 0 & 0 & \frac{\sqrt{2}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{2}i}{12} & 0 & 0 & 0 & \frac{\sqrt{10}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{6}i}{42} & 0 & 0 & \frac{\sqrt{70}i}{28} & 0 & 0 & 0 & \frac{\sqrt{2}i}{28} & 0 & 0 & 0 \\
\frac{\sqrt{5}i}{21} & 0 & 0 & 0 & -\frac{2i}{21} & 0 & 0 & \frac{\sqrt{30}i}{28} & 0 & 0 & 0 & \frac{\sqrt{10}i}{28} & 0 & 0 \\
0 & \frac{2i}{21} & 0 & 0 & 0 & -\frac{\sqrt{5}i}{21} & 0 & 0 & \frac{\sqrt{10}i}{28} & 0 & 0 & 0 & \frac{\sqrt{30}i}{28} & 0 \\
0 & 0 & \frac{\sqrt{6}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{28} & 0 & 0 & 0 & \frac{\sqrt{70}i}{28}
\end{pmatrix}$$

**367** symmetry $\sqrt{3}xy$

$\mathbb{T}_2^{(a)}(B_{2g})$

$$\begin{pmatrix}
-\frac{\sqrt{10}}{12} & 0 & 0 & 0 & \frac{\sqrt{2}}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{2}}{12} & 0 & 0 & 0 & \frac{\sqrt{10}}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{6}}{42} & 0 & 0 & -\frac{\sqrt{70}}{28} & 0 & 0 & 0 & \frac{\sqrt{2}}{28} & 0 & 0 & 0 \\
-\frac{\sqrt{5}}{21} & 0 & 0 & 0 & -\frac{2}{21} & 0 & 0 & -\frac{\sqrt{30}}{28} & 0 & 0 & 0 & \frac{\sqrt{10}}{28} & 0 & 0 \\
0 & -\frac{2}{21} & 0 & 0 & 0 & -\frac{\sqrt{5}}{21} & 0 & 0 & -\frac{\sqrt{10}}{28} & 0 & 0 & 0 & \frac{\sqrt{30}}{28} & 0 \\
0 & 0 & -\frac{\sqrt{6}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{28} & 0 & 0 & 0 & \frac{\sqrt{70}}{28}
\end{pmatrix}$$

**368** symmetry $\sqrt{3}yz$

*continued ...*

Table 7

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{T}_{2,1}^{(a)}(E_g) \quad \begin{bmatrix} 0 & \frac{\sqrt{2}}{6} & 0 & \frac{1}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{1}{6} & 0 & \frac{\sqrt{2}}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ -\frac{\sqrt{15}}{42} & 0 & -\frac{\sqrt{6}}{28} & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{14} & 0 & \frac{\sqrt{2}}{14} & 0 & 0 & 0 & 0 \\ 0 & \frac{1}{42} & 0 & -\frac{5\sqrt{2}}{84} & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{14} & 0 & \frac{\sqrt{6}}{14} & 0 & 0 & 0 \\ 0 & 0 & \frac{5\sqrt{2}}{84} & 0 & -\frac{1}{42} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{14} & 0 & \frac{\sqrt{10}}{14} & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{6}}{28} & 0 & \frac{\sqrt{15}}{42} & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{14} & 0 & \frac{\sqrt{10}}{14} & 0 \end{bmatrix}$$

| 369 | symmetry | $\sqrt{3}xz$ |

$$\mathbb{T}_{2,2}^{(a)}(E_g) \quad \begin{bmatrix} 0 & -\frac{\sqrt{2}i}{6} & 0 & \frac{i}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{i}{6} & 0 & \frac{\sqrt{2}i}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \frac{\sqrt{15}i}{42} & 0 & -\frac{\sqrt{6}i}{28} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{14} & 0 & \frac{\sqrt{2}i}{14} & 0 & 0 & 0 & 0 \\ 0 & -\frac{i}{42} & 0 & -\frac{5\sqrt{2}i}{84} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{14} & 0 & \frac{\sqrt{6}i}{14} & 0 & 0 & 0 \\ 0 & 0 & -\frac{5\sqrt{2}i}{84} & 0 & -\frac{i}{42} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{14} & 0 & \frac{\sqrt{10}i}{14} & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{6}i}{28} & 0 & \frac{\sqrt{15}i}{42} & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{14} & 0 & \frac{\sqrt{10}i}{14} & 0 \end{bmatrix}$$

| 370 | symmetry | $\frac{\sqrt{21}\left(x^4-3x^2y^2-3x^2z^2+y^4-3y^2z^2+z^4\right)}{6}$ |

$$\mathbb{T}_{4}^{(a)}(A_{1g},1) \quad \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{12} & 0 & 0 & 0 & -\frac{\sqrt{5}i}{12} \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}i}{12} & 0 & 0 & 0 & \frac{\sqrt{7}i}{12} & 0 & 0 & 0 \\ 0 & \frac{\sqrt{7}i}{28} & 0 & 0 & 0 & \frac{\sqrt{35}i}{28} & 0 & 0 & -\frac{\sqrt{70}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{210}i}{168} & 0 \\ 0 & 0 & -\frac{\sqrt{42}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{14}i}{168} & 0 & 0 & 0 & -\frac{\sqrt{10}i}{24} \\ 0 & 0 & 0 & \frac{\sqrt{42}i}{28} & 0 & 0 & -\frac{\sqrt{10}i}{24} & 0 & 0 & 0 & \frac{5\sqrt{14}i}{168} & 0 & 0 & 0 \\ -\frac{\sqrt{35}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{7}i}{28} & 0 & 0 & -\frac{\sqrt{210}i}{168} & 0 & 0 & 0 & -\frac{\sqrt{70}i}{56} & 0 & 0 \end{bmatrix}$$

| 371 | symmetry | $-\frac{\sqrt{15}\left(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4\right)}{12}$ |

$$\mathbb{T}_{4}^{(a)}(A_{1g},2) \quad \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}i}{12} & 0 & 0 & 0 & \frac{\sqrt{7}i}{12} \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{12} & 0 & 0 & 0 & \frac{\sqrt{5}i}{12} & 0 & 0 & 0 \\ 0 & \frac{\sqrt{5}i}{28} & 0 & 0 & 0 & -\frac{i}{4} & 0 & 0 & -\frac{5\sqrt{2}i}{56} & 0 & 0 & 0 & \frac{\sqrt{6}i}{24} & 0 \\ 0 & 0 & -\frac{\sqrt{30}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{10}i}{168} & 0 & 0 & 0 & \frac{\sqrt{14}i}{24} \\ 0 & 0 & 0 & \frac{\sqrt{30}i}{28} & 0 & 0 & \frac{\sqrt{14}i}{24} & 0 & 0 & 0 & \frac{5\sqrt{10}i}{168} & 0 & 0 & 0 \\ \frac{i}{4} & 0 & 0 & 0 & -\frac{\sqrt{5}i}{28} & 0 & 0 & \frac{\sqrt{6}i}{24} & 0 & 0 & 0 & -\frac{5\sqrt{2}i}{56} & 0 & 0 \end{bmatrix}$$

| 372 | symmetry | $\frac{\sqrt{35}xy(x-y)(x+y)}{2}$ |

continued ...

Table 7

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_4^{(a)}(A_{2g})$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{6} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{28} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{12} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{21}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{28} & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

**373** symmetry

$$\frac{\sqrt{5}(x-y)(x+y)\left(x^2+y^2-6z^2\right)}{4}$$

$\mathbb{T}_4^{(a)}(B_{1g})$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{12} & 0 & 0 & 0 & \frac{i}{4} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{i}{4} & 0 & 0 & 0 & -\frac{\sqrt{3}i}{12} & 0 \\
0 & 0 & 0 & -\frac{\sqrt{30}i}{28} & 0 & 0 & \frac{\sqrt{14}i}{56} & 0 & 0 & 0 & \frac{3\sqrt{10}i}{56} & 0 & 0 & 0 \\
\frac{3i}{28} & 0 & 0 & 0 & \frac{3\sqrt{5}i}{28} & 0 & 0 & -\frac{11\sqrt{6}i}{168} & 0 & 0 & 0 & \frac{\sqrt{2}i}{56} & 0 & 0 \\
0 & -\frac{3\sqrt{5}i}{28} & 0 & 0 & 0 & -\frac{3i}{28} & 0 & 0 & \frac{\sqrt{2}i}{56} & 0 & 0 & 0 & -\frac{11\sqrt{6}i}{168} & 0 \\
0 & 0 & \frac{\sqrt{30}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{10}i}{56} & 0 & 0 & 0 & \frac{\sqrt{14}i}{56}
\end{pmatrix}$$

**374** symmetry

$$-\frac{\sqrt{5}xy\left(x^2+y^2-6z^2\right)}{2}$$

$\mathbb{T}_4^{(a)}(B_{2g})$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{12} & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & 0 & \frac{\sqrt{3}}{12} & 0 \\
0 & 0 & 0 & \frac{\sqrt{30}}{28} & 0 & 0 & \frac{\sqrt{14}}{56} & 0 & 0 & 0 & -\frac{3\sqrt{10}}{56} & 0 & 0 & 0 \\
\frac{3}{28} & 0 & 0 & 0 & -\frac{3\sqrt{5}}{28} & 0 & 0 & -\frac{11\sqrt{6}}{168} & 0 & 0 & 0 & -\frac{\sqrt{2}}{56} & 0 & 0 \\
0 & -\frac{3\sqrt{5}}{28} & 0 & 0 & 0 & \frac{3}{28} & 0 & 0 & \frac{\sqrt{2}}{56} & 0 & 0 & 0 & \frac{11\sqrt{6}}{168} & 0 \\
0 & 0 & \frac{\sqrt{30}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{10}}{56} & 0 & 0 & 0 & -\frac{\sqrt{14}}{56}
\end{pmatrix}$$

**375** symmetry

$$\frac{\sqrt{35}yz(y-z)(y+z)}{2}$$

$\mathbb{T}_{4,1}^{(a)}(E_g,1)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{48} & 0 & \frac{\sqrt{7}}{16} & 0 & \frac{\sqrt{105}}{48} & 0 & \frac{\sqrt{21}}{48} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}}{48} & 0 & -\frac{\sqrt{105}}{48} & 0 & -\frac{\sqrt{7}}{16} & 0 & -\frac{\sqrt{3}}{48} \\
-\frac{\sqrt{21}}{112} & 0 & -\frac{\sqrt{210}}{112} & 0 & -\frac{\sqrt{105}}{112} & 0 & 0 & \frac{3\sqrt{14}}{112} & 0 & \frac{\sqrt{70}}{56} & 0 & \frac{\sqrt{42}}{112} & 0 & 0 \\
0 & \frac{3\sqrt{35}}{112} & 0 & \frac{3\sqrt{70}}{112} & 0 & \frac{3\sqrt{7}}{112} & -\frac{\sqrt{6}}{48} & 0 & -\frac{\sqrt{14}}{28} & 0 & -\frac{\sqrt{210}}{336} & 0 & \frac{\sqrt{42}}{168} & 0 \\
-\frac{3\sqrt{7}}{112} & 0 & -\frac{3\sqrt{70}}{112} & 0 & -\frac{3\sqrt{35}}{112} & 0 & 0 & \frac{\sqrt{42}}{168} & 0 & -\frac{\sqrt{210}}{336} & 0 & -\frac{\sqrt{14}}{28} & 0 & -\frac{\sqrt{6}}{48} \\
0 & \frac{\sqrt{105}}{112} & 0 & \frac{\sqrt{210}}{112} & 0 & \frac{\sqrt{21}}{112} & 0 & 0 & \frac{\sqrt{42}}{112} & 0 & \frac{\sqrt{70}}{56} & 0 & \frac{3\sqrt{14}}{112} & 0
\end{pmatrix}$$

**376** symmetry

$$\frac{\sqrt{35}xz(x-z)(x+z)}{2}$$

78

Table 7

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{T}_{4,2}^{(a)}(E_g,1)$$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{48} & 0 & -\frac{\sqrt{7}i}{16} & 0 & \frac{\sqrt{105}i}{48} & 0 & -\frac{\sqrt{21}i}{48} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{48} & 0 & \frac{\sqrt{105}i}{48} & 0 & -\frac{\sqrt{7}i}{16} & 0 & \frac{\sqrt{3}i}{48} \\
\frac{\sqrt{21}i}{112} & 0 & -\frac{\sqrt{210}i}{112} & 0 & \frac{\sqrt{105}i}{112} & 0 & 0 & -\frac{3\sqrt{14}i}{112} & 0 & \frac{\sqrt{70}i}{56} & 0 & -\frac{\sqrt{42}i}{112} & 0 & 0 \\
0 & -\frac{3\sqrt{35}i}{112} & 0 & \frac{3\sqrt{70}i}{112} & 0 & -\frac{3\sqrt{7}i}{112} & -\frac{\sqrt{6}i}{48} & 0 & \frac{\sqrt{14}i}{28} & 0 & -\frac{\sqrt{210}i}{336} & 0 & -\frac{\sqrt{42}i}{168} & 0 \\
-\frac{3\sqrt{7}i}{112} & 0 & \frac{3\sqrt{70}i}{112} & 0 & -\frac{3\sqrt{35}i}{112} & 0 & 0 & \frac{\sqrt{42}i}{168} & 0 & \frac{\sqrt{210}i}{336} & 0 & -\frac{\sqrt{14}i}{28} & 0 & \frac{\sqrt{6}i}{48} \\
0 & \frac{\sqrt{105}i}{112} & 0 & -\frac{\sqrt{210}i}{112} & 0 & \frac{\sqrt{21}i}{112} & 0 & 0 & \frac{\sqrt{42}i}{112} & 0 & -\frac{\sqrt{70}i}{56} & 0 & \frac{3\sqrt{14}i}{112} & 0
\end{bmatrix}$$

| 377 | symmetry | $\dfrac{\sqrt{5}yz(6x^2-y^2-z^2)}{2}$ |
|---|---|---|

$$\mathbb{T}_{4,1}^{(a)}(E_g,2)$$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}}{48} & 0 & \frac{1}{16} & 0 & \frac{\sqrt{15}}{48} & 0 & -\frac{7\sqrt{3}}{48} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{7\sqrt{3}}{48} & 0 & -\frac{\sqrt{15}}{48} & 0 & -\frac{1}{16} & 0 & \frac{\sqrt{21}}{48} \\
-\frac{\sqrt{3}}{112} & 0 & -\frac{\sqrt{30}}{112} & 0 & \frac{\sqrt{15}}{16} & 0 & 0 & \frac{3\sqrt{2}}{112} & 0 & \frac{\sqrt{10}}{56} & 0 & -\frac{\sqrt{6}}{16} & 0 & 0 \\
0 & \frac{3\sqrt{5}}{112} & 0 & \frac{3\sqrt{10}}{112} & 0 & -\frac{3}{16} & \frac{\sqrt{42}}{48} & 0 & -\frac{\sqrt{2}}{28} & 0 & -\frac{\sqrt{30}}{336} & 0 & -\frac{\sqrt{6}}{24} & 0 \\
\frac{3}{16} & 0 & -\frac{3\sqrt{10}}{112} & 0 & -\frac{3\sqrt{5}}{112} & 0 & 0 & -\frac{\sqrt{6}}{24} & 0 & -\frac{\sqrt{30}}{336} & 0 & -\frac{\sqrt{2}}{28} & 0 & \frac{\sqrt{42}}{48} \\
0 & -\frac{\sqrt{15}}{16} & 0 & \frac{\sqrt{30}}{112} & 0 & \frac{\sqrt{3}}{112} & 0 & 0 & -\frac{\sqrt{6}}{16} & 0 & \frac{\sqrt{10}}{56} & 0 & \frac{3\sqrt{2}}{112} & 0
\end{bmatrix}$$

| 378 | symmetry | $-\dfrac{\sqrt{5}xz(x^2-6y^2+z^2)}{2}$ |
|---|---|---|

$$\mathbb{T}_{4,2}^{(a)}(E_g,2)$$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{48} & 0 & -\frac{i}{16} & 0 & \frac{\sqrt{15}i}{48} & 0 & \frac{7\sqrt{3}i}{48} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{7\sqrt{3}i}{48} & 0 & \frac{\sqrt{15}i}{48} & 0 & -\frac{i}{16} & 0 & -\frac{\sqrt{21}i}{48} \\
\frac{\sqrt{3}i}{112} & 0 & -\frac{\sqrt{30}i}{112} & 0 & -\frac{\sqrt{15}i}{16} & 0 & 0 & -\frac{3\sqrt{2}i}{112} & 0 & \frac{\sqrt{10}i}{56} & 0 & \frac{\sqrt{6}i}{16} & 0 & 0 \\
0 & -\frac{3\sqrt{5}i}{112} & 0 & \frac{3\sqrt{10}i}{112} & 0 & \frac{3i}{16} & \frac{\sqrt{42}i}{48} & 0 & \frac{\sqrt{2}i}{28} & 0 & -\frac{\sqrt{30}i}{336} & 0 & \frac{\sqrt{6}i}{24} & 0 \\
\frac{3i}{16} & 0 & \frac{3\sqrt{10}i}{112} & 0 & -\frac{3\sqrt{5}i}{112} & 0 & 0 & -\frac{\sqrt{6}i}{24} & 0 & \frac{\sqrt{30}i}{336} & 0 & -\frac{\sqrt{2}i}{28} & 0 & -\frac{\sqrt{42}i}{48} \\
0 & -\frac{\sqrt{15}i}{16} & 0 & -\frac{\sqrt{30}i}{112} & 0 & \frac{\sqrt{3}i}{112} & 0 & 0 & -\frac{\sqrt{6}i}{16} & 0 & -\frac{\sqrt{10}i}{56} & 0 & \frac{3\sqrt{2}i}{112} & 0
\end{bmatrix}$$

| 379 | symmetry | $\dfrac{\sqrt{21}(x^4-3x^2y^2-3x^2z^2+y^4-3y^2z^2+z^4)}{6}$ |
|---|---|---|

$$\mathbb{T}_{4}^{(1,-1;a)}(A_{1g},1)$$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{24} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{24} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{24} & 0 & 0 & 0 & \frac{\sqrt{21}i}{24} & 0 & 0 & 0 \\
0 & \frac{\sqrt{21}i}{168} & 0 & 0 & 0 & \frac{\sqrt{105}i}{168} & 0 & 0 & \frac{\sqrt{210}i}{56} & 0 & 0 & 0 & \frac{\sqrt{70}i}{56} & 0 \\
0 & 0 & -\frac{\sqrt{14}i}{56} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{42}i}{168} & 0 & 0 & 0 & \frac{\sqrt{30}i}{24} \\
0 & 0 & 0 & \frac{\sqrt{14}i}{56} & 0 & 0 & \frac{\sqrt{30}i}{24} & 0 & 0 & 0 & -\frac{5\sqrt{42}i}{168} & 0 & 0 & 0 \\
-\frac{\sqrt{105}i}{168} & 0 & 0 & 0 & -\frac{\sqrt{21}i}{168} & 0 & 0 & \frac{\sqrt{70}i}{56} & 0 & 0 & 0 & \frac{\sqrt{210}i}{56} & 0 & 0
\end{bmatrix}$$

| 380 | symmetry | $-\dfrac{\sqrt{15}(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4)}{12}$ |
|---|---|---|

Table 7

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_4^{(1,-1;a)}(A_{1g},2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{24} & 0 & 0 & 0 & \frac{\sqrt{21}i}{24} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{24} & 0 & 0 & 0 & \frac{\sqrt{15}i}{24} & 0 & 0 & 0 \\
0 & \frac{\sqrt{15}i}{168} & 0 & 0 & 0 & -\frac{\sqrt{3}i}{24} & 0 & 0 & \frac{5\sqrt{6}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{2}i}{8} & 0 \\
0 & 0 & -\frac{\sqrt{10}i}{56} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{30}i}{168} & 0 & 0 & 0 & -\frac{\sqrt{42}i}{24} \\
0 & 0 & 0 & \frac{\sqrt{10}i}{56} & 0 & 0 & -\frac{\sqrt{42}i}{24} & 0 & 0 & 0 & -\frac{5\sqrt{30}i}{168} & 0 & 0 & 0 \\
\frac{\sqrt{3}i}{24} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{168} & 0 & 0 & -\frac{\sqrt{2}i}{8} & 0 & 0 & 0 & \frac{5\sqrt{6}i}{56} & 0 & 0 \\
\end{bmatrix}$$

**381** symmetry

$$\frac{\sqrt{35}xy(x-y)(x+y)}{2}$$

$\mathbb{T}_4^{(1,-1;a)}(A_{2g})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{4} \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{28} & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{28} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{4} \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{4} & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{7}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}}{28} & 0 & 0 & 0 & 0 & 0 & 0 \\
\end{bmatrix}$$

**382** symmetry

$$\frac{\sqrt{5}(x-y)(x+y)\left(x^2+y^2-6z^2\right)}{4}$$

$\mathbb{T}_4^{(1,-1;a)}(B_{1g})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{i}{8} & 0 & 0 & 0 & \frac{\sqrt{3}i}{8} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{8} & 0 & 0 & 0 & -\frac{i}{8} & 0 \\
0 & 0 & 0 & -\frac{\sqrt{10}i}{56} & 0 & 0 & -\frac{\sqrt{42}i}{56} & 0 & 0 & 0 & -\frac{3\sqrt{30}i}{56} & 0 & 0 & 0 \\
\frac{\sqrt{3}i}{56} & 0 & 0 & 0 & \frac{\sqrt{15}i}{56} & 0 & 0 & \frac{11\sqrt{2}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{6}i}{56} & 0 & 0 \\
0 & -\frac{\sqrt{15}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{3}i}{56} & 0 & 0 & -\frac{\sqrt{6}i}{56} & 0 & 0 & 0 & \frac{11\sqrt{2}i}{56} & 0 \\
0 & 0 & \frac{\sqrt{10}i}{56} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{30}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{42}i}{56} \\
\end{bmatrix}$$

**383** symmetry

$$-\frac{\sqrt{5}xy\left(x^2+y^2-6z^2\right)}{2}$$

$\mathbb{T}_4^{(1,-1;a)}(B_{2g})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{8} & 0 & 0 & 0 & -\frac{\sqrt{3}}{8} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{8} & 0 & 0 & 0 & \frac{1}{8} & 0 \\
0 & 0 & 0 & \frac{\sqrt{10}}{56} & 0 & 0 & -\frac{\sqrt{42}}{56} & 0 & 0 & 0 & \frac{3\sqrt{30}}{56} & 0 & 0 & 0 \\
\frac{\sqrt{3}}{56} & 0 & 0 & 0 & -\frac{\sqrt{15}}{56} & 0 & 0 & \frac{11\sqrt{2}}{56} & 0 & 0 & 0 & \frac{\sqrt{6}}{56} & 0 & 0 \\
0 & -\frac{\sqrt{15}}{56} & 0 & 0 & 0 & \frac{\sqrt{3}}{56} & 0 & 0 & -\frac{\sqrt{6}}{56} & 0 & 0 & 0 & -\frac{11\sqrt{2}}{56} & 0 \\
0 & 0 & \frac{\sqrt{10}}{56} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{30}}{56} & 0 & 0 & 0 & \frac{\sqrt{42}}{56} \\
\end{bmatrix}$$

**384** symmetry

$$\frac{\sqrt{35}yz(y-z)(y+z)}{2}$$

*continued ...*

Table 7

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_{4,1}^{(1,-1;a)}(E_g,1)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{32} & 0 & \frac{\sqrt{21}}{32} & 0 & \frac{\sqrt{35}}{32} & 0 & \frac{\sqrt{7}}{32} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{32} & 0 & -\frac{\sqrt{35}}{32} & 0 & -\frac{\sqrt{21}}{32} & 0 & -\frac{1}{32} \\
-\frac{\sqrt{7}}{224} & 0 & -\frac{\sqrt{70}}{224} & 0 & -\frac{\sqrt{35}}{224} & 0 & 0 & -\frac{3\sqrt{42}}{112} & 0 & -\frac{\sqrt{210}}{56} & 0 & -\frac{3\sqrt{14}}{112} & 0 & 0 \\
0 & \frac{\sqrt{105}}{224} & 0 & \frac{\sqrt{210}}{224} & 0 & \frac{\sqrt{21}}{224} & \frac{\sqrt{2}}{16} & 0 & \frac{\sqrt{42}}{28} & 0 & \frac{\sqrt{70}}{112} & 0 & -\frac{\sqrt{14}}{56} & 0 \\
-\frac{\sqrt{21}}{224} & 0 & -\frac{\sqrt{210}}{224} & 0 & -\frac{\sqrt{105}}{224} & 0 & 0 & -\frac{\sqrt{14}}{56} & 0 & \frac{\sqrt{70}}{112} & 0 & \frac{\sqrt{42}}{28} & 0 & \frac{\sqrt{2}}{16} \\
0 & \frac{\sqrt{35}}{224} & 0 & \frac{\sqrt{70}}{224} & 0 & \frac{\sqrt{7}}{224} & 0 & 0 & -\frac{3\sqrt{14}}{112} & 0 & -\frac{\sqrt{210}}{56} & 0 & -\frac{3\sqrt{42}}{112} & 0
\end{pmatrix}$$

**385  symmetry**
$$\frac{\sqrt{35}xz(x-z)(x+z)}{2}$$

$\mathbb{T}_{4,2}^{(1,-1;a)}(E_g,1)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{i}{32} & 0 & -\frac{\sqrt{21}i}{32} & 0 & \frac{\sqrt{35}i}{32} & 0 & -\frac{\sqrt{7}i}{32} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{32} & 0 & \frac{\sqrt{35}i}{32} & 0 & -\frac{\sqrt{21}i}{32} & 0 & \frac{i}{32} \\
\frac{\sqrt{7}i}{224} & 0 & -\frac{\sqrt{70}i}{224} & 0 & \frac{\sqrt{35}i}{224} & 0 & 0 & \frac{3\sqrt{42}i}{112} & 0 & -\frac{\sqrt{210}i}{56} & 0 & \frac{3\sqrt{14}i}{112} & 0 & 0 \\
0 & -\frac{\sqrt{105}i}{224} & 0 & \frac{\sqrt{210}i}{224} & 0 & -\frac{\sqrt{21}i}{224} & \frac{\sqrt{2}i}{16} & 0 & -\frac{\sqrt{42}i}{28} & 0 & \frac{\sqrt{70}i}{112} & 0 & \frac{\sqrt{14}i}{56} & 0 \\
-\frac{\sqrt{21}i}{224} & 0 & \frac{\sqrt{210}i}{224} & 0 & -\frac{\sqrt{105}i}{224} & 0 & 0 & -\frac{\sqrt{14}i}{56} & 0 & -\frac{\sqrt{70}i}{112} & 0 & \frac{\sqrt{42}i}{28} & 0 & -\frac{\sqrt{2}i}{16} \\
0 & \frac{\sqrt{35}i}{224} & 0 & -\frac{\sqrt{70}i}{224} & 0 & \frac{\sqrt{7}i}{224} & 0 & 0 & -\frac{3\sqrt{14}i}{112} & 0 & \frac{\sqrt{210}i}{56} & 0 & -\frac{3\sqrt{42}i}{112} & 0
\end{pmatrix}$$

**386  symmetry**
$$\frac{\sqrt{5}yz\left(6x^2-y^2-z^2\right)}{2}$$

$\mathbb{T}_{4,1}^{(1,-1;a)}(E_g,2)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{32} & 0 & \frac{\sqrt{3}}{32} & 0 & \frac{\sqrt{5}}{32} & 0 & -\frac{7}{32} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{7}{32} & 0 & -\frac{\sqrt{5}}{32} & 0 & -\frac{\sqrt{3}}{32} & 0 & \frac{\sqrt{7}}{32} \\
-\frac{1}{224} & 0 & -\frac{\sqrt{10}}{224} & 0 & \frac{\sqrt{5}}{32} & 0 & 0 & -\frac{3\sqrt{6}}{112} & 0 & -\frac{\sqrt{30}}{56} & 0 & \frac{3\sqrt{2}}{16} & 0 & 0 \\
0 & \frac{\sqrt{15}}{224} & 0 & \frac{\sqrt{30}}{224} & 0 & -\frac{\sqrt{3}}{32} & -\frac{\sqrt{14}}{16} & 0 & \frac{\sqrt{6}}{28} & 0 & \frac{\sqrt{10}}{112} & 0 & \frac{\sqrt{2}}{8} & 0 \\
\frac{\sqrt{3}}{32} & 0 & -\frac{\sqrt{30}}{224} & 0 & -\frac{\sqrt{15}}{224} & 0 & 0 & \frac{\sqrt{2}}{8} & 0 & \frac{\sqrt{10}}{112} & 0 & \frac{\sqrt{6}}{28} & 0 & -\frac{\sqrt{14}}{16} \\
0 & -\frac{\sqrt{5}}{32} & 0 & \frac{\sqrt{10}}{224} & 0 & \frac{1}{224} & 0 & 0 & \frac{3\sqrt{2}}{16} & 0 & -\frac{\sqrt{30}}{56} & 0 & -\frac{3\sqrt{6}}{112} & 0
\end{pmatrix}$$

**387  symmetry**
$$-\frac{\sqrt{5}xz\left(x^2-6y^2+z^2\right)}{2}$$

$\mathbb{T}_{4,2}^{(1,-1;a)}(E_g,2)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{32} & 0 & -\frac{\sqrt{3}i}{32} & 0 & \frac{\sqrt{5}i}{32} & 0 & \frac{7i}{32} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{7i}{32} & 0 & \frac{\sqrt{5}i}{32} & 0 & -\frac{\sqrt{3}i}{32} & 0 & -\frac{\sqrt{7}i}{32} \\
\frac{i}{224} & 0 & -\frac{\sqrt{10}i}{224} & 0 & -\frac{\sqrt{5}i}{32} & 0 & 0 & \frac{3\sqrt{6}i}{112} & 0 & -\frac{\sqrt{30}i}{56} & 0 & -\frac{3\sqrt{2}i}{16} & 0 & 0 \\
0 & -\frac{\sqrt{15}i}{224} & 0 & \frac{\sqrt{30}i}{224} & 0 & \frac{\sqrt{3}i}{32} & -\frac{\sqrt{14}i}{16} & 0 & -\frac{\sqrt{6}i}{28} & 0 & \frac{\sqrt{10}i}{112} & 0 & -\frac{\sqrt{2}i}{8} & 0 \\
\frac{\sqrt{3}i}{32} & 0 & \frac{\sqrt{30}i}{224} & 0 & -\frac{\sqrt{15}i}{224} & 0 & 0 & \frac{\sqrt{2}i}{8} & 0 & -\frac{\sqrt{10}i}{112} & 0 & \frac{\sqrt{6}i}{28} & 0 & \frac{\sqrt{14}i}{16} \\
0 & -\frac{\sqrt{5}i}{32} & 0 & -\frac{\sqrt{10}i}{224} & 0 & \frac{i}{224} & 0 & 0 & \frac{3\sqrt{2}i}{16} & 0 & \frac{\sqrt{30}i}{56} & 0 & -\frac{3\sqrt{6}i}{112} & 0
\end{pmatrix}$$

**388  symmetry**
$$-\frac{x^2}{2}-\frac{y^2}{2}+z^2$$

*continued ...*

Table 7

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{T}_2^{(1,0;a)}(A_{1g})$ | $\begin{bmatrix} 0 & 0 & \frac{\sqrt{2}i}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{2}i}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{5\sqrt{6}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{21} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{5i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{7} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{5i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{7} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{5\sqrt{6}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{21} & 0 & 0 \end{bmatrix}$ |
| 389 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |
| | $\mathbb{T}_2^{(1,0;a)}(B_{1g})$ | $\begin{bmatrix} \frac{\sqrt{15}i}{18} & 0 & 0 & 0 & \frac{\sqrt{3}i}{18} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{3}i}{18} & 0 & 0 & 0 & \frac{\sqrt{15}i}{18} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{5i}{42} & 0 & 0 & -\frac{\sqrt{105}i}{42} & 0 & 0 & 0 & -\frac{\sqrt{3}i}{42} & 0 & 0 & 0 \\ \frac{5\sqrt{30}i}{126} & 0 & 0 & 0 & -\frac{5\sqrt{6}i}{63} & 0 & 0 & -\frac{\sqrt{5}i}{14} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{42} & 0 & 0 \\ 0 & \frac{5\sqrt{6}i}{63} & 0 & 0 & 0 & -\frac{5\sqrt{30}i}{126} & 0 & 0 & -\frac{\sqrt{15}i}{42} & 0 & 0 & 0 & -\frac{\sqrt{5}i}{14} & 0 \\ 0 & 0 & \frac{5i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{42} & 0 & 0 & 0 & -\frac{\sqrt{105}i}{42} \end{bmatrix}$ |
| 390 | symmetry | $\sqrt{3}xy$ |
| | $\mathbb{T}_2^{(1,0;a)}(B_{2g})$ | $\begin{bmatrix} -\frac{\sqrt{15}}{18} & 0 & 0 & 0 & \frac{\sqrt{3}}{18} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{3}}{18} & 0 & 0 & 0 & \frac{\sqrt{15}}{18} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{5}{42} & 0 & 0 & \frac{\sqrt{105}}{42} & 0 & 0 & 0 & -\frac{\sqrt{3}}{42} & 0 & 0 & 0 \\ -\frac{5\sqrt{30}}{126} & 0 & 0 & 0 & -\frac{5\sqrt{6}}{63} & 0 & 0 & \frac{\sqrt{5}}{14} & 0 & 0 & 0 & -\frac{\sqrt{15}}{42} & 0 & 0 \\ 0 & -\frac{5\sqrt{6}}{63} & 0 & 0 & 0 & -\frac{5\sqrt{30}}{126} & 0 & 0 & \frac{\sqrt{15}}{42} & 0 & 0 & 0 & -\frac{\sqrt{5}}{14} & 0 \\ 0 & 0 & -\frac{5}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{42} & 0 & 0 & 0 & -\frac{\sqrt{105}}{42} \end{bmatrix}$ |
| 391 | symmetry | $\sqrt{3}yz$ |
| | $\mathbb{T}_{2,1}^{(1,0;a)}(E_g)$ | $\begin{bmatrix} 0 & \frac{\sqrt{3}}{9} & 0 & \frac{\sqrt{6}}{18} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{6}}{18} & 0 & \frac{\sqrt{3}}{9} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ -\frac{5\sqrt{10}}{84} & 0 & -\frac{5}{28} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{21} & 0 & -\frac{\sqrt{3}}{21} & 0 & 0 & 0 & 0 \\ 0 & \frac{5\sqrt{6}}{252} & 0 & -\frac{25\sqrt{3}}{252} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{21} & 0 & -\frac{1}{7} & 0 & 0 & 0 \\ 0 & 0 & \frac{25\sqrt{3}}{252} & 0 & -\frac{5\sqrt{6}}{252} & 0 & 0 & 0 & 0 & -\frac{1}{7} & 0 & -\frac{\sqrt{15}}{21} & 0 & 0 \\ 0 & 0 & 0 & \frac{5}{28} & 0 & \frac{5\sqrt{10}}{84} & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{21} & 0 & -\frac{\sqrt{15}}{21} & 0 \end{bmatrix}$ |
| 392 | symmetry | $\sqrt{3}xz$ |

*continued ...*

Table 7

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{T}_{2,2}^{(1,0;a)}(E_g)$ | $\begin{bmatrix} 0 & -\frac{\sqrt{3}i}{9} & 0 & \frac{\sqrt{6}i}{18} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{6}i}{18} & 0 & \frac{\sqrt{3}i}{9} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \frac{5\sqrt{10}i}{84} & 0 & -\frac{5i}{28} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{21} & 0 & -\frac{\sqrt{3}i}{21} & 0 & 0 & 0 & 0 \\ 0 & -\frac{5\sqrt{6}i}{252} & 0 & -\frac{25\sqrt{3}i}{252} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{21} & 0 & -\frac{i}{7} & 0 & 0 & 0 \\ 0 & 0 & -\frac{25\sqrt{3}i}{252} & 0 & -\frac{5\sqrt{6}i}{252} & 0 & 0 & 0 & 0 & \frac{i}{7} & 0 & -\frac{\sqrt{15}i}{21} & 0 & 0 \\ 0 & 0 & 0 & -\frac{5i}{28} & 0 & \frac{5\sqrt{10}i}{84} & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{21} & 0 & -\frac{\sqrt{15}i}{21} & 0 \end{bmatrix}$ |
| 393 | symmetry | $\dfrac{\sqrt{21}\left(x^4-3x^2y^2-3x^2z^2+y^4-3y^2z^2+z^4\right)}{6}$ |
| | $\mathbb{T}_4^{(1,0;a)}(A_{1g},1)$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{35}i}{24} & 0 & 0 & 0 & \frac{5i}{24} \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5i}{24} & 0 & 0 & 0 & -\frac{\sqrt{35}i}{24} & 0 & 0 & 0 \\ 0 & \frac{\sqrt{35}i}{56} & 0 & 0 & 0 & \frac{5\sqrt{7}i}{56} & 0 & 0 & \frac{\sqrt{14}i}{56} & 0 & 0 & 0 & \frac{\sqrt{42}i}{168} & 0 \\ 0 & 0 & -\frac{\sqrt{210}i}{56} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{168} & 0 & 0 & 0 & \frac{\sqrt{2}i}{24} \\ 0 & 0 & 0 & \frac{\sqrt{210}i}{56} & 0 & 0 & \frac{\sqrt{2}i}{24} & 0 & 0 & 0 & -\frac{\sqrt{70}i}{168} & 0 & 0 & 0 \\ -\frac{5\sqrt{7}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{35}i}{56} & 0 & 0 & \frac{\sqrt{42}i}{168} & 0 & 0 & 0 & \frac{\sqrt{14}i}{56} & 0 & 0 \end{bmatrix}$ |
| 394 | symmetry | $-\dfrac{\sqrt{15}\left(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4\right)}{12}$ |
| | $\mathbb{T}_4^{(1,0;a)}(A_{1g},2)$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5i}{24} & 0 & 0 & 0 & -\frac{\sqrt{35}i}{24} \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{35}i}{24} & 0 & 0 & 0 & -\frac{5i}{24} & 0 & 0 & 0 \\ 0 & \frac{5i}{56} & 0 & 0 & 0 & -\frac{\sqrt{5}i}{8} & 0 & 0 & \frac{\sqrt{10}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{120} & 0 \\ 0 & 0 & -\frac{5\sqrt{6}i}{56} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{2}i}{168} & 0 & 0 & 0 & -\frac{\sqrt{70}i}{120} \\ 0 & 0 & 0 & \frac{5\sqrt{6}i}{56} & 0 & 0 & -\frac{\sqrt{70}i}{120} & 0 & 0 & 0 & -\frac{5\sqrt{2}i}{168} & 0 & 0 & 0 \\ \frac{\sqrt{5}i}{8} & 0 & 0 & 0 & -\frac{5i}{56} & 0 & 0 & -\frac{\sqrt{30}i}{120} & 0 & 0 & 0 & \frac{\sqrt{10}i}{56} & 0 & 0 \end{bmatrix}$ |
| 395 | symmetry | $\dfrac{\sqrt{35}xy(x-y)(x+y)}{2}$ |
| | $\mathbb{T}_4^{(1,0;a)}(A_{2g})$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{12} \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{140} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{60} \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{60} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \frac{\sqrt{105}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{140} & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$ |
| 396 | symmetry | $\dfrac{\sqrt{5}(x-y)(x+y)\left(x^2+y^2-6z^2\right)}{4}$ |

*continued …*

Table 7

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{T}_4^{(1,0;a)}(B_{1g}) = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{24} & 0 & 0 & 0 & -\frac{\sqrt{5}i}{8} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}i}{8} & 0 & 0 & 0 & \frac{\sqrt{15}i}{24} & 0 \\ 0 & 0 & 0 & -\frac{5\sqrt{6}i}{56} & 0 & 0 & -\frac{\sqrt{70}i}{280} & 0 & 0 & 0 & -\frac{3\sqrt{2}i}{56} & 0 & 0 & 0 \\ \frac{3\sqrt{5}i}{56} & 0 & 0 & 0 & \frac{15i}{56} & 0 & 0 & \frac{11\sqrt{30}i}{840} & 0 & 0 & 0 & -\frac{\sqrt{10}i}{280} & 0 & 0 \\ 0 & -\frac{15i}{56} & 0 & 0 & 0 & -\frac{3\sqrt{5}i}{56} & 0 & 0 & -\frac{\sqrt{10}i}{280} & 0 & 0 & 0 & \frac{11\sqrt{30}i}{840} & 0 \\ 0 & 0 & \frac{5\sqrt{6}i}{56} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{2}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{70}i}{280} \end{bmatrix}$$

**397**    symmetry    $-\frac{\sqrt{5}xy(x^2+y^2-6z^2)}{2}$

$$\mathbb{T}_4^{(1,0;a)}(B_{2g}) = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{24} & 0 & 0 & 0 & \frac{\sqrt{5}}{8} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{8} & 0 & 0 & 0 & -\frac{\sqrt{15}}{24} & 0 \\ 0 & 0 & 0 & \frac{5\sqrt{6}}{56} & 0 & 0 & -\frac{\sqrt{70}}{280} & 0 & 0 & 0 & \frac{3\sqrt{2}}{56} & 0 & 0 & 0 \\ \frac{3\sqrt{5}}{56} & 0 & 0 & 0 & -\frac{15}{56} & 0 & 0 & \frac{11\sqrt{30}}{840} & 0 & 0 & 0 & \frac{\sqrt{10}}{280} & 0 & 0 \\ 0 & -\frac{15}{56} & 0 & 0 & 0 & \frac{3\sqrt{5}}{56} & 0 & 0 & -\frac{\sqrt{10}}{280} & 0 & 0 & 0 & -\frac{11\sqrt{30}}{840} & 0 \\ 0 & 0 & \frac{5\sqrt{6}}{56} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{2}}{56} & 0 & 0 & 0 & \frac{\sqrt{70}}{280} \end{bmatrix}$$

**398**    symmetry    $\frac{\sqrt{35}yz(y-z)(y+z)}{2}$

$$\mathbb{T}_{4,1}^{(1,0;a)}(E_g,1) = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{96} & 0 & -\frac{\sqrt{35}}{32} & 0 & -\frac{5\sqrt{21}}{96} & 0 & -\frac{\sqrt{105}}{96} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}}{96} & 0 & \frac{5\sqrt{21}}{96} & 0 & \frac{\sqrt{35}}{32} & 0 & \frac{\sqrt{15}}{96} \\ -\frac{\sqrt{105}}{224} & 0 & -\frac{5\sqrt{42}}{224} & 0 & -\frac{5\sqrt{21}}{224} & 0 & 0 & -\frac{3\sqrt{70}}{560} & 0 & -\frac{\sqrt{14}}{56} & 0 & -\frac{\sqrt{210}}{560} & 0 & 0 \\ 0 & \frac{15\sqrt{7}}{224} & 0 & \frac{15\sqrt{14}}{224} & 0 & \frac{3\sqrt{35}}{224} & \frac{\sqrt{30}}{240} & 0 & \frac{\sqrt{70}}{140} & 0 & \frac{\sqrt{42}}{336} & 0 & -\frac{\sqrt{210}}{840} & 0 \\ -\frac{3\sqrt{35}}{224} & 0 & -\frac{15\sqrt{14}}{224} & 0 & -\frac{15\sqrt{7}}{224} & 0 & 0 & -\frac{\sqrt{210}}{840} & 0 & \frac{\sqrt{42}}{336} & 0 & \frac{\sqrt{70}}{140} & 0 & \frac{\sqrt{30}}{240} \\ 0 & \frac{5\sqrt{21}}{224} & 0 & \frac{5\sqrt{42}}{224} & 0 & \frac{\sqrt{105}}{224} & 0 & 0 & -\frac{\sqrt{210}}{560} & 0 & -\frac{\sqrt{14}}{56} & 0 & -\frac{3\sqrt{70}}{560} & 0 \end{bmatrix}$$

**399**    symmetry    $\frac{\sqrt{35}xz(x-z)(x+z)}{2}$

$$\mathbb{T}_{4,2}^{(1,0;a)}(E_g,1) = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{96} & 0 & \frac{\sqrt{35}i}{32} & 0 & -\frac{5\sqrt{21}i}{96} & 0 & \frac{\sqrt{105}i}{96} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}i}{96} & 0 & -\frac{5\sqrt{21}i}{96} & 0 & \frac{\sqrt{35}i}{32} & 0 & -\frac{\sqrt{15}i}{96} \\ \frac{\sqrt{105}i}{224} & 0 & -\frac{5\sqrt{42}i}{224} & 0 & \frac{5\sqrt{21}i}{224} & 0 & 0 & \frac{3\sqrt{70}i}{560} & 0 & -\frac{\sqrt{14}i}{56} & 0 & \frac{\sqrt{210}i}{560} & 0 & 0 \\ 0 & -\frac{15\sqrt{7}i}{224} & 0 & \frac{15\sqrt{14}i}{224} & 0 & -\frac{3\sqrt{35}i}{224} & \frac{\sqrt{30}i}{240} & 0 & -\frac{\sqrt{70}i}{140} & 0 & \frac{\sqrt{42}i}{336} & 0 & \frac{\sqrt{210}i}{840} & 0 \\ -\frac{3\sqrt{35}i}{224} & 0 & \frac{15\sqrt{14}i}{224} & 0 & -\frac{15\sqrt{7}i}{224} & 0 & 0 & -\frac{\sqrt{210}i}{840} & 0 & -\frac{\sqrt{42}i}{336} & 0 & \frac{\sqrt{70}i}{140} & 0 & -\frac{\sqrt{30}i}{240} \\ 0 & \frac{5\sqrt{21}i}{224} & 0 & -\frac{5\sqrt{42}i}{224} & 0 & \frac{\sqrt{105}i}{224} & 0 & 0 & -\frac{\sqrt{210}i}{560} & 0 & \frac{\sqrt{14}i}{56} & 0 & -\frac{3\sqrt{70}i}{560} & 0 \end{bmatrix}$$

**400**    symmetry    $\frac{\sqrt{5}yz(6x^2-y^2-z^2)}{2}$

Table 7

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_{4,1}^{(1,0;a)}(E_g,2)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}}{96} & 0 & -\frac{\sqrt{5}}{32} & 0 & -\frac{5\sqrt{3}}{96} & 0 & \frac{7\sqrt{15}}{96} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{7\sqrt{15}}{96} & 0 & \frac{5\sqrt{3}}{96} & 0 & \frac{\sqrt{5}}{32} & 0 & -\frac{\sqrt{105}}{96} \\
-\frac{\sqrt{15}}{224} & 0 & -\frac{5\sqrt{6}}{224} & 0 & \frac{5\sqrt{3}}{32} & 0 & 0 & -\frac{3\sqrt{10}}{560} & 0 & -\frac{\sqrt{2}}{56} & 0 & \frac{\sqrt{30}}{80} & 0 & 0 \\
0 & \frac{15}{224} & 0 & \frac{15\sqrt{2}}{224} & 0 & -\frac{3\sqrt{5}}{32} & -\frac{\sqrt{210}}{240} & 0 & \frac{\sqrt{10}}{140} & 0 & \frac{\sqrt{6}}{336} & 0 & \frac{\sqrt{30}}{120} & 0 \\
\frac{3\sqrt{5}}{32} & 0 & -\frac{15\sqrt{2}}{224} & 0 & -\frac{15}{224} & 0 & 0 & \frac{\sqrt{30}}{120} & 0 & \frac{\sqrt{6}}{336} & 0 & \frac{\sqrt{10}}{140} & 0 & -\frac{\sqrt{210}}{240} \\
0 & -\frac{5\sqrt{3}}{32} & 0 & \frac{5\sqrt{6}}{224} & 0 & \frac{\sqrt{15}}{224} & 0 & 0 & \frac{\sqrt{30}}{80} & 0 & -\frac{\sqrt{2}}{56} & 0 & -\frac{3\sqrt{10}}{560} & 0
\end{pmatrix}$$

| 401 | symmetry | $-\dfrac{\sqrt{5}xz(x^2-6y^2+z^2)}{2}$ |

$\mathbb{T}_{4,2}^{(1,0;a)}(E_g,2)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}i}{96} & 0 & \frac{\sqrt{5}i}{32} & 0 & -\frac{5\sqrt{3}i}{96} & 0 & -\frac{7\sqrt{15}i}{96} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{7\sqrt{15}i}{96} & 0 & -\frac{5\sqrt{3}i}{96} & 0 & \frac{\sqrt{5}i}{32} & 0 & \frac{\sqrt{105}i}{96} \\
\frac{\sqrt{15}i}{224} & 0 & -\frac{5\sqrt{6}i}{224} & 0 & -\frac{5\sqrt{3}i}{32} & 0 & 0 & \frac{3\sqrt{10}i}{560} & 0 & -\frac{\sqrt{2}i}{56} & 0 & -\frac{\sqrt{30}i}{80} & 0 & 0 \\
0 & -\frac{15i}{224} & 0 & \frac{15\sqrt{2}i}{224} & 0 & \frac{3\sqrt{5}i}{32} & -\frac{\sqrt{210}i}{240} & 0 & -\frac{\sqrt{10}i}{140} & 0 & \frac{\sqrt{6}i}{336} & 0 & -\frac{\sqrt{30}i}{120} & 0 \\
\frac{3\sqrt{5}i}{32} & 0 & \frac{15\sqrt{2}i}{224} & 0 & -\frac{15i}{224} & 0 & 0 & \frac{\sqrt{30}i}{120} & 0 & -\frac{\sqrt{6}i}{336} & 0 & \frac{\sqrt{10}i}{140} & 0 & \frac{\sqrt{210}i}{240} \\
0 & -\frac{5\sqrt{3}i}{32} & 0 & -\frac{5\sqrt{6}i}{224} & 0 & \frac{\sqrt{15}i}{224} & 0 & 0 & \frac{\sqrt{30}i}{80} & 0 & \frac{\sqrt{2}i}{56} & 0 & -\frac{3\sqrt{10}i}{560} & 0
\end{pmatrix}$$

| 402 | symmetry | $-\dfrac{x^2}{2}-\dfrac{y^2}{2}+z^2$ |

$\mathbb{T}_{2}^{(1,1;a)}(A_{1g})$

$$\begin{pmatrix}
0 & 0 & -\frac{i}{3} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{i}{3} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{4\sqrt{3}i}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{84} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{2\sqrt{2}i}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{28} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{2\sqrt{2}i}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{28} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{4\sqrt{3}i}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{84} & 0 & 0
\end{pmatrix}$$

| 403 | symmetry | $\dfrac{\sqrt{3}(x-y)(x+y)}{2}$ |

$\mathbb{T}_{2}^{(1,1;a)}(B_{1g})$

$$\begin{pmatrix}
-\frac{\sqrt{30}i}{18} & 0 & 0 & 0 & -\frac{\sqrt{6}i}{18} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{6}i}{18} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{18} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{2\sqrt{2}i}{21} & 0 & 0 & \frac{\sqrt{210}i}{168} & 0 & 0 & 0 & \frac{\sqrt{6}i}{168} & 0 & 0 & 0 \\
\frac{4\sqrt{15}i}{63} & 0 & 0 & 0 & -\frac{8\sqrt{3}i}{63} & 0 & 0 & \frac{\sqrt{10}i}{56} & 0 & 0 & 0 & \frac{\sqrt{30}i}{168} & 0 & 0 \\
0 & \frac{8\sqrt{3}i}{63} & 0 & 0 & 0 & -\frac{4\sqrt{15}i}{63} & 0 & 0 & \frac{\sqrt{30}i}{168} & 0 & 0 & 0 & \frac{\sqrt{10}i}{56} & 0 \\
0 & 0 & \frac{2\sqrt{2}i}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{168} & 0 & 0 & 0 & \frac{\sqrt{210}i}{168}
\end{pmatrix}$$

| 404 | symmetry | $\sqrt{3}xy$ |

*continued ...*

Table 7

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{T}_2^{(1,1;a)}(B_{2g})$$

$$\begin{bmatrix}
\frac{\sqrt{30}}{18} & 0 & 0 & 0 & -\frac{\sqrt{6}}{18} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{6}}{18} & 0 & 0 & 0 & -\frac{\sqrt{30}}{18} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{2\sqrt{2}}{21} & 0 & 0 & -\frac{\sqrt{210}}{168} & 0 & 0 & 0 & \frac{\sqrt{6}}{168} & 0 & 0 & 0 \\
-\frac{4\sqrt{15}}{63} & 0 & 0 & 0 & -\frac{8\sqrt{3}}{63} & 0 & 0 & -\frac{\sqrt{10}}{56} & 0 & 0 & 0 & \frac{\sqrt{30}}{168} & 0 & 0 \\
0 & -\frac{8\sqrt{3}}{63} & 0 & 0 & 0 & -\frac{4\sqrt{15}}{63} & 0 & 0 & -\frac{\sqrt{30}}{168} & 0 & 0 & 0 & \frac{\sqrt{10}}{56} & 0 \\
0 & 0 & -\frac{2\sqrt{2}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{168} & 0 & 0 & 0 & \frac{\sqrt{210}}{168}
\end{bmatrix}$$

| 405 | symmetry | $\sqrt{3}yz$ |
|---|---|---|

$$\mathbb{T}_{2,1}^{(1,1;a)}(E_g)$$

$$\begin{bmatrix}
0 & -\frac{\sqrt{6}}{9} & 0 & -\frac{\sqrt{3}}{9} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{3}}{9} & 0 & -\frac{\sqrt{6}}{9} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{2\sqrt{5}}{21} & 0 & -\frac{\sqrt{2}}{7} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{84} & 0 & \frac{\sqrt{6}}{84} & 0 & 0 & 0 & 0 \\
0 & \frac{2\sqrt{3}}{63} & 0 & -\frac{5\sqrt{6}}{63} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{84} & 0 & \frac{\sqrt{2}}{28} & 0 & 0 & 0 \\
0 & 0 & \frac{5\sqrt{6}}{63} & 0 & -\frac{2\sqrt{3}}{63} & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{28} & 0 & \frac{\sqrt{30}}{84} & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{2}}{7} & 0 & \frac{2\sqrt{5}}{21} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{84} & 0 & \frac{\sqrt{30}}{84} & 0
\end{bmatrix}$$

| 406 | symmetry | $\sqrt{3}xz$ |
|---|---|---|

$$\mathbb{T}_{2,2}^{(1,1;a)}(E_g)$$

$$\begin{bmatrix}
0 & \frac{\sqrt{6}i}{9} & 0 & -\frac{\sqrt{3}i}{9} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{3}i}{9} & 0 & -\frac{\sqrt{6}i}{9} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{2\sqrt{5}i}{21} & 0 & -\frac{\sqrt{2}i}{7} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{84} & 0 & \frac{\sqrt{6}i}{84} & 0 & 0 & 0 & 0 \\
0 & -\frac{2\sqrt{3}i}{63} & 0 & -\frac{5\sqrt{6}i}{63} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{84} & 0 & \frac{\sqrt{2}i}{28} & 0 & 0 & 0 \\
0 & 0 & -\frac{5\sqrt{6}i}{63} & 0 & -\frac{2\sqrt{3}i}{63} & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{28} & 0 & \frac{\sqrt{30}i}{84} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{2}i}{7} & 0 & \frac{2\sqrt{5}i}{21} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{84} & 0 & \frac{\sqrt{30}i}{84} & 0
\end{bmatrix}$$

| 407 | symmetry | $-\frac{z\left(3x^2+3y^2-2z^2\right)}{2}$ |
|---|---|---|

$$\mathbb{M}_3^{(a)}(A_{2g})$$

$$\begin{bmatrix}
0 & 0 & \frac{\sqrt{21}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{14} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{21}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{14} & 0 & 0 & 0 \\
0 & -\frac{\sqrt{7}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{28} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{42}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{28} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{42}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{28} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{28} & 0 & 0
\end{bmatrix}$$

| 408 | symmetry | $\sqrt{15}xyz$ |
|---|---|---|

*continued ...*

Table 7

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_3^{(a)}(B_{1g}) = \begin{bmatrix}
\frac{\sqrt{14}i}{42} & 0 & 0 & 0 & -\frac{\sqrt{70}i}{42} & 0 & 0 & \frac{\sqrt{21}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{7}i}{28} & 0 & 0 \\
0 & -\frac{\sqrt{70}i}{42} & 0 & 0 & 0 & \frac{\sqrt{14}i}{42} & 0 & 0 & \frac{\sqrt{7}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{21}i}{28} & 0 \\
0 & 0 & 0 & \frac{\sqrt{210}i}{84} & 0 & 0 & \frac{\sqrt{2}i}{8} & 0 & 0 & 0 & -\frac{\sqrt{70}i}{56} & 0 & 0 & 0 \\
\frac{5\sqrt{7}i}{84} & 0 & 0 & 0 & \frac{\sqrt{35}i}{84} & 0 & 0 & -\frac{\sqrt{42}i}{56} & 0 & 0 & 0 & -\frac{3\sqrt{14}i}{56} & 0 & 0 \\
0 & -\frac{\sqrt{35}i}{84} & 0 & 0 & 0 & -\frac{5\sqrt{7}i}{84} & 0 & 0 & -\frac{3\sqrt{14}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{42}i}{56} & 0 \\
0 & 0 & -\frac{\sqrt{210}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{56} & 0 & 0 & 0 & \frac{\sqrt{2}i}{8}
\end{bmatrix}$$

**409**  symmetry  $\dfrac{\sqrt{15}z(x-y)(x+y)}{2}$

$$\mathbb{M}_3^{(a)}(B_{2g}) = \begin{bmatrix}
\frac{\sqrt{14}}{42} & 0 & 0 & 0 & \frac{\sqrt{70}}{42} & 0 & 0 & \frac{\sqrt{21}}{28} & 0 & 0 & 0 & \frac{\sqrt{7}}{28} & 0 & 0 \\
0 & -\frac{\sqrt{70}}{42} & 0 & 0 & 0 & -\frac{\sqrt{14}}{42} & 0 & 0 & \frac{\sqrt{7}}{28} & 0 & 0 & 0 & \frac{\sqrt{21}}{28} & 0 \\
0 & 0 & 0 & -\frac{\sqrt{210}}{84} & 0 & 0 & \frac{\sqrt{2}}{8} & 0 & 0 & 0 & \frac{\sqrt{70}}{56} & 0 & 0 & 0 \\
\frac{5\sqrt{7}}{84} & 0 & 0 & 0 & -\frac{\sqrt{35}}{84} & 0 & 0 & -\frac{\sqrt{42}}{56} & 0 & 0 & 0 & \frac{3\sqrt{14}}{56} & 0 & 0 \\
0 & -\frac{\sqrt{35}}{84} & 0 & 0 & 0 & \frac{5\sqrt{7}}{84} & 0 & 0 & -\frac{3\sqrt{14}}{56} & 0 & 0 & 0 & \frac{\sqrt{42}}{56} & 0 \\
0 & 0 & -\frac{\sqrt{210}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{56} & 0 & 0 & 0 & -\frac{\sqrt{2}}{8}
\end{bmatrix}$$

**410**  symmetry  $\dfrac{x\left(2x^2-3y^2-3z^2\right)}{2}$

$$\mathbb{M}_{3,1}^{(a)}(E_g,1) = \begin{bmatrix}
0 & \frac{\sqrt{42}}{84} & 0 & -\frac{\sqrt{21}}{42} & 0 & \frac{\sqrt{210}}{84} & -\frac{\sqrt{5}}{16} & 0 & \frac{\sqrt{105}}{112} & 0 & -\frac{3\sqrt{7}}{112} & 0 & \frac{\sqrt{35}}{112} & 0 \\
\frac{\sqrt{210}}{84} & 0 & -\frac{\sqrt{21}}{42} & 0 & \frac{\sqrt{42}}{84} & 0 & 0 & -\frac{\sqrt{35}}{112} & 0 & \frac{3\sqrt{7}}{112} & 0 & -\frac{\sqrt{105}}{112} & 0 & \frac{\sqrt{5}}{16} \\
-\frac{\sqrt{35}}{112} & 0 & \frac{3\sqrt{14}}{112} & 0 & -\frac{5\sqrt{7}}{112} & 0 & 0 & \frac{\sqrt{210}}{112} & 0 & -\frac{\sqrt{42}}{56} & 0 & \frac{\sqrt{70}}{112} & 0 & 0 \\
0 & \frac{\sqrt{21}}{48} & 0 & -\frac{\sqrt{42}}{336} & 0 & -\frac{5\sqrt{105}}{336} & \frac{\sqrt{10}}{16} & 0 & 0 & 0 & -\frac{3\sqrt{14}}{112} & 0 & \frac{\sqrt{70}}{56} & 0 \\
\frac{5\sqrt{105}}{336} & 0 & \frac{\sqrt{42}}{336} & 0 & -\frac{\sqrt{21}}{48} & 0 & 0 & \frac{\sqrt{70}}{56} & 0 & -\frac{3\sqrt{14}}{112} & 0 & 0 & 0 & \frac{\sqrt{10}}{16} \\
0 & \frac{5\sqrt{7}}{112} & 0 & -\frac{3\sqrt{14}}{112} & 0 & \frac{\sqrt{35}}{112} & 0 & 0 & \frac{\sqrt{70}}{112} & 0 & -\frac{\sqrt{42}}{56} & 0 & \frac{\sqrt{210}}{112} & 0
\end{bmatrix}$$

**411**  symmetry  $\dfrac{y\left(3x^2-2y^2+3z^2\right)}{2}$

$$\mathbb{M}_{3,2}^{(a)}(E_g,1) = \begin{bmatrix}
0 & -\frac{\sqrt{42}i}{84} & 0 & -\frac{\sqrt{21}i}{42} & 0 & -\frac{\sqrt{210}i}{84} & -\frac{\sqrt{5}i}{16} & 0 & -\frac{\sqrt{105}i}{112} & 0 & -\frac{3\sqrt{7}i}{112} & 0 & -\frac{\sqrt{35}i}{112} & 0 \\
\frac{\sqrt{210}i}{84} & 0 & \frac{\sqrt{21}i}{42} & 0 & \frac{\sqrt{42}i}{84} & 0 & 0 & -\frac{\sqrt{35}i}{112} & 0 & -\frac{3\sqrt{7}i}{112} & 0 & -\frac{\sqrt{105}i}{112} & 0 & -\frac{\sqrt{5}i}{16} \\
\frac{\sqrt{35}i}{112} & 0 & \frac{3\sqrt{14}i}{112} & 0 & \frac{5\sqrt{7}i}{112} & 0 & 0 & -\frac{\sqrt{210}i}{112} & 0 & -\frac{\sqrt{42}i}{56} & 0 & -\frac{\sqrt{70}i}{112} & 0 & 0 \\
0 & -\frac{\sqrt{21}i}{48} & 0 & -\frac{\sqrt{42}i}{336} & 0 & \frac{5\sqrt{105}i}{336} & \frac{\sqrt{10}i}{16} & 0 & 0 & 0 & -\frac{3\sqrt{14}i}{112} & 0 & -\frac{\sqrt{70}i}{56} & 0 \\
\frac{5\sqrt{105}i}{336} & 0 & -\frac{\sqrt{42}i}{336} & 0 & -\frac{\sqrt{21}i}{48} & 0 & 0 & \frac{\sqrt{70}i}{56} & 0 & \frac{3\sqrt{14}i}{112} & 0 & 0 & 0 & -\frac{\sqrt{10}i}{16} \\
0 & \frac{5\sqrt{7}i}{112} & 0 & \frac{3\sqrt{14}i}{112} & 0 & \frac{\sqrt{35}i}{112} & 0 & 0 & \frac{\sqrt{70}i}{112} & 0 & \frac{\sqrt{42}i}{56} & 0 & \frac{\sqrt{210}i}{112} & 0
\end{bmatrix}$$

**412**  symmetry  $\dfrac{\sqrt{15}x(y-z)(y+z)}{2}$

Table 7

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_{3,1}^{(a)}(E_g,2)$$

$$\begin{bmatrix}
0 & \frac{\sqrt{70}}{84} & 0 & -\frac{\sqrt{35}}{42} & 0 & -\frac{\sqrt{14}}{28} & \frac{\sqrt{3}}{16} & 0 & \frac{5\sqrt{7}}{112} & 0 & -\frac{\sqrt{105}}{112} & 0 & -\frac{\sqrt{21}}{112} & 0 \\
-\frac{\sqrt{14}}{28} & 0 & -\frac{\sqrt{35}}{42} & 0 & \frac{\sqrt{70}}{84} & 0 & 0 & \frac{\sqrt{21}}{112} & 0 & \frac{\sqrt{105}}{112} & 0 & -\frac{5\sqrt{7}}{112} & 0 & -\frac{\sqrt{3}}{16} \\
-\frac{5\sqrt{21}}{336} & 0 & \frac{\sqrt{210}}{112} & 0 & \frac{\sqrt{105}}{112} & 0 & 0 & \frac{5\sqrt{14}}{112} & 0 & -\frac{\sqrt{70}}{56} & 0 & -\frac{\sqrt{42}}{112} & 0 & 0 \\
0 & \frac{\sqrt{35}}{48} & 0 & -\frac{\sqrt{70}}{336} & 0 & \frac{5\sqrt{7}}{112} & -\frac{\sqrt{6}}{16} & 0 & 0 & 0 & -\frac{\sqrt{210}}{112} & 0 & -\frac{\sqrt{42}}{56} & 0 \\
-\frac{5\sqrt{7}}{112} & 0 & \frac{\sqrt{70}}{336} & 0 & -\frac{\sqrt{35}}{48} & 0 & 0 & -\frac{\sqrt{42}}{56} & 0 & -\frac{\sqrt{210}}{112} & 0 & 0 & 0 & -\frac{\sqrt{6}}{16} \\
0 & -\frac{\sqrt{105}}{112} & 0 & -\frac{\sqrt{210}}{112} & 0 & \frac{5\sqrt{21}}{336} & 0 & 0 & -\frac{\sqrt{42}}{112} & 0 & -\frac{\sqrt{70}}{56} & 0 & \frac{5\sqrt{14}}{112} & 0
\end{bmatrix}$$

**413**    symmetry
$$-\frac{\sqrt{15}\,y(x-z)(x+z)}{2}$$

$$\mathbb{M}_{3,2}^{(a)}(E_g,2)$$

$$\begin{bmatrix}
0 & -\frac{\sqrt{70}i}{84} & 0 & -\frac{\sqrt{35}i}{42} & 0 & \frac{\sqrt{14}i}{28} & \frac{\sqrt{3}i}{16} & 0 & -\frac{5\sqrt{7}i}{112} & 0 & -\frac{\sqrt{105}i}{112} & 0 & \frac{\sqrt{21}i}{112} & 0 \\
-\frac{\sqrt{14}i}{28} & 0 & \frac{\sqrt{35}i}{42} & 0 & \frac{\sqrt{70}i}{84} & 0 & 0 & \frac{\sqrt{21}i}{112} & 0 & -\frac{\sqrt{105}i}{112} & 0 & -\frac{5\sqrt{7}i}{112} & 0 & \frac{\sqrt{3}i}{16} \\
\frac{5\sqrt{21}i}{336} & 0 & \frac{\sqrt{210}i}{112} & 0 & -\frac{\sqrt{105}i}{112} & 0 & 0 & -\frac{5\sqrt{14}i}{112} & 0 & -\frac{\sqrt{70}i}{56} & 0 & \frac{\sqrt{42}i}{112} & 0 & 0 \\
0 & -\frac{\sqrt{35}i}{48} & 0 & -\frac{\sqrt{70}i}{336} & 0 & -\frac{5\sqrt{7}i}{112} & -\frac{\sqrt{6}i}{16} & 0 & 0 & 0 & -\frac{\sqrt{210}i}{112} & 0 & \frac{\sqrt{42}i}{56} & 0 \\
-\frac{5\sqrt{7}i}{112} & 0 & -\frac{\sqrt{70}i}{336} & 0 & -\frac{\sqrt{35}i}{48} & 0 & 0 & -\frac{\sqrt{42}i}{56} & 0 & \frac{\sqrt{210}i}{112} & 0 & 0 & 0 & \frac{\sqrt{6}i}{16} \\
0 & -\frac{\sqrt{105}i}{112} & 0 & \frac{\sqrt{210}i}{112} & 0 & \frac{5\sqrt{21}i}{336} & 0 & 0 & -\frac{\sqrt{42}i}{112} & 0 & \frac{\sqrt{70}i}{56} & 0 & \frac{5\sqrt{14}i}{112} & 0
\end{bmatrix}$$

**414**    symmetry
$$-\frac{z\left(3x^2+3y^2-2z^2\right)}{2}$$

$$\mathbb{M}_{3}^{(1,-1;a)}(A_{2g})$$

$$\begin{bmatrix}
0 & 0 & -\frac{\sqrt{5}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{15}}{21} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{5}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{15}}{21} & 0 & 0 & 0 \\
0 & \frac{2\sqrt{15}}{105} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{6}}{42} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{2\sqrt{10}}{105} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{42} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{2\sqrt{10}}{105} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{42} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{2\sqrt{15}}{105} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{6}}{42} & 0 & 0
\end{bmatrix}$$

**415**    symmetry
$$\sqrt{15}\,xyz$$

$$\mathbb{M}_{3}^{(1,-1;a)}(B_{1g})$$

$$\begin{bmatrix}
-\frac{\sqrt{30}i}{252} & 0 & 0 & 0 & \frac{5\sqrt{6}i}{252} & 0 & 0 & -\frac{\sqrt{5}i}{7} & 0 & 0 & 0 & \frac{\sqrt{15}i}{21} & 0 & 0 \\
0 & \frac{5\sqrt{6}i}{252} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{252} & 0 & 0 & -\frac{\sqrt{15}i}{21} & 0 & 0 & 0 & \frac{\sqrt{5}i}{7} & 0 \\
0 & 0 & 0 & -\frac{\sqrt{2}i}{21} & 0 & 0 & \frac{\sqrt{210}i}{84} & 0 & 0 & 0 & -\frac{5\sqrt{6}i}{84} & 0 & 0 & 0 \\
-\frac{\sqrt{15}i}{63} & 0 & 0 & 0 & -\frac{\sqrt{3}i}{63} & 0 & 0 & -\frac{\sqrt{10}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{28} & 0 & 0 \\
0 & \frac{\sqrt{3}i}{63} & 0 & 0 & 0 & \frac{\sqrt{15}i}{63} & 0 & 0 & -\frac{\sqrt{30}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{10}i}{28} & 0 \\
0 & 0 & \frac{\sqrt{2}i}{21} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{6}i}{84} & 0 & 0 & 0 & \frac{\sqrt{210}i}{84}
\end{bmatrix}$$

**416**    symmetry
$$\frac{\sqrt{15}\,z(x-y)(x+y)}{2}$$

*continued ...*

Table 7

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{M}_3^{(1,-1;a)}(B_{2g})$

$$\begin{bmatrix}
-\frac{\sqrt{30}}{252} & 0 & 0 & 0 & -\frac{5\sqrt{6}}{252} & 0 & 0 & -\frac{\sqrt{5}}{7} & 0 & 0 & 0 & -\frac{\sqrt{15}}{21} & 0 & 0 \\
0 & \frac{5\sqrt{6}}{252} & 0 & 0 & 0 & \frac{\sqrt{30}}{252} & 0 & 0 & -\frac{\sqrt{15}}{21} & 0 & 0 & 0 & -\frac{\sqrt{5}}{7} & 0 \\
0 & 0 & 0 & \frac{\sqrt{2}}{21} & 0 & 0 & \frac{\sqrt{210}}{84} & 0 & 0 & 0 & \frac{5\sqrt{6}}{84} & 0 & 0 & 0 \\
-\frac{\sqrt{15}}{63} & 0 & 0 & 0 & \frac{\sqrt{3}}{63} & 0 & 0 & -\frac{\sqrt{10}}{28} & 0 & 0 & 0 & \frac{\sqrt{30}}{28} & 0 & 0 \\
0 & \frac{\sqrt{3}}{63} & 0 & 0 & 0 & -\frac{\sqrt{15}}{63} & 0 & 0 & -\frac{\sqrt{30}}{28} & 0 & 0 & 0 & \frac{\sqrt{10}}{28} & 0 \\
0 & 0 & \frac{\sqrt{2}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{6}}{84} & 0 & 0 & 0 & -\frac{\sqrt{210}}{84}
\end{bmatrix}$$

| 417 | symmetry | $\dfrac{x(2x^2-3y^2-3z^2)}{2}$ |

$\mathbb{M}_{3,1}^{(1,-1;a)}(E_g,1)$

$$\begin{bmatrix}
0 & -\frac{\sqrt{10}}{168} & 0 & \frac{\sqrt{5}}{84} & 0 & -\frac{5\sqrt{2}}{168} & \frac{5\sqrt{21}}{84} & 0 & -\frac{5}{28} & 0 & \frac{\sqrt{15}}{28} & 0 & -\frac{5\sqrt{3}}{84} & 0 \\
-\frac{5\sqrt{2}}{168} & 0 & \frac{\sqrt{5}}{84} & 0 & -\frac{\sqrt{10}}{168} & 0 & 0 & \frac{5\sqrt{3}}{84} & 0 & -\frac{\sqrt{15}}{28} & 0 & \frac{5}{28} & 0 & -\frac{5\sqrt{21}}{84} \\
\frac{\sqrt{3}}{84} & 0 & -\frac{\sqrt{30}}{140} & 0 & \frac{\sqrt{15}}{84} & 0 & 0 & \frac{5\sqrt{2}}{56} & 0 & -\frac{\sqrt{10}}{28} & 0 & \frac{5\sqrt{6}}{168} & 0 & 0 \\
0 & -\frac{\sqrt{5}}{60} & 0 & \frac{\sqrt{10}}{420} & 0 & \frac{5}{84} & \frac{5\sqrt{42}}{168} & 0 & 0 & 0 & -\frac{\sqrt{30}}{56} & 0 & \frac{5\sqrt{6}}{84} & 0 \\
-\frac{5}{84} & 0 & -\frac{\sqrt{10}}{420} & 0 & \frac{\sqrt{5}}{60} & 0 & 0 & \frac{5\sqrt{6}}{84} & 0 & -\frac{\sqrt{30}}{56} & 0 & 0 & 0 & \frac{5\sqrt{42}}{168} \\
0 & -\frac{\sqrt{15}}{84} & 0 & \frac{\sqrt{30}}{140} & 0 & -\frac{\sqrt{3}}{84} & 0 & 0 & \frac{5\sqrt{6}}{168} & 0 & -\frac{\sqrt{10}}{28} & 0 & \frac{5\sqrt{2}}{56} & 0
\end{bmatrix}$$

| 418 | symmetry | $\dfrac{y(3x^2-2y^2+3z^2)}{2}$ |

$\mathbb{M}_{3,2}^{(1,-1;a)}(E_g,1)$

$$\begin{bmatrix}
0 & \frac{\sqrt{10}i}{168} & 0 & \frac{\sqrt{5}i}{84} & 0 & \frac{5\sqrt{2}i}{168} & \frac{5\sqrt{21}i}{84} & 0 & \frac{5i}{28} & 0 & \frac{\sqrt{15}i}{28} & 0 & \frac{5\sqrt{3}i}{84} & 0 \\
-\frac{5\sqrt{2}i}{168} & 0 & -\frac{\sqrt{5}i}{84} & 0 & -\frac{\sqrt{10}i}{168} & 0 & 0 & \frac{5\sqrt{3}i}{84} & 0 & \frac{\sqrt{15}i}{28} & 0 & \frac{5i}{28} & 0 & \frac{5\sqrt{21}i}{84} \\
-\frac{\sqrt{3}i}{84} & 0 & -\frac{\sqrt{30}i}{140} & 0 & -\frac{\sqrt{15}i}{84} & 0 & 0 & -\frac{5\sqrt{2}i}{56} & 0 & -\frac{\sqrt{10}i}{28} & 0 & -\frac{5\sqrt{6}i}{168} & 0 & 0 \\
0 & \frac{\sqrt{5}i}{60} & 0 & \frac{\sqrt{10}i}{420} & 0 & -\frac{5i}{84} & \frac{5\sqrt{42}i}{168} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{56} & 0 & -\frac{5\sqrt{6}i}{84} & 0 \\
-\frac{5i}{84} & 0 & \frac{\sqrt{10}i}{420} & 0 & \frac{\sqrt{5}i}{60} & 0 & 0 & \frac{5\sqrt{6}i}{84} & 0 & \frac{\sqrt{30}i}{56} & 0 & 0 & 0 & -\frac{5\sqrt{42}i}{168} \\
0 & -\frac{\sqrt{15}i}{84} & 0 & -\frac{\sqrt{30}i}{140} & 0 & -\frac{\sqrt{3}i}{84} & 0 & 0 & \frac{5\sqrt{6}i}{168} & 0 & \frac{\sqrt{10}i}{28} & 0 & \frac{5\sqrt{2}i}{56} & 0
\end{bmatrix}$$

| 419 | symmetry | $\dfrac{\sqrt{15}x(y-z)(y+z)}{2}$ |

$\mathbb{M}_{3,1}^{(1,-1;a)}(E_g,2)$

$$\begin{bmatrix}
0 & -\frac{5\sqrt{6}}{504} & 0 & \frac{5\sqrt{3}}{252} & 0 & \frac{\sqrt{30}}{168} & -\frac{\sqrt{35}}{28} & 0 & -\frac{5\sqrt{15}}{84} & 0 & \frac{5}{28} & 0 & \frac{\sqrt{5}}{28} & 0 \\
\frac{\sqrt{30}}{168} & 0 & \frac{5\sqrt{3}}{252} & 0 & -\frac{5\sqrt{6}}{504} & 0 & 0 & -\frac{\sqrt{5}}{28} & 0 & -\frac{5}{28} & 0 & \frac{5\sqrt{15}}{84} & 0 & \frac{\sqrt{35}}{28} \\
\frac{\sqrt{5}}{84} & 0 & -\frac{\sqrt{2}}{28} & 0 & -\frac{1}{28} & 0 & 0 & \frac{5\sqrt{30}}{168} & 0 & -\frac{5\sqrt{6}}{84} & 0 & -\frac{\sqrt{10}}{56} & 0 & 0 \\
0 & -\frac{\sqrt{3}}{36} & 0 & \frac{\sqrt{6}}{252} & 0 & -\frac{\sqrt{15}}{84} & -\frac{\sqrt{70}}{56} & 0 & 0 & 0 & -\frac{5\sqrt{2}}{56} & 0 & -\frac{\sqrt{10}}{28} & 0 \\
\frac{\sqrt{15}}{84} & 0 & -\frac{\sqrt{6}}{252} & 0 & \frac{\sqrt{3}}{36} & 0 & 0 & -\frac{\sqrt{10}}{28} & 0 & -\frac{5\sqrt{2}}{56} & 0 & 0 & 0 & -\frac{\sqrt{70}}{56} \\
0 & \frac{1}{28} & 0 & \frac{\sqrt{2}}{28} & 0 & -\frac{\sqrt{5}}{84} & 0 & 0 & -\frac{\sqrt{10}}{56} & 0 & -\frac{5\sqrt{6}}{84} & 0 & \frac{5\sqrt{30}}{168} & 0
\end{bmatrix}$$

| 420 | symmetry | $-\dfrac{\sqrt{15}y(x-z)(x+z)}{2}$ |

continued ...

Table 7

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_{3,2}^{(1,-1;a)}(E_g,2)$

$$\begin{pmatrix}
0 & \frac{5\sqrt6 i}{504} & 0 & \frac{5\sqrt3 i}{252} & 0 & -\frac{\sqrt{30}i}{168} & -\frac{\sqrt{35}i}{28} & 0 & \frac{5\sqrt{15}i}{84} & 0 & \frac{5i}{28} & 0 & -\frac{\sqrt5 i}{28} & 0 \\
\frac{\sqrt{30}i}{168} & 0 & -\frac{5\sqrt3 i}{252} & 0 & -\frac{5\sqrt6 i}{504} & 0 & 0 & -\frac{\sqrt5 i}{28} & 0 & \frac{5i}{28} & 0 & \frac{5\sqrt{15}i}{84} & 0 & -\frac{\sqrt{35}i}{28} \\
-\frac{\sqrt5 i}{84} & 0 & -\frac{\sqrt2 i}{28} & 0 & \frac{i}{28} & 0 & 0 & -\frac{5\sqrt{30}i}{168} & 0 & -\frac{5\sqrt6 i}{84} & 0 & \frac{\sqrt{10}i}{56} & 0 & 0 \\
0 & \frac{\sqrt3 i}{36} & 0 & \frac{\sqrt6 i}{252} & 0 & \frac{\sqrt{15}i}{84} & -\frac{\sqrt{70}i}{56} & 0 & 0 & 0 & -\frac{5\sqrt2 i}{56} & 0 & \frac{\sqrt{10}i}{28} & 0 \\
\frac{\sqrt{15}i}{84} & 0 & \frac{\sqrt6 i}{252} & 0 & \frac{\sqrt3 i}{36} & 0 & 0 & -\frac{\sqrt{10}i}{28} & 0 & \frac{5\sqrt2 i}{56} & 0 & 0 & 0 & \frac{\sqrt{70}i}{56} \\
0 & \frac{i}{28} & 0 & -\frac{\sqrt2 i}{28} & 0 & -\frac{\sqrt5 i}{84} & 0 & 0 & -\frac{\sqrt{10}i}{56} & 0 & \frac{5\sqrt6 i}{84} & 0 & \frac{5\sqrt{30}i}{168} & 0
\end{pmatrix}$$

**421  symmetry**

$$\frac{3\sqrt{35}xyz(x-y)(x+y)}{2}$$

$\mathbb{M}_5^{(1,-1;a)}(A_{1g})$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{20} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{20} \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{20} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{20} & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

**422  symmetry**

$$\frac{z\left(15x^4+30x^2y^2-40x^2z^2+15y^4-40y^2z^2+8z^4\right)}{8}$$

$\mathbb{M}_5^{(1,-1;a)}(A_{2g},1)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt6}{12} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{12} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{12} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt6}{12} & 0 & 0
\end{pmatrix}$$

**423  symmetry**

$$\frac{3\sqrt{35}z\left(x^2-2xy-y^2\right)\left(x^2+2xy-y^2\right)}{8}$$

$\mathbb{M}_5^{(1,-1;a)}(A_{2g},2)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{20} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{20} \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{20} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{20} & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

**424  symmetry**

$$\frac{\sqrt{105}xyz\left(x^2+y^2-2z^2\right)}{2}$$

Table 7

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_5^{(1,-1;a)}(B_{1g})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{120} & 0 & 0 & 0 & -\frac{\sqrt{42}i}{24} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{40} & 0 & 0 & 0 & \frac{\sqrt{210}i}{40} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{40} & 0 & 0 & 0 & -\frac{\sqrt{70}i}{40} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}i}{24} & 0 & 0 & 0 & \frac{\sqrt{30}i}{120}
\end{bmatrix}$$

425    symmetry    $-\frac{\sqrt{105}z(x-y)(x+y)\left(x^2+y^2-2z^2\right)}{4}$

$\mathbb{M}_5^{(1,-1;a)}(B_{2g})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{120} & 0 & 0 & 0 & -\frac{\sqrt{42}}{24} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{40} & 0 & 0 & 0 & \frac{\sqrt{210}}{40} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{40} & 0 & 0 & 0 & -\frac{\sqrt{70}}{40} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{24} & 0 & 0 & 0 & \frac{\sqrt{30}}{120}
\end{bmatrix}$$

426    symmetry    $\frac{x\left(8x^4-40x^2y^2-40x^2z^2+15y^4+30y^2z^2+15z^4\right)}{8}$

$\mathbb{M}_{5,1}^{(1,-1;a)}(E_g,1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{32} & 0 & -\frac{\sqrt{10}}{32} & 0 & \frac{7\sqrt{6}}{96} & 0 & -\frac{3\sqrt{14}}{32} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{96} & 0 & -\frac{3\sqrt{2}}{32} & 0 & \frac{\sqrt{30}}{32} & 0 & -\frac{7\sqrt{6}}{96} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{7\sqrt{6}}{96} & 0 & \frac{\sqrt{30}}{32} & 0 & -\frac{3\sqrt{2}}{32} & 0 & \frac{\sqrt{42}}{96} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{14}}{32} & 0 & \frac{7\sqrt{6}}{96} & 0 & -\frac{\sqrt{10}}{32} & 0 & \frac{\sqrt{2}}{32} & 0
\end{bmatrix}$$

427    symmetry    $-\frac{y\left(15x^4-40x^2y^2+30x^2z^2+8y^4-40y^2z^2+15z^4\right)}{8}$

$\mathbb{M}_{5,2}^{(1,-1;a)}(E_g,1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{32} & 0 & -\frac{\sqrt{10}i}{32} & 0 & -\frac{7\sqrt{6}i}{96} & 0 & -\frac{3\sqrt{14}i}{32} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{96} & 0 & \frac{3\sqrt{2}i}{32} & 0 & \frac{\sqrt{30}i}{32} & 0 & \frac{7\sqrt{6}i}{96} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{7\sqrt{6}i}{96} & 0 & -\frac{\sqrt{30}i}{32} & 0 & -\frac{3\sqrt{2}i}{32} & 0 & -\frac{\sqrt{42}i}{96} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{14}i}{32} & 0 & \frac{7\sqrt{6}i}{96} & 0 & \frac{\sqrt{10}i}{32} & 0 & \frac{\sqrt{2}i}{32} & 0
\end{bmatrix}$$

428    symmetry    $\frac{3\sqrt{35}x\left(y^2-2yz-z^2\right)\left(y^2+2yz-z^2\right)}{8}$

Table 7

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_{5,1}^{(1,-1;a)}(E_g,2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{160} & 0 & -\frac{\sqrt{14}}{32} & 0 & -\frac{3\sqrt{210}}{160} & 0 & -\frac{\sqrt{10}}{32} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{30}}{160} & 0 & -\frac{3\sqrt{70}}{160} & 0 & \frac{\sqrt{42}}{32} & 0 & \frac{3\sqrt{210}}{160} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{210}}{160} & 0 & \frac{\sqrt{42}}{32} & 0 & -\frac{3\sqrt{70}}{160} & 0 & -\frac{3\sqrt{30}}{160} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{32} & 0 & -\frac{3\sqrt{210}}{160} & 0 & -\frac{\sqrt{14}}{32} & 0 & \frac{\sqrt{70}}{160} & 0
\end{bmatrix}$$

**429 symmetry**

$$-\frac{3\sqrt{35}\,y\left(x^2-2xz-z^2\right)\left(x^2+2xz-z^2\right)}{8}$$

$\mathbb{M}_{5,2}^{(1,-1;a)}(E_g,2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{160} & 0 & -\frac{\sqrt{14}i}{32} & 0 & \frac{3\sqrt{210}i}{160} & 0 & -\frac{\sqrt{10}i}{32} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{30}i}{160} & 0 & \frac{3\sqrt{70}i}{160} & 0 & \frac{\sqrt{42}i}{32} & 0 & -\frac{3\sqrt{210}i}{160} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{210}i}{160} & 0 & -\frac{\sqrt{42}i}{32} & 0 & -\frac{3\sqrt{70}i}{160} & 0 & \frac{3\sqrt{30}i}{160} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{32} & 0 & -\frac{3\sqrt{210}i}{160} & 0 & \frac{\sqrt{14}i}{32} & 0 & \frac{\sqrt{70}i}{160} & 0
\end{bmatrix}$$

**430 symmetry**

$$\frac{\sqrt{105}\,x(y-z)(y+z)\left(2x^2-y^2-z^2\right)}{4}$$

$\mathbb{M}_{5,1}^{(1,-1;a)}(E_g,3)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{240} & 0 & -\frac{\sqrt{42}}{48} & 0 & \frac{\sqrt{70}}{80} & 0 & \frac{\sqrt{30}}{16} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{80} & 0 & -\frac{\sqrt{210}}{80} & 0 & \frac{\sqrt{14}}{16} & 0 & -\frac{\sqrt{70}}{80} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{80} & 0 & \frac{\sqrt{14}}{16} & 0 & -\frac{\sqrt{210}}{80} & 0 & \frac{\sqrt{10}}{80} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{16} & 0 & \frac{\sqrt{70}}{80} & 0 & -\frac{\sqrt{42}}{48} & 0 & \frac{\sqrt{210}}{240} & 0
\end{bmatrix}$$

**431 symmetry**

$$\frac{\sqrt{105}\,y(x-z)(x+z)\left(x^2-2y^2+z^2\right)}{4}$$

$\mathbb{M}_{5,2}^{(1,-1;a)}(E_g,3)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{240} & 0 & -\frac{\sqrt{42}i}{48} & 0 & -\frac{\sqrt{70}i}{80} & 0 & \frac{\sqrt{30}i}{16} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{80} & 0 & \frac{\sqrt{210}i}{80} & 0 & \frac{\sqrt{14}i}{16} & 0 & \frac{\sqrt{70}i}{80} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{80} & 0 & -\frac{\sqrt{14}i}{16} & 0 & -\frac{\sqrt{210}i}{80} & 0 & -\frac{\sqrt{10}i}{80} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{16} & 0 & \frac{\sqrt{70}i}{80} & 0 & \frac{\sqrt{42}i}{48} & 0 & \frac{\sqrt{210}i}{240} & 0
\end{bmatrix}$$

**432 symmetry**

$$-\frac{z\left(3x^2+3y^2-2z^2\right)}{2}$$

*continued ...*

Table 7

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_3^{(1,0;a)}(A_{2g})$$

$$\begin{pmatrix}
0 & 0 & -\frac{\sqrt{7}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{21}}{84} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{7}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{21}}{84} & 0 & 0 & 0 \\
0 & \frac{5\sqrt{21}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{84} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{5\sqrt{14}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{84} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{5\sqrt{14}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}}{84} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{5\sqrt{21}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{84} & 0 & 0
\end{pmatrix}$$

**433**    symmetry    $\sqrt{15}xyz$

$$\mathbb{M}_3^{(1,0;a)}(B_{1g})$$

$$\begin{pmatrix}
-\frac{\sqrt{42}i}{126} & 0 & 0 & 0 & \frac{\sqrt{210}i}{126} & 0 & 0 & \frac{5\sqrt{7}i}{56} & 0 & 0 & 0 & -\frac{5\sqrt{21}i}{168} & 0 & 0 \\
0 & \frac{\sqrt{210}i}{126} & 0 & 0 & 0 & -\frac{\sqrt{42}i}{126} & 0 & 0 & \frac{5\sqrt{21}i}{168} & 0 & 0 & 0 & -\frac{5\sqrt{7}i}{56} & 0 \\
0 & 0 & 0 & -\frac{5\sqrt{70}i}{168} & 0 & 0 & \frac{\sqrt{6}i}{24} & 0 & 0 & 0 & -\frac{\sqrt{210}i}{168} & 0 & 0 & 0 \\
-\frac{25\sqrt{21}i}{504} & 0 & 0 & 0 & -\frac{5\sqrt{105}i}{504} & 0 & 0 & -\frac{\sqrt{14}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{42}i}{56} & 0 & 0 \\
0 & \frac{5\sqrt{105}i}{504} & 0 & 0 & 0 & \frac{25\sqrt{21}i}{504} & 0 & 0 & -\frac{\sqrt{42}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{14}i}{56} & 0 \\
0 & 0 & \frac{5\sqrt{70}i}{168} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{168} & 0 & 0 & 0 & \frac{\sqrt{6}i}{24}
\end{pmatrix}$$

**434**    symmetry    $\frac{\sqrt{15}z(x-y)(x+y)}{2}$

$$\mathbb{M}_3^{(1,0;a)}(B_{2g})$$

$$\begin{pmatrix}
-\frac{\sqrt{42}}{126} & 0 & 0 & 0 & -\frac{\sqrt{210}}{126} & 0 & 0 & \frac{5\sqrt{7}}{56} & 0 & 0 & 0 & \frac{5\sqrt{21}}{168} & 0 & 0 \\
0 & \frac{\sqrt{210}}{126} & 0 & 0 & 0 & \frac{\sqrt{42}}{126} & 0 & 0 & \frac{5\sqrt{21}}{168} & 0 & 0 & 0 & \frac{5\sqrt{7}}{56} & 0 \\
0 & 0 & 0 & \frac{5\sqrt{70}}{168} & 0 & 0 & \frac{\sqrt{6}}{24} & 0 & 0 & 0 & \frac{\sqrt{210}}{168} & 0 & 0 & 0 \\
-\frac{25\sqrt{21}}{504} & 0 & 0 & 0 & \frac{5\sqrt{105}}{504} & 0 & 0 & -\frac{\sqrt{14}}{56} & 0 & 0 & 0 & \frac{\sqrt{42}}{56} & 0 & 0 \\
0 & \frac{5\sqrt{105}}{504} & 0 & 0 & 0 & -\frac{25\sqrt{21}}{504} & 0 & 0 & -\frac{\sqrt{42}}{56} & 0 & 0 & 0 & \frac{\sqrt{14}}{56} & 0 \\
0 & 0 & \frac{5\sqrt{70}}{168} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{168} & 0 & 0 & 0 & -\frac{\sqrt{6}}{24}
\end{pmatrix}$$

**435**    symmetry    $\frac{x\left(2x^2-3y^2-3z^2\right)}{2}$

$$\mathbb{M}_{3,1}^{(1,0;a)}(E_g,1)$$

$$\begin{pmatrix}
0 & -\frac{\sqrt{14}}{84} & 0 & \frac{\sqrt{7}}{42} & 0 & -\frac{\sqrt{70}}{84} & -\frac{5\sqrt{15}}{96} & 0 & \frac{5\sqrt{35}}{224} & 0 & -\frac{5\sqrt{21}}{224} & 0 & \frac{5\sqrt{105}}{672} & 0 \\
-\frac{\sqrt{70}}{84} & 0 & \frac{\sqrt{7}}{42} & 0 & -\frac{\sqrt{14}}{84} & 0 & 0 & -\frac{5\sqrt{105}}{672} & 0 & \frac{5\sqrt{21}}{224} & 0 & -\frac{5\sqrt{35}}{224} & 0 & \frac{5\sqrt{15}}{96} \\
\frac{5\sqrt{105}}{672} & 0 & -\frac{5\sqrt{42}}{224} & 0 & \frac{25\sqrt{21}}{672} & 0 & 0 & \frac{\sqrt{70}}{112} & 0 & -\frac{\sqrt{14}}{56} & 0 & \frac{\sqrt{210}}{336} & 0 & 0 \\
0 & -\frac{5\sqrt{7}}{96} & 0 & \frac{5\sqrt{14}}{672} & 0 & \frac{25\sqrt{35}}{672} & \frac{\sqrt{30}}{48} & 0 & 0 & 0 & -\frac{\sqrt{42}}{112} & 0 & \frac{\sqrt{210}}{168} & 0 \\
-\frac{25\sqrt{35}}{672} & 0 & -\frac{5\sqrt{14}}{672} & 0 & \frac{5\sqrt{7}}{96} & 0 & 0 & \frac{\sqrt{210}}{168} & 0 & -\frac{\sqrt{42}}{112} & 0 & 0 & 0 & \frac{\sqrt{30}}{48} \\
0 & -\frac{25\sqrt{21}}{672} & 0 & \frac{5\sqrt{42}}{224} & 0 & -\frac{5\sqrt{105}}{672} & 0 & 0 & \frac{\sqrt{210}}{336} & 0 & -\frac{\sqrt{14}}{56} & 0 & \frac{\sqrt{70}}{112} & 0
\end{pmatrix}$$

**436**    symmetry    $\frac{y\left(3x^2-2y^2+3z^2\right)}{2}$

*continued ...*

Table 7

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_{3,2}^{(1,0;a)}(E_g,1)$$

$$\begin{bmatrix}
0 & \frac{\sqrt{14}i}{84} & 0 & \frac{\sqrt{7}i}{42} & 0 & \frac{\sqrt{70}i}{84} & -\frac{5\sqrt{15}i}{96} & 0 & -\frac{5\sqrt{35}i}{224} & 0 & -\frac{5\sqrt{21}i}{224} & 0 & -\frac{5\sqrt{105}i}{672} & 0 \\
-\frac{\sqrt{70}i}{84} & 0 & -\frac{\sqrt{7}i}{42} & 0 & -\frac{\sqrt{14}i}{84} & 0 & 0 & -\frac{5\sqrt{105}i}{672} & 0 & -\frac{5\sqrt{21}i}{224} & 0 & -\frac{5\sqrt{35}i}{224} & 0 & -\frac{5\sqrt{15}i}{96} \\
-\frac{5\sqrt{105}i}{672} & 0 & -\frac{5\sqrt{42}i}{224} & 0 & -\frac{25\sqrt{21}i}{672} & 0 & 0 & -\frac{\sqrt{70}i}{112} & 0 & -\frac{\sqrt{14}i}{56} & 0 & -\frac{\sqrt{210}i}{336} & 0 & 0 \\
0 & \frac{5\sqrt{7}i}{96} & 0 & \frac{5\sqrt{14}i}{672} & 0 & -\frac{25\sqrt{35}i}{672} & \frac{\sqrt{30}i}{48} & 0 & 0 & 0 & -\frac{\sqrt{42}i}{112} & 0 & -\frac{\sqrt{210}i}{168} & 0 \\
-\frac{25\sqrt{35}i}{672} & 0 & \frac{5\sqrt{14}i}{672} & 0 & \frac{5\sqrt{7}i}{96} & 0 & 0 & \frac{\sqrt{210}i}{168} & 0 & \frac{\sqrt{42}i}{112} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{48} \\
0 & -\frac{25\sqrt{21}i}{672} & 0 & -\frac{5\sqrt{42}i}{224} & 0 & -\frac{5\sqrt{105}i}{672} & 0 & 0 & \frac{\sqrt{210}i}{336} & 0 & \frac{\sqrt{14}i}{56} & 0 & \frac{\sqrt{70}i}{112} & 0
\end{bmatrix}$$

| 437 | symmetry | $\dfrac{\sqrt{15}x(y-z)(y+z)}{2}$ |
|---|---|---|

$$\mathbb{M}_{3,1}^{(1,0;a)}(E_g,2)$$

$$\begin{bmatrix}
0 & -\frac{\sqrt{210}}{252} & 0 & \frac{\sqrt{105}}{126} & 0 & \frac{\sqrt{42}}{84} & \frac{5}{32} & 0 & \frac{25\sqrt{21}}{672} & 0 & -\frac{5\sqrt{35}}{224} & 0 & -\frac{5\sqrt{7}}{224} & 0 \\
\frac{\sqrt{42}}{84} & 0 & \frac{\sqrt{105}}{126} & 0 & -\frac{\sqrt{210}}{252} & 0 & 0 & \frac{5\sqrt{7}}{224} & 0 & \frac{5\sqrt{35}}{224} & 0 & -\frac{25\sqrt{21}}{672} & 0 & -\frac{5}{32} \\
\frac{25\sqrt{7}}{672} & 0 & -\frac{5\sqrt{70}}{224} & 0 & -\frac{5\sqrt{35}}{224} & 0 & 0 & \frac{5\sqrt{42}}{336} & 0 & -\frac{\sqrt{210}}{168} & 0 & -\frac{\sqrt{14}}{112} & 0 & 0 \\
0 & -\frac{5\sqrt{105}}{288} & 0 & \frac{5\sqrt{210}}{2016} & 0 & -\frac{25\sqrt{21}}{672} & -\frac{\sqrt{2}}{16} & 0 & 0 & 0 & -\frac{\sqrt{70}}{112} & 0 & -\frac{\sqrt{14}}{56} & 0 \\
\frac{25\sqrt{21}}{672} & 0 & -\frac{5\sqrt{210}}{2016} & 0 & \frac{5\sqrt{105}}{288} & 0 & 0 & -\frac{\sqrt{14}}{56} & 0 & -\frac{\sqrt{70}}{112} & 0 & 0 & 0 & -\frac{\sqrt{2}}{16} \\
0 & \frac{5\sqrt{35}}{224} & 0 & \frac{5\sqrt{70}}{224} & 0 & -\frac{25\sqrt{7}}{672} & 0 & 0 & -\frac{\sqrt{14}}{112} & 0 & -\frac{\sqrt{210}}{168} & 0 & \frac{5\sqrt{42}}{336} & 0
\end{bmatrix}$$

| 438 | symmetry | $-\dfrac{\sqrt{15}y(x-z)(x+z)}{2}$ |
|---|---|---|

$$\mathbb{M}_{3,2}^{(1,0;a)}(E_g,2)$$

$$\begin{bmatrix}
0 & \frac{\sqrt{210}i}{252} & 0 & \frac{\sqrt{105}i}{126} & 0 & -\frac{\sqrt{42}i}{84} & \frac{5i}{32} & 0 & -\frac{25\sqrt{21}i}{672} & 0 & -\frac{5\sqrt{35}i}{224} & 0 & \frac{5\sqrt{7}i}{224} & 0 \\
\frac{\sqrt{42}i}{84} & 0 & -\frac{\sqrt{105}i}{126} & 0 & -\frac{\sqrt{210}i}{252} & 0 & 0 & \frac{5\sqrt{7}i}{224} & 0 & -\frac{5\sqrt{35}i}{224} & 0 & -\frac{25\sqrt{21}i}{672} & 0 & \frac{5i}{32} \\
-\frac{25\sqrt{7}i}{672} & 0 & -\frac{5\sqrt{70}i}{224} & 0 & \frac{5\sqrt{35}i}{224} & 0 & 0 & -\frac{5\sqrt{42}i}{336} & 0 & -\frac{\sqrt{210}i}{168} & 0 & \frac{\sqrt{14}i}{112} & 0 & 0 \\
0 & \frac{5\sqrt{105}i}{288} & 0 & \frac{5\sqrt{210}i}{2016} & 0 & \frac{25\sqrt{21}i}{672} & -\frac{\sqrt{2}i}{16} & 0 & 0 & 0 & -\frac{\sqrt{70}i}{112} & 0 & \frac{\sqrt{14}i}{56} & 0 \\
\frac{25\sqrt{21}i}{672} & 0 & \frac{5\sqrt{210}i}{2016} & 0 & \frac{5\sqrt{105}i}{288} & 0 & 0 & -\frac{\sqrt{14}i}{56} & 0 & \frac{\sqrt{70}i}{112} & 0 & 0 & 0 & \frac{\sqrt{2}i}{16} \\
0 & \frac{5\sqrt{35}i}{224} & 0 & -\frac{5\sqrt{70}i}{224} & 0 & -\frac{25\sqrt{7}i}{672} & 0 & 0 & -\frac{\sqrt{14}i}{112} & 0 & \frac{\sqrt{210}i}{168} & 0 & \frac{5\sqrt{42}i}{336} & 0
\end{bmatrix}$$

| 439 | symmetry | $z$ |
|---|---|---|

$$\mathbb{M}_1^{(1,1;a)}(A_{2g})$$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{10}}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{15}}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{15}}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

| 440 | symmetry | $x$ |
|---|---|---|

continued …

Table 7

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_{1,1}^{(1,1;a)}(E_g)$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \frac{\sqrt{2}}{4} & 0 & -\frac{\sqrt{5}}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{30}}{20} & 0 & -\frac{\sqrt{15}}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{15}}{20} & 0 & -\frac{\sqrt{30}}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{5}}{20} & 0 & -\frac{\sqrt{2}}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

441    symmetry      $-y$

$\mathbb{M}_{1,2}^{(1,1;a)}(E_g)$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ -\frac{\sqrt{2}i}{4} & 0 & -\frac{\sqrt{5}i}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{30}i}{20} & 0 & -\frac{\sqrt{15}i}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{15}i}{20} & 0 & -\frac{\sqrt{30}i}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{5}i}{20} & 0 & -\frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

442    symmetry      $-\frac{z\left(3x^2+3y^2-2z^2\right)}{2}$

$\mathbb{M}_{3}^{(1,1;a)}(A_{2g})$

$$\begin{bmatrix} 0 & 0 & \frac{3}{7} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{28} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{3}{7} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{28} & 0 & 0 & 0 \\ 0 & \frac{3\sqrt{3}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{84} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{3\sqrt{2}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{84} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{3\sqrt{2}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{84} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{3\sqrt{3}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{84} & 0 & 0 \end{bmatrix}$$

443    symmetry      $\sqrt{15}xyz$

$\mathbb{M}_{3}^{(1,1;a)}(B_{1g})$

$$\begin{bmatrix} \frac{\sqrt{6}i}{14} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{14} & 0 & 0 & -\frac{3i}{56} & 0 & 0 & 0 & \frac{\sqrt{3}i}{56} & 0 & 0 \\ 0 & -\frac{\sqrt{30}i}{14} & 0 & 0 & 0 & \frac{\sqrt{6}i}{14} & 0 & 0 & -\frac{\sqrt{3}i}{56} & 0 & 0 & 0 & \frac{3i}{56} & 0 \\ 0 & 0 & 0 & -\frac{3\sqrt{10}i}{56} & 0 & 0 & -\frac{\sqrt{42}i}{168} & 0 & 0 & 0 & \frac{\sqrt{30}i}{168} & 0 & 0 & 0 \\ -\frac{5\sqrt{3}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{56} & 0 & 0 & \frac{\sqrt{2}i}{56} & 0 & 0 & 0 & \frac{\sqrt{6}i}{56} & 0 & 0 \\ 0 & \frac{\sqrt{15}i}{56} & 0 & 0 & 0 & \frac{5\sqrt{3}i}{56} & 0 & 0 & \frac{\sqrt{6}i}{56} & 0 & 0 & 0 & \frac{\sqrt{2}i}{56} & 0 \\ 0 & 0 & \frac{3\sqrt{10}i}{56} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{168} & 0 & 0 & 0 & -\frac{\sqrt{42}i}{168} \end{bmatrix}$$

444    symmetry      $\frac{\sqrt{15}z(x-y)(x+y)}{2}$

*continued ...*

Table 7

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_3^{(1,1;a)}(B_{2g})$

$$\begin{bmatrix}
\frac{\sqrt6}{14} & 0 & 0 & 0 & \frac{\sqrt{30}}{14} & 0 & 0 & -\frac{3}{56} & 0 & 0 & 0 & -\frac{\sqrt3}{56} & 0 & 0 \\
0 & -\frac{\sqrt{30}}{14} & 0 & 0 & 0 & -\frac{\sqrt6}{14} & 0 & 0 & -\frac{\sqrt3}{56} & 0 & 0 & 0 & -\frac{3}{56} & 0 \\
0 & 0 & 0 & \frac{3\sqrt{10}}{56} & 0 & 0 & -\frac{\sqrt{42}}{168} & 0 & 0 & 0 & -\frac{\sqrt{30}}{168} & 0 & 0 & 0 \\
-\frac{5\sqrt3}{56} & 0 & 0 & 0 & \frac{\sqrt{15}}{56} & 0 & 0 & \frac{\sqrt2}{56} & 0 & 0 & 0 & -\frac{\sqrt6}{56} & 0 & 0 \\
0 & \frac{\sqrt{15}}{56} & 0 & 0 & 0 & -\frac{5\sqrt3}{56} & 0 & 0 & \frac{\sqrt6}{56} & 0 & 0 & 0 & -\frac{\sqrt2}{56} & 0 \\
0 & 0 & \frac{3\sqrt{10}}{56} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{168} & 0 & 0 & 0 & \frac{\sqrt{42}}{168}
\end{bmatrix}$$

**445**    symmetry    $\dfrac{x(2x^2-3y^2-3z^2)}{2}$

$\mathbb{M}_{3,1}^{(1,1;a)}(E_g,1)$

$$\begin{bmatrix}
0 & \frac{3\sqrt2}{28} & 0 & -\frac{3}{14} & 0 & \frac{3\sqrt{10}}{28} & \frac{\sqrt{105}}{224} & 0 & -\frac{3\sqrt5}{224} & 0 & \frac{3\sqrt3}{224} & 0 & -\frac{\sqrt{15}}{224} & 0 \\
\frac{3\sqrt{10}}{28} & 0 & -\frac{3}{14} & 0 & \frac{3\sqrt2}{28} & 0 & 0 & \frac{\sqrt{15}}{224} & 0 & -\frac{3\sqrt3}{224} & 0 & \frac{3\sqrt5}{224} & 0 & -\frac{\sqrt{105}}{224} \\
\frac{3\sqrt{15}}{224} & 0 & -\frac{9\sqrt6}{224} & 0 & \frac{15\sqrt3}{224} & 0 & 0 & -\frac{\sqrt{10}}{112} & 0 & \frac{\sqrt2}{56} & 0 & -\frac{\sqrt{30}}{336} & 0 & 0 \\
0 & -\frac{3}{32} & 0 & \frac{3\sqrt2}{224} & 0 & \frac{15\sqrt5}{224} & -\frac{\sqrt{210}}{336} & 0 & 0 & 0 & \frac{\sqrt6}{112} & 0 & -\frac{\sqrt{30}}{168} & 0 \\
-\frac{15\sqrt5}{224} & 0 & -\frac{3\sqrt2}{224} & 0 & \frac{3}{32} & 0 & 0 & -\frac{\sqrt{30}}{168} & 0 & \frac{\sqrt6}{112} & 0 & 0 & 0 & -\frac{\sqrt{210}}{336} \\
0 & -\frac{15\sqrt3}{224} & 0 & \frac{9\sqrt6}{224} & 0 & -\frac{3\sqrt{15}}{224} & 0 & 0 & -\frac{\sqrt{30}}{336} & 0 & \frac{\sqrt2}{56} & 0 & -\frac{\sqrt{10}}{112} & 0
\end{bmatrix}$$

**446**    symmetry    $\dfrac{y(3x^2-2y^2+3z^2)}{2}$

$\mathbb{M}_{3,2}^{(1,1;a)}(E_g,1)$

$$\begin{bmatrix}
0 & -\frac{3\sqrt2 i}{28} & 0 & -\frac{3i}{14} & 0 & -\frac{3\sqrt{10}i}{28} & \frac{\sqrt{105}i}{224} & 0 & \frac{3\sqrt5 i}{224} & 0 & \frac{3\sqrt3 i}{224} & 0 & \frac{\sqrt{15}i}{224} & 0 \\
\frac{3\sqrt{10}i}{28} & 0 & \frac{3i}{14} & 0 & \frac{3\sqrt2 i}{28} & 0 & 0 & \frac{\sqrt{15}i}{224} & 0 & \frac{3\sqrt3 i}{224} & 0 & \frac{3\sqrt5 i}{224} & 0 & \frac{\sqrt{105}i}{224} \\
-\frac{3\sqrt{15}i}{224} & 0 & -\frac{9\sqrt6 i}{224} & 0 & -\frac{15\sqrt3 i}{224} & 0 & 0 & \frac{\sqrt{10}i}{112} & 0 & \frac{\sqrt2 i}{56} & 0 & \frac{\sqrt{30}i}{336} & 0 & 0 \\
0 & \frac{3i}{32} & 0 & \frac{3\sqrt2 i}{224} & 0 & -\frac{15\sqrt5 i}{224} & -\frac{\sqrt{210}i}{336} & 0 & 0 & 0 & \frac{\sqrt6 i}{112} & 0 & \frac{\sqrt{30}i}{168} & 0 \\
-\frac{15\sqrt5 i}{224} & 0 & \frac{3\sqrt2 i}{224} & 0 & \frac{3i}{32} & 0 & 0 & -\frac{\sqrt{30}i}{168} & 0 & -\frac{\sqrt6 i}{112} & 0 & 0 & 0 & \frac{\sqrt{210}i}{336} \\
0 & -\frac{15\sqrt3 i}{224} & 0 & -\frac{9\sqrt6 i}{224} & 0 & -\frac{3\sqrt{15}i}{224} & 0 & 0 & -\frac{\sqrt{30}i}{336} & 0 & -\frac{\sqrt2 i}{56} & 0 & -\frac{\sqrt{10}i}{112} & 0
\end{bmatrix}$$

**447**    symmetry    $\dfrac{\sqrt{15}x(y-z)(y+z)}{2}$

$\mathbb{M}_{3,1}^{(1,1;a)}(E_g,2)$

$$\begin{bmatrix}
0 & \frac{\sqrt{30}}{28} & 0 & -\frac{\sqrt{15}}{14} & 0 & -\frac{3\sqrt6}{28} & -\frac{3\sqrt7}{224} & 0 & -\frac{5\sqrt3}{224} & 0 & \frac{3\sqrt5}{224} & 0 & \frac{3}{224} & 0 \\
-\frac{3\sqrt6}{28} & 0 & -\frac{\sqrt{15}}{14} & 0 & \frac{\sqrt{30}}{28} & 0 & 0 & -\frac{3}{224} & 0 & -\frac{3\sqrt5}{224} & 0 & \frac{5\sqrt3}{224} & 0 & \frac{3\sqrt7}{224} \\
\frac{15}{224} & 0 & -\frac{9\sqrt{10}}{224} & 0 & -\frac{9\sqrt5}{224} & 0 & 0 & -\frac{5\sqrt6}{336} & 0 & \frac{\sqrt{30}}{168} & 0 & \frac{\sqrt2}{112} & 0 & 0 \\
0 & -\frac{\sqrt{15}}{32} & 0 & \frac{\sqrt{30}}{224} & 0 & -\frac{15\sqrt3}{224} & \frac{\sqrt{14}}{112} & 0 & 0 & 0 & \frac{\sqrt{10}}{112} & 0 & \frac{\sqrt2}{56} & 0 \\
\frac{15\sqrt3}{224} & 0 & -\frac{\sqrt{30}}{224} & 0 & \frac{\sqrt{15}}{32} & 0 & 0 & \frac{\sqrt2}{56} & 0 & \frac{\sqrt{10}}{112} & 0 & 0 & 0 & \frac{\sqrt{14}}{112} \\
0 & \frac{9\sqrt5}{224} & 0 & \frac{9\sqrt{10}}{224} & 0 & -\frac{15}{224} & 0 & 0 & \frac{\sqrt2}{112} & 0 & \frac{\sqrt{30}}{168} & 0 & -\frac{5\sqrt6}{336} & 0
\end{bmatrix}$$

**448**    symmetry    $-\dfrac{\sqrt{15}y(x-z)(x+z)}{2}$

*continued ...*

Table 7

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}^{(1,1;a)}_{3,2}(E_g,2)$

$$\begin{bmatrix} 0 & -\frac{\sqrt{30}i}{28} & 0 & -\frac{\sqrt{15}i}{14} & 0 & \frac{3\sqrt{6}i}{28} & -\frac{3\sqrt{7}i}{224} & 0 & \frac{5\sqrt{3}i}{224} & 0 & \frac{3\sqrt{5}i}{224} & 0 & -\frac{3i}{224} & 0 \\[4pt] -\frac{3\sqrt{6}i}{28} & 0 & \frac{\sqrt{15}i}{14} & 0 & \frac{\sqrt{30}i}{28} & 0 & 0 & -\frac{3i}{224} & 0 & \frac{3\sqrt{5}i}{224} & 0 & \frac{5\sqrt{3}i}{224} & 0 & -\frac{3\sqrt{7}i}{224} \\[4pt] -\frac{15i}{224} & 0 & -\frac{9\sqrt{10}i}{224} & 0 & \frac{9\sqrt{5}i}{224} & 0 & 0 & \frac{5\sqrt{6}i}{336} & 0 & \frac{\sqrt{30}i}{168} & 0 & -\frac{\sqrt{2}i}{112} & 0 & 0 \\[4pt] 0 & \frac{\sqrt{15}i}{32} & 0 & \frac{\sqrt{30}i}{224} & 0 & \frac{15\sqrt{3}i}{224} & \frac{\sqrt{14}i}{112} & 0 & 0 & 0 & \frac{\sqrt{10}i}{112} & 0 & -\frac{\sqrt{2}i}{56} & 0 \\[4pt] \frac{15\sqrt{3}i}{224} & 0 & \frac{\sqrt{30}i}{224} & 0 & \frac{\sqrt{15}i}{32} & 0 & 0 & \frac{\sqrt{2}i}{56} & 0 & -\frac{\sqrt{10}i}{112} & 0 & 0 & 0 & -\frac{\sqrt{14}i}{112} \\[4pt] 0 & \frac{9\sqrt{5}i}{224} & 0 & -\frac{9\sqrt{10}i}{224} & 0 & -\frac{15i}{224} & 0 & 0 & \frac{\sqrt{2}i}{112} & 0 & -\frac{\sqrt{30}i}{168} & 0 & -\frac{5\sqrt{6}i}{336} & 0 \end{bmatrix}$$

bra: $= \langle\frac{3}{2},\frac{3}{2};d|, \langle\frac{3}{2},\frac{1}{2};d|, \langle\frac{3}{2},-\frac{1}{2};d|, \langle\frac{3}{2},-\frac{3}{2};d|, \langle\frac{5}{2},\frac{5}{2};d|, \langle\frac{5}{2},\frac{3}{2};d|, \langle\frac{5}{2},\frac{1}{2};d|, \langle\frac{5}{2},-\frac{1}{2};d|, \langle\frac{5}{2},-\frac{3}{2};d|, \langle\frac{5}{2},-\frac{5}{2};d|$

ket: $= |\frac{3}{2},\frac{3}{2};d\rangle, |\frac{3}{2},\frac{1}{2};d\rangle, |\frac{3}{2},-\frac{1}{2};d\rangle, |\frac{3}{2},-\frac{3}{2};d\rangle, |\frac{5}{2},\frac{5}{2};d\rangle, |\frac{5}{2},\frac{3}{2};d\rangle, |\frac{5}{2},\frac{1}{2};d\rangle, |\frac{5}{2},-\frac{1}{2};d\rangle, |\frac{5}{2},-\frac{3}{2};d\rangle, |\frac{5}{2},-\frac{5}{2};d\rangle$

Table 8: (d,d) block.

| No. | multipole | matrix |
|---|---|---|
| 449 | symmetry | 1 |

$\mathbb{Q}^{(a)}_0(A_{1g})$

$$\begin{bmatrix} \frac{\sqrt{10}}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{10}}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{10}}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{10}}{10} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{10} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{10} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{10} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{10} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{10} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{10} \end{bmatrix}$$

| 450 | symmetry | $-\frac{x^2}{2} - \frac{y^2}{2} + z^2$ |

*continued ...*

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_2^{(a)}(A_{1g})$

$$\begin{bmatrix}
-\frac{\sqrt{7}}{10} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{7}}{35} & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{7}}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}}{70} & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{7}}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{70} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{7}}{10} & 0 & 0 & 0 & 0 & \frac{3\sqrt{7}}{35} & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{7} & 0 & 0 & 0 & 0 & 0 \\
-\frac{3\sqrt{7}}{35} & 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{35} & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{42}}{70} & 0 & 0 & 0 & 0 & \frac{4\sqrt{7}}{35} & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{42}}{70} & 0 & 0 & 0 & 0 & \frac{4\sqrt{7}}{35} & 0 & 0 \\
0 & 0 & 0 & \frac{3\sqrt{7}}{35} & 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{35} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{7}
\end{bmatrix}$$

| 451 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |
|---|---|---|

$\mathbb{Q}_2^{(a)}(B_{1g})$

$$\begin{bmatrix}
0 & 0 & -\frac{\sqrt{7}}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}}{70} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{7}}{10} & \frac{\sqrt{35}}{35} & 0 & 0 & 0 & -\frac{2\sqrt{7}}{35} & 0 \\
-\frac{\sqrt{7}}{10} & 0 & 0 & 0 & 0 & \frac{2\sqrt{7}}{35} & 0 & 0 & 0 & -\frac{\sqrt{35}}{35} \\
0 & -\frac{\sqrt{7}}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{70} & 0 & 0 & 0 \\
0 & \frac{\sqrt{35}}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{70} & 0 & 0 & 0 \\
0 & 0 & \frac{2\sqrt{7}}{35} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{42}}{70} & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{42}}{70} & -\frac{\sqrt{210}}{70} & 0 & 0 & 0 & -\frac{3\sqrt{42}}{70} & 0 \\
-\frac{\sqrt{42}}{70} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{42}}{70} & 0 & 0 & 0 & -\frac{\sqrt{210}}{70} \\
0 & -\frac{2\sqrt{7}}{35} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{42}}{70} & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{35}}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{70} & 0 & 0
\end{bmatrix}$$

| 452 | symmetry | $\sqrt{3}xy$ |
|---|---|---|

*continued …*

Table 8

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_2^{(a)}(B_{2g})$

$$
\begin{bmatrix}
0 & 0 & \frac{\sqrt{7}i}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{70} & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{7}i}{10} & \frac{\sqrt{35}i}{35} & 0 & 0 & 0 & \frac{2\sqrt{7}i}{35} & 0 \\
-\frac{\sqrt{7}i}{10} & 0 & 0 & 0 & 0 & \frac{2\sqrt{7}i}{35} & 0 & 0 & 0 & \frac{\sqrt{35}i}{35} \\
0 & -\frac{\sqrt{7}i}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{70} & 0 & 0 & 0 \\
0 & -\frac{\sqrt{35}i}{35} & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{70} & 0 & 0 & 0 \\
0 & 0 & -\frac{2\sqrt{7}i}{35} & 0 & 0 & 0 & 0 & \frac{3\sqrt{42}i}{70} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{42}i}{70} & -\frac{\sqrt{210}i}{70} & 0 & 0 & 0 & \frac{3\sqrt{42}i}{70} & 0 \\
-\frac{\sqrt{42}i}{70} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{42}i}{70} & 0 & 0 & 0 & \frac{\sqrt{210}i}{70} \\
0 & -\frac{2\sqrt{7}i}{35} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{42}i}{70} & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{35}i}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{70} & 0 & 0
\end{bmatrix}
$$

| 453 | symmetry | $\sqrt{3}yz$ |
|---|---|---|

$\mathbb{Q}_{2,1}^{(a)}(E_g)$

$$
\begin{bmatrix}
0 & \frac{\sqrt{7}i}{10} & 0 & 0 & \frac{\sqrt{105}i}{70} & 0 & \frac{3\sqrt{42}i}{140} & 0 & 0 & 0 \\
-\frac{\sqrt{7}i}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{70} & 0 & \frac{\sqrt{14}i}{28} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{7}i}{10} & 0 & 0 & -\frac{\sqrt{14}i}{28} & 0 & \frac{\sqrt{7}i}{70} & 0 \\
0 & 0 & \frac{\sqrt{7}i}{10} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{42}i}{140} & 0 & -\frac{\sqrt{105}i}{70} \\
-\frac{\sqrt{105}i}{70} & 0 & 0 & 0 & 0 & \frac{\sqrt{105}i}{35} & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{7}i}{70} & 0 & 0 & -\frac{\sqrt{105}i}{35} & 0 & \frac{\sqrt{42}i}{35} & 0 & 0 & 0 \\
-\frac{3\sqrt{42}i}{140} & 0 & \frac{\sqrt{14}i}{28} & 0 & 0 & -\frac{\sqrt{42}i}{35} & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{14}i}{28} & 0 & \frac{3\sqrt{42}i}{140} & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}i}{35} & 0 \\
0 & 0 & -\frac{\sqrt{7}i}{70} & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{35} & 0 & -\frac{\sqrt{105}i}{35} \\
0 & 0 & 0 & \frac{\sqrt{105}i}{70} & 0 & 0 & 0 & 0 & \frac{\sqrt{105}i}{35} & 0
\end{bmatrix}
$$

| 454 | symmetry | $\sqrt{3}xz$ |
|---|---|---|

*continued ...*

99

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{2,2}^{(a)}(E_g)$

$$\begin{bmatrix}
0 & -\frac{\sqrt{7}}{10} & 0 & 0 & \frac{\sqrt{105}}{70} & 0 & -\frac{3\sqrt{42}}{140} & 0 & 0 & 0 \\
-\frac{\sqrt{7}}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{70} & 0 & -\frac{\sqrt{14}}{28} & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{7}}{10} & 0 & 0 & -\frac{\sqrt{14}}{28} & 0 & -\frac{\sqrt{7}}{70} & 0 \\
0 & 0 & \frac{\sqrt{7}}{10} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{42}}{140} & 0 & \frac{\sqrt{105}}{70} \\
\frac{\sqrt{105}}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}}{35} & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{7}}{70} & 0 & 0 & -\frac{\sqrt{105}}{35} & 0 & -\frac{\sqrt{42}}{35} & 0 & 0 & 0 \\
-\frac{3\sqrt{42}}{140} & 0 & -\frac{\sqrt{14}}{28} & 0 & 0 & -\frac{\sqrt{42}}{35} & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{14}}{28} & 0 & -\frac{3\sqrt{42}}{140} & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{35} & 0 \\
0 & 0 & -\frac{\sqrt{7}}{70} & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{35} & 0 & \frac{\sqrt{105}}{35} \\
0 & 0 & 0 & \frac{\sqrt{105}}{70} & 0 & 0 & 0 & 0 & \frac{\sqrt{105}}{35} & 0
\end{bmatrix}$$

| 455 | symmetry | $\dfrac{\sqrt{21}\left(x^4-3x^2y^2-3x^2z^2+y^4-3y^2z^2+z^4\right)}{6}$ |

$\mathbb{Q}_4^{(a)}(A_{1g},1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{30} & 0 & 0 & 0 & \frac{\sqrt{3}}{6} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{10} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{10} & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{6} & 0 & 0 & 0 & -\frac{\sqrt{15}}{30} & 0 \\
0 & 0 & 0 & -\frac{\sqrt{3}}{6} & \frac{\sqrt{15}}{60} & 0 & 0 & 0 & \frac{\sqrt{3}}{12} & 0 \\
\frac{\sqrt{15}}{30} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{20} & 0 & 0 & 0 & \frac{\sqrt{3}}{12} \\
0 & -\frac{\sqrt{10}}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{30} & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{10}}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{30} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{15}}{30} & \frac{\sqrt{3}}{12} & 0 & 0 & 0 & -\frac{\sqrt{15}}{20} & 0 \\
\frac{\sqrt{3}}{6} & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{12} & 0 & 0 & 0 & \frac{\sqrt{15}}{60}
\end{bmatrix}$$

| 456 | symmetry | $-\dfrac{\sqrt{15}\left(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4\right)}{12}$ |

*continued …*

Table 8

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_4^{(a)}(A_{1g},2)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}}{42} & 0 & 0 & 0 & -\frac{\sqrt{105}}{30} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{14} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{14} & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{105}}{30} & 0 & 0 & 0 & -\frac{\sqrt{21}}{42} & 0 \\
0 & 0 & 0 & \frac{\sqrt{105}}{30} & \frac{\sqrt{21}}{84} & 0 & 0 & 0 & -\frac{\sqrt{105}}{60} & 0 \\
\frac{\sqrt{21}}{42} & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}}{28} & 0 & 0 & 0 & -\frac{\sqrt{105}}{60} \\
0 & -\frac{\sqrt{14}}{14} & 0 & 0 & 0 & 0 & \frac{\sqrt{21}}{42} & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{14}}{14} & 0 & 0 & 0 & 0 & \frac{\sqrt{21}}{42} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{21}}{42} & -\frac{\sqrt{105}}{60} & 0 & 0 & 0 & -\frac{\sqrt{21}}{28} & 0 \\
-\frac{\sqrt{105}}{30} & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}}{60} & 0 & 0 & 0 & \frac{\sqrt{21}}{84}
\end{pmatrix}$$

| 457 | symmetry | $\dfrac{\sqrt{35}xy(x-y)(x+y)}{2}$ |

$\mathbb{Q}_4^{(a)}(A_{2g})$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}i}{5} \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{5}i}{5} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{5}i}{5} & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}i}{10} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}i}{10} \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{5}i}{10} & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{5}i}{5} & 0 & 0 & 0 & 0 & \frac{\sqrt{5}i}{10} & 0 & 0 & 0 & 0
\end{pmatrix}$$

| 458 | symmetry | $\dfrac{\sqrt{5}(x-y)(x+y)\left(x^2+y^2-6z^2\right)}{4}$ |

Table 8

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_4^{(a)}(B_{1g})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{14} & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{105}}{70} & 0 & 0 & 0 & \frac{\sqrt{21}}{14} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}}{14} & 0 & 0 & 0 & -\frac{\sqrt{105}}{70} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{14} & 0 & 0 & 0 \\
0 & \frac{\sqrt{105}}{70} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{70}}{140} & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{21}}{14} & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{28} & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{14}}{14} & -\frac{3\sqrt{70}}{140} & 0 & 0 & 0 & \frac{\sqrt{14}}{28} & 0 \\
-\frac{\sqrt{14}}{14} & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{28} & 0 & 0 & 0 & -\frac{3\sqrt{70}}{140} \\
0 & \frac{\sqrt{21}}{14} & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{28} & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{105}}{70} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{70}}{140} & 0 & 0 \\
\end{bmatrix}$$

| 459 | symmetry | $-\frac{\sqrt{5}xy\left(x^2+y^2-6z^2\right)}{2}$ |

$\mathbb{Q}_4^{(a)}(B_{2g})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}i}{14} & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{105}i}{70} & 0 & 0 & 0 & \frac{\sqrt{21}i}{14} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}i}{14} & 0 & 0 & 0 & -\frac{\sqrt{105}i}{70} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}i}{14} & 0 & 0 & 0 \\
0 & \frac{\sqrt{105}i}{70} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{70}i}{140} & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{21}i}{14} & 0 & 0 & 0 & 0 & \frac{\sqrt{14}i}{28} & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{14}i}{14} & \frac{3\sqrt{70}i}{140} & 0 & 0 & 0 & \frac{\sqrt{14}i}{28} & 0 \\
\frac{\sqrt{14}i}{14} & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}i}{28} & 0 & 0 & 0 & -\frac{3\sqrt{70}i}{140} \\
0 & -\frac{\sqrt{21}i}{14} & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}i}{28} & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{105}i}{70} & 0 & 0 & 0 & 0 & \frac{3\sqrt{70}i}{140} & 0 & 0 \\
\end{bmatrix}$$

| 460 | symmetry | $\frac{\sqrt{35}yz(y-z)(y+z)}{2}$ |

Table 8

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{4,1}^{(a)}(E_g,1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & \frac{\sqrt{5}i}{40} & 0 & \frac{\sqrt{2}i}{8} & 0 & \frac{i}{8} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{8} & 0 & -\frac{\sqrt{6}i}{8} & 0 & -\frac{\sqrt{15}i}{40} \\
0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{40} & 0 & \frac{\sqrt{6}i}{8} & 0 & \frac{\sqrt{3}i}{8} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{i}{8} & 0 & -\frac{\sqrt{2}i}{8} & 0 & -\frac{\sqrt{5}i}{40} \\
-\frac{\sqrt{5}i}{40} & 0 & -\frac{\sqrt{15}i}{40} & 0 & 0 & \frac{\sqrt{5}i}{20} & 0 & \frac{\sqrt{10}i}{40} & 0 & 0 \\
0 & \frac{\sqrt{3}i}{8} & 0 & \frac{i}{8} & -\frac{\sqrt{5}i}{20} & 0 & -\frac{\sqrt{2}i}{8} & 0 & 0 & 0 \\
-\frac{\sqrt{2}i}{8} & 0 & -\frac{\sqrt{6}i}{8} & 0 & 0 & \frac{\sqrt{2}i}{8} & 0 & 0 & 0 & -\frac{\sqrt{10}i}{40} \\
0 & \frac{\sqrt{6}i}{8} & 0 & \frac{\sqrt{2}i}{8} & -\frac{\sqrt{10}i}{40} & 0 & 0 & 0 & \frac{\sqrt{2}i}{8} & 0 \\
-\frac{i}{8} & 0 & -\frac{\sqrt{3}i}{8} & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{8} & 0 & -\frac{\sqrt{5}i}{20} \\
0 & \frac{\sqrt{15}i}{40} & 0 & \frac{\sqrt{5}i}{40} & 0 & 0 & \frac{\sqrt{10}i}{40} & 0 & \frac{\sqrt{5}i}{20} & 0
\end{bmatrix}$$

| 461 | symmetry | $\frac{\sqrt{35}xz(x-z)(x+z)}{2}$ |
|---|---|---|

$\mathbb{Q}_{4,2}^{(a)}(E_g,1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & \frac{\sqrt{5}}{40} & 0 & -\frac{\sqrt{2}}{8} & 0 & \frac{1}{8} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{8} & 0 & \frac{\sqrt{6}}{8} & 0 & -\frac{\sqrt{15}}{40} \\
0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{40} & 0 & \frac{\sqrt{6}}{8} & 0 & -\frac{\sqrt{3}}{8} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{1}{8} & 0 & -\frac{\sqrt{2}}{8} & 0 & \frac{\sqrt{5}}{40} \\
\frac{\sqrt{5}}{40} & 0 & -\frac{\sqrt{15}}{40} & 0 & 0 & -\frac{\sqrt{5}}{20} & 0 & \frac{\sqrt{10}}{40} & 0 & 0 \\
0 & -\frac{\sqrt{3}}{8} & 0 & \frac{1}{8} & -\frac{\sqrt{5}}{20} & 0 & \frac{\sqrt{2}}{8} & 0 & 0 & 0 \\
-\frac{\sqrt{2}}{8} & 0 & \frac{\sqrt{6}}{8} & 0 & 0 & \frac{\sqrt{2}}{8} & 0 & 0 & 0 & -\frac{\sqrt{10}}{40} \\
0 & \frac{\sqrt{6}}{8} & 0 & -\frac{\sqrt{2}}{8} & \frac{\sqrt{10}}{40} & 0 & 0 & 0 & -\frac{\sqrt{2}}{8} & 0 \\
\frac{1}{8} & 0 & -\frac{\sqrt{3}}{8} & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{8} & 0 & \frac{\sqrt{5}}{20} \\
0 & -\frac{\sqrt{15}}{40} & 0 & \frac{\sqrt{5}}{40} & 0 & 0 & -\frac{\sqrt{10}}{40} & 0 & \frac{\sqrt{5}}{20} & 0
\end{bmatrix}$$

| 462 | symmetry | $\frac{\sqrt{5}yz(6x^2-y^2-z^2)}{2}$ |
|---|---|---|

*continued ...*

Table 8

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{4,1}^{(a)}(E_g,2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & \frac{\sqrt{35}i}{280} & 0 & \frac{\sqrt{14}i}{56} & 0 & -\frac{\sqrt{7}i}{8} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{56} & 0 & -\frac{\sqrt{42}i}{56} & 0 & \frac{\sqrt{105}i}{40} \\
0 & 0 & 0 & 0 & -\frac{\sqrt{105}i}{40} & 0 & \frac{\sqrt{42}i}{56} & 0 & \frac{\sqrt{21}i}{56} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{8} & 0 & -\frac{\sqrt{14}i}{56} & 0 & -\frac{\sqrt{35}i}{280} \\
-\frac{\sqrt{35}i}{280} & 0 & \frac{\sqrt{105}i}{40} & 0 & 0 & \frac{\sqrt{35}i}{140} & 0 & -\frac{\sqrt{70}i}{40} & 0 & 0 \\
0 & \frac{\sqrt{21}i}{56} & 0 & -\frac{\sqrt{7}i}{8} & -\frac{\sqrt{35}i}{140} & 0 & -\frac{\sqrt{14}i}{56} & 0 & 0 & 0 \\
-\frac{\sqrt{14}i}{56} & 0 & -\frac{\sqrt{42}i}{56} & 0 & 0 & \frac{\sqrt{14}i}{56} & 0 & 0 & 0 & \frac{\sqrt{70}i}{40} \\
0 & \frac{\sqrt{42}i}{56} & 0 & \frac{\sqrt{14}i}{56} & \frac{\sqrt{70}i}{40} & 0 & 0 & 0 & \frac{\sqrt{14}i}{56} & 0 \\
\frac{\sqrt{7}i}{8} & 0 & -\frac{\sqrt{21}i}{56} & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}i}{56} & 0 & -\frac{\sqrt{35}i}{140} \\
0 & -\frac{\sqrt{105}i}{40} & 0 & \frac{\sqrt{35}i}{280} & 0 & 0 & -\frac{\sqrt{70}i}{40} & 0 & \frac{\sqrt{35}i}{140} & 0
\end{bmatrix}$$

| 463 | symmetry | $-\frac{\sqrt{5}xz(x^2-6y^2+z^2)}{2}$ |

$\mathbb{Q}_{4,2}^{(a)}(E_g,2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & \frac{\sqrt{35}}{280} & 0 & -\frac{\sqrt{14}}{56} & 0 & -\frac{\sqrt{7}}{8} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}}{56} & 0 & \frac{\sqrt{42}}{56} & 0 & \frac{\sqrt{105}}{40} \\
0 & 0 & 0 & 0 & \frac{\sqrt{105}}{40} & 0 & \frac{\sqrt{42}}{56} & 0 & -\frac{\sqrt{21}}{56} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{8} & 0 & -\frac{\sqrt{14}}{56} & 0 & \frac{\sqrt{35}}{280} \\
\frac{\sqrt{35}}{280} & 0 & \frac{\sqrt{105}}{40} & 0 & 0 & -\frac{\sqrt{35}}{140} & 0 & -\frac{\sqrt{70}}{40} & 0 & 0 \\
0 & -\frac{\sqrt{21}}{56} & 0 & -\frac{\sqrt{7}}{8} & -\frac{\sqrt{35}}{140} & 0 & \frac{\sqrt{14}}{56} & 0 & 0 & 0 \\
-\frac{\sqrt{14}}{56} & 0 & \frac{\sqrt{42}}{56} & 0 & 0 & \frac{\sqrt{14}}{56} & 0 & 0 & 0 & \frac{\sqrt{70}}{40} \\
0 & \frac{\sqrt{42}}{56} & 0 & -\frac{\sqrt{14}}{56} & -\frac{\sqrt{70}}{40} & 0 & 0 & 0 & -\frac{\sqrt{14}}{56} & 0 \\
-\frac{\sqrt{7}}{8} & 0 & -\frac{\sqrt{21}}{56} & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{56} & 0 & \frac{\sqrt{35}}{140} \\
0 & \frac{\sqrt{105}}{40} & 0 & \frac{\sqrt{35}}{280} & 0 & 0 & \frac{\sqrt{70}}{40} & 0 & \frac{\sqrt{35}}{140} & 0
\end{bmatrix}$$

| 464 | symmetry | $-\frac{x^2}{2}-\frac{y^2}{2}+z^2$ |

*continued ...*

Table 8

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_2^{(1,-1;a)}(A_{1g})$

$$\begin{bmatrix}
-\frac{\sqrt{30}}{50} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{30}}{50} & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{30}}{50} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{5}}{50} & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{30}}{50} & 0 & 0 & 0 & 0 & \frac{3\sqrt{5}}{50} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{30}}{50} & 0 & 0 & 0 & 0 & \frac{3\sqrt{30}}{50} & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{30}}{15} & 0 & 0 & 0 & 0 & 0 \\
-\frac{3\sqrt{30}}{50} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{75} & 0 & 0 & 0 & 0 \\
0 & -\frac{3\sqrt{5}}{50} & 0 & 0 & 0 & 0 & -\frac{4\sqrt{30}}{75} & 0 & 0 & 0 \\
0 & 0 & \frac{3\sqrt{5}}{50} & 0 & 0 & 0 & 0 & -\frac{4\sqrt{30}}{75} & 0 & 0 \\
0 & 0 & 0 & \frac{3\sqrt{30}}{50} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{75} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{15}
\end{bmatrix}$$

| 465 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |
|---|---|---|

$\mathbb{Q}_2^{(1,-1;a)}(B_{1g})$

$$\begin{bmatrix}
0 & 0 & -\frac{\sqrt{30}}{50} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{5}}{50} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{30}}{50} & \frac{\sqrt{6}}{10} & 0 & 0 & 0 & -\frac{\sqrt{30}}{25} & 0 \\
-\frac{\sqrt{30}}{50} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{25} & 0 & 0 & 0 & -\frac{\sqrt{6}}{10} \\
0 & -\frac{\sqrt{30}}{50} & 0 & 0 & 0 & 0 & \frac{3\sqrt{5}}{50} & 0 & 0 & 0 \\
0 & \frac{\sqrt{6}}{10} & 0 & 0 & 0 & 0 & \frac{1}{5} & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{30}}{25} & 0 & 0 & 0 & 0 & \frac{3\sqrt{5}}{25} & 0 & 0 \\
0 & 0 & 0 & \frac{3\sqrt{5}}{50} & \frac{1}{5} & 0 & 0 & 0 & \frac{3\sqrt{5}}{25} & 0 \\
-\frac{3\sqrt{5}}{50} & 0 & 0 & 0 & 0 & \frac{3\sqrt{5}}{25} & 0 & 0 & 0 & \frac{1}{5} \\
0 & -\frac{\sqrt{30}}{25} & 0 & 0 & 0 & 0 & \frac{3\sqrt{5}}{25} & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{6}}{10} & 0 & 0 & 0 & 0 & \frac{1}{5} & 0 & 0
\end{bmatrix}$$

| 466 | symmetry | $\sqrt{3}xy$ |
|---|---|---|

*continued ...*

Table 8

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_2^{(1,-1;a)}(B_{2g})$

$$\begin{bmatrix}
0 & 0 & \frac{\sqrt{30}i}{50} & 0 & 0 & 0 & 0 & \frac{3\sqrt{5}i}{50} & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{30}i}{50} & \frac{\sqrt{6}i}{10} & 0 & 0 & 0 & \frac{\sqrt{30}i}{25} & 0 \\
-\frac{\sqrt{30}i}{50} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{25} & 0 & 0 & 0 & \frac{\sqrt{6}i}{10} \\
0 & -\frac{\sqrt{30}i}{50} & 0 & 0 & 0 & 0 & \frac{3\sqrt{5}i}{50} & 0 & 0 & 0 \\
0 & -\frac{\sqrt{6}i}{10} & 0 & 0 & 0 & 0 & -\frac{i}{5} & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{30}i}{25} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{5}i}{25} & 0 & 0 \\
0 & 0 & 0 & -\frac{3\sqrt{5}i}{50} & \frac{i}{5} & 0 & 0 & 0 & -\frac{3\sqrt{5}i}{25} & 0 \\
-\frac{3\sqrt{5}i}{50} & 0 & 0 & 0 & 0 & \frac{3\sqrt{5}i}{25} & 0 & 0 & 0 & -\frac{i}{5} \\
0 & -\frac{\sqrt{30}i}{25} & 0 & 0 & 0 & 0 & \frac{3\sqrt{5}i}{25} & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{6}i}{10} & 0 & 0 & 0 & 0 & \frac{i}{5} & 0 & 0
\end{bmatrix}$$

| 467 | symmetry | $\sqrt{3}yz$ |
|---|---|---|

$\mathbb{Q}_{2,1}^{(1,-1;a)}(E_g)$

$$\begin{bmatrix}
0 & \frac{\sqrt{30}i}{50} & 0 & 0 & \frac{3\sqrt{2}i}{20} & 0 & \frac{9\sqrt{5}i}{100} & 0 & 0 & 0 \\
-\frac{\sqrt{30}i}{50} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{100} & 0 & \frac{\sqrt{15}i}{20} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{30}i}{50} & 0 & 0 & -\frac{\sqrt{15}i}{20} & 0 & \frac{\sqrt{30}i}{100} & 0 \\
0 & 0 & \frac{\sqrt{30}i}{50} & 0 & 0 & 0 & 0 & -\frac{9\sqrt{5}i}{100} & 0 & -\frac{3\sqrt{2}i}{20} \\
-\frac{3\sqrt{2}i}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{5} & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{30}i}{100} & 0 & 0 & \frac{\sqrt{2}i}{5} & 0 & -\frac{2\sqrt{5}i}{25} & 0 & 0 & 0 \\
-\frac{9\sqrt{5}i}{100} & 0 & \frac{\sqrt{15}i}{20} & 0 & 0 & \frac{2\sqrt{5}i}{25} & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{15}i}{20} & 0 & \frac{9\sqrt{5}i}{100} & 0 & 0 & 0 & 0 & \frac{2\sqrt{5}i}{25} & 0 \\
0 & 0 & -\frac{\sqrt{30}i}{100} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{5}i}{25} & 0 & \frac{\sqrt{2}i}{5} \\
0 & 0 & 0 & \frac{3\sqrt{2}i}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{5} & 0
\end{bmatrix}$$

| 468 | symmetry | $\sqrt{3}xz$ |
|---|---|---|

*continued …*

Table 8

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{Q}_{2,2}^{(1,-1;a)}(E_g)$

$$\begin{pmatrix} 0 & -\frac{\sqrt{30}}{50} & 0 & 0 & \frac{3\sqrt{2}}{20} & 0 & -\frac{9\sqrt{5}}{100} & 0 & 0 & 0 \\ -\frac{\sqrt{30}}{50} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{100} & 0 & -\frac{\sqrt{15}}{20} & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{30}}{50} & 0 & 0 & -\frac{\sqrt{15}}{20} & 0 & -\frac{\sqrt{30}}{100} & 0 \\ 0 & 0 & \frac{\sqrt{30}}{50} & 0 & 0 & 0 & 0 & -\frac{9\sqrt{5}}{100} & 0 & \frac{3\sqrt{2}}{20} \\ \frac{3\sqrt{2}}{20} & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{5} & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{30}}{100} & 0 & 0 & \frac{\sqrt{2}}{5} & 0 & \frac{2\sqrt{5}}{25} & 0 & 0 & 0 \\ -\frac{9\sqrt{5}}{100} & 0 & -\frac{\sqrt{15}}{20} & 0 & 0 & \frac{2\sqrt{5}}{25} & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{15}}{20} & 0 & -\frac{9\sqrt{5}}{100} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{5}}{25} & 0 \\ 0 & 0 & -\frac{\sqrt{30}}{100} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{5}}{25} & 0 & -\frac{\sqrt{2}}{5} \\ 0 & 0 & 0 & \frac{3\sqrt{2}}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{5} & 0 \end{pmatrix}$$

| 469 | symmetry | $\dfrac{\sqrt{21}\left(x^4-3x^2y^2-3x^2z^2+y^4-3y^2z^2+z^4\right)}{6}$ |

$\mathbb{Q}_{4}^{(1,-1;a)}(A_{1g},1)$

$$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{60} & 0 & 0 & 0 & \frac{\sqrt{3}}{12} \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{20} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{20} & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{12} & 0 & 0 & 0 & -\frac{\sqrt{15}}{60} & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{3}}{12} & -\frac{\sqrt{15}}{30} & 0 & 0 & 0 & -\frac{\sqrt{3}}{6} & 0 \\ \frac{\sqrt{15}}{60} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{10} & 0 & 0 & 0 & -\frac{\sqrt{3}}{6} \\ 0 & -\frac{\sqrt{10}}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{15} & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{10}}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{15} & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{15}}{60} & -\frac{\sqrt{3}}{6} & 0 & 0 & 0 & \frac{\sqrt{15}}{10} & 0 \\ \frac{\sqrt{3}}{12} & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{6} & 0 & 0 & 0 & -\frac{\sqrt{15}}{30} \end{pmatrix}$$

| 470 | symmetry | $-\dfrac{\sqrt{15}\left(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4\right)}{12}$ |

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{Q}_4^{(1,-1;a)}(A_{1g},2) = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}}{84} & 0 & 0 & 0 & -\frac{\sqrt{105}}{60} \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{28} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{28} & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{105}}{60} & 0 & 0 & 0 & -\frac{\sqrt{21}}{84} & 0 \\ 0 & 0 & 0 & \frac{\sqrt{105}}{60} & -\frac{\sqrt{21}}{42} & 0 & 0 & 0 & \frac{\sqrt{105}}{30} & 0 \\ \frac{\sqrt{21}}{84} & 0 & 0 & 0 & 0 & \frac{\sqrt{21}}{14} & 0 & 0 & 0 & \frac{\sqrt{105}}{30} \\ 0 & -\frac{\sqrt{14}}{28} & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}}{21} & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{14}}{28} & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}}{21} & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{21}}{84} & \frac{\sqrt{105}}{30} & 0 & 0 & 0 & \frac{\sqrt{21}}{14} & 0 \\ -\frac{\sqrt{105}}{60} & 0 & 0 & 0 & 0 & \frac{\sqrt{105}}{30} & 0 & 0 & 0 & -\frac{\sqrt{21}}{42} \end{bmatrix}$$

| 471 | symmetry | $\frac{\sqrt{35}xy(x-y)(x+y)}{2}$ |

$$\mathbb{Q}_4^{(1,-1;a)}(A_{2g}) = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}i}{10} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{5}i}{10} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{5}i}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{5}i}{5} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}i}{5} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{5}i}{5} & 0 & 0 & 0 & 0 & 0 \\ \frac{\sqrt{5}i}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}i}{5} & 0 & 0 & 0 & 0 \end{bmatrix}$$

| 472 | symmetry | $\frac{\sqrt{5}(x-y)(x+y)\left(x^2+y^2-6z^2\right)}{4}$ |

*continued …*

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_4^{(1,-1;a)}(B_{1g})$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{28} & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{105}}{140} & 0 & 0 & 0 & \frac{\sqrt{21}}{28} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}}{28} & 0 & 0 & 0 & -\frac{\sqrt{105}}{140} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{28} & 0 & 0 & 0 \\
0 & \frac{\sqrt{105}}{140} & 0 & 0 & 0 & 0 & \frac{3\sqrt{70}}{70} & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{21}}{28} & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{14} & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{14}}{28} & \frac{3\sqrt{70}}{70} & 0 & 0 & 0 & -\frac{\sqrt{14}}{14} & 0 \\
-\frac{\sqrt{14}}{28} & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{14} & 0 & 0 & 0 & \frac{3\sqrt{70}}{70} \\
0 & \frac{\sqrt{21}}{28} & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{14} & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{105}}{140} & 0 & 0 & 0 & 0 & \frac{3\sqrt{70}}{70} & 0 & 0
\end{pmatrix}$$

| 473 | symmetry | $-\frac{\sqrt{5}xy\left(x^2+y^2-6z^2\right)}{2}$ |
|---|---|---|

$\mathbb{Q}_4^{(1,-1;a)}(B_{2g})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}i}{28} & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{105}i}{140} & 0 & 0 & 0 & \frac{\sqrt{21}i}{28} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{105}i}{140} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}i}{28} & 0 & 0 & 0 \\
0 & \frac{\sqrt{105}i}{140} & 0 & 0 & 0 & 0 & \frac{3\sqrt{70}i}{70} & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{21}i}{28} & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}i}{14} & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{14}i}{28} & -\frac{3\sqrt{70}i}{70} & 0 & 0 & 0 & -\frac{\sqrt{14}i}{14} & 0 \\
\frac{\sqrt{14}i}{28} & 0 & 0 & 0 & 0 & \frac{\sqrt{14}i}{14} & 0 & 0 & 0 & \frac{3\sqrt{70}i}{70} \\
0 & -\frac{\sqrt{21}i}{28} & 0 & 0 & 0 & 0 & \frac{\sqrt{14}i}{14} & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{105}i}{140} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{70}i}{70} & 0 & 0
\end{bmatrix}$$

| 474 | symmetry | $\frac{\sqrt{35}yz(y-z)(y+z)}{2}$ |
|---|---|---|

*continued ...*

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{4,1}^{(1,-1;a)}(E_g,1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & \frac{\sqrt{5}i}{80} & 0 & \frac{\sqrt{2}i}{16} & 0 & \frac{i}{16} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{16} & 0 & -\frac{\sqrt{6}i}{16} & 0 & -\frac{\sqrt{15}i}{80} \\
0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{80} & 0 & \frac{\sqrt{6}i}{16} & 0 & \frac{\sqrt{3}i}{16} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{i}{16} & 0 & -\frac{\sqrt{2}i}{16} & 0 & -\frac{\sqrt{5}i}{80} \\
-\frac{\sqrt{5}i}{80} & 0 & -\frac{\sqrt{15}i}{80} & 0 & 0 & -\frac{\sqrt{5}i}{10} & 0 & -\frac{\sqrt{10}i}{20} & 0 & 0 \\
0 & \frac{\sqrt{3}i}{16} & 0 & \frac{i}{16} & \frac{\sqrt{5}i}{10} & 0 & \frac{\sqrt{2}i}{4} & 0 & 0 & 0 \\
-\frac{\sqrt{2}i}{16} & 0 & -\frac{\sqrt{6}i}{16} & 0 & 0 & -\frac{\sqrt{2}i}{4} & 0 & 0 & 0 & \frac{\sqrt{10}i}{20} \\
0 & \frac{\sqrt{6}i}{16} & 0 & \frac{\sqrt{2}i}{16} & \frac{\sqrt{10}i}{20} & 0 & 0 & 0 & -\frac{\sqrt{2}i}{4} & 0 \\
-\frac{i}{16} & 0 & -\frac{\sqrt{3}i}{16} & 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{4} & 0 & \frac{\sqrt{5}i}{10} \\
0 & \frac{\sqrt{15}i}{80} & 0 & \frac{\sqrt{5}i}{80} & 0 & 0 & -\frac{\sqrt{10}i}{20} & 0 & -\frac{\sqrt{5}i}{10} & 0
\end{bmatrix}$$

| 475 | symmetry | $\frac{\sqrt{35}xz(x-z)(x+z)}{2}$ |
|---|---|---|

$\mathbb{Q}_{4,2}^{(1,-1;a)}(E_g,1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & \frac{\sqrt{5}}{80} & 0 & -\frac{\sqrt{2}}{16} & 0 & \frac{1}{16} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{16} & 0 & \frac{\sqrt{6}}{16} & 0 & -\frac{\sqrt{15}}{80} \\
0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{80} & 0 & \frac{\sqrt{6}}{16} & 0 & -\frac{\sqrt{3}}{16} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{1}{16} & 0 & -\frac{\sqrt{2}}{16} & 0 & \frac{\sqrt{5}}{80} \\
\frac{\sqrt{5}}{80} & 0 & -\frac{\sqrt{15}}{80} & 0 & 0 & \frac{\sqrt{5}}{10} & 0 & -\frac{\sqrt{10}}{20} & 0 & 0 \\
0 & -\frac{\sqrt{3}}{16} & 0 & \frac{1}{16} & \frac{\sqrt{5}}{10} & 0 & -\frac{\sqrt{2}}{4} & 0 & 0 & 0 \\
-\frac{\sqrt{2}}{16} & 0 & \frac{\sqrt{6}}{16} & 0 & 0 & -\frac{\sqrt{2}}{4} & 0 & 0 & 0 & \frac{\sqrt{10}}{20} \\
0 & \frac{\sqrt{6}}{16} & 0 & -\frac{\sqrt{2}}{16} & -\frac{\sqrt{10}}{20} & 0 & 0 & 0 & \frac{\sqrt{2}}{4} & 0 \\
\frac{1}{16} & 0 & -\frac{\sqrt{3}}{16} & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{4} & 0 & -\frac{\sqrt{5}}{10} \\
0 & -\frac{\sqrt{15}}{80} & 0 & \frac{\sqrt{5}}{80} & 0 & 0 & \frac{\sqrt{10}}{20} & 0 & -\frac{\sqrt{5}}{10} & 0
\end{bmatrix}$$

| 476 | symmetry | $\frac{\sqrt{5}yz(6x^2-y^2-z^2)}{2}$ |
|---|---|---|

Table 8

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{4,1}^{(1,-1;a)}(E_g,2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & \frac{\sqrt{35}i}{560} & 0 & \frac{\sqrt{14}i}{112} & 0 & -\frac{\sqrt{7}i}{16} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{112} & 0 & -\frac{\sqrt{42}i}{112} & 0 & \frac{\sqrt{105}i}{80} \\
0 & 0 & 0 & 0 & -\frac{\sqrt{105}i}{80} & 0 & \frac{\sqrt{42}i}{112} & 0 & \frac{\sqrt{21}i}{112} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{16} & 0 & -\frac{\sqrt{14}i}{112} & 0 & -\frac{\sqrt{35}i}{560} \\
-\frac{\sqrt{35}i}{560} & 0 & \frac{\sqrt{105}i}{80} & 0 & 0 & -\frac{\sqrt{35}i}{70} & 0 & \frac{\sqrt{70}i}{20} & 0 & 0 \\
0 & \frac{\sqrt{21}i}{112} & 0 & -\frac{\sqrt{7}i}{16} & \frac{\sqrt{35}i}{70} & 0 & \frac{\sqrt{14}i}{28} & 0 & 0 & 0 \\
-\frac{\sqrt{14}i}{112} & 0 & -\frac{\sqrt{42}i}{112} & 0 & 0 & -\frac{\sqrt{14}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{70}i}{20} \\
0 & \frac{\sqrt{42}i}{112} & 0 & \frac{\sqrt{14}i}{112} & -\frac{\sqrt{70}i}{20} & 0 & 0 & 0 & -\frac{\sqrt{14}i}{28} & 0 \\
\frac{\sqrt{7}i}{16} & 0 & -\frac{\sqrt{21}i}{112} & 0 & 0 & 0 & 0 & \frac{\sqrt{14}i}{28} & 0 & \frac{\sqrt{35}i}{70} \\
0 & -\frac{\sqrt{105}i}{80} & 0 & \frac{\sqrt{35}i}{560} & 0 & 0 & \frac{\sqrt{70}i}{20} & 0 & -\frac{\sqrt{35}i}{70} & 0
\end{bmatrix}$$

| 477 | symmetry | $-\frac{\sqrt{5}xz(x^2-6y^2+z^2)}{2}$ |
|---|---|---|

$\mathbb{Q}_{4,2}^{(1,-1;a)}(E_g,2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & \frac{\sqrt{35}}{560} & 0 & -\frac{\sqrt{14}}{112} & 0 & -\frac{\sqrt{7}}{16} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}}{112} & 0 & \frac{\sqrt{42}}{112} & 0 & \frac{\sqrt{105}}{80} \\
0 & 0 & 0 & 0 & \frac{\sqrt{105}}{80} & 0 & \frac{\sqrt{42}}{112} & 0 & -\frac{\sqrt{21}}{112} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{16} & 0 & -\frac{\sqrt{14}}{112} & 0 & \frac{\sqrt{35}}{560} \\
\frac{\sqrt{35}}{560} & 0 & \frac{\sqrt{105}}{80} & 0 & 0 & \frac{\sqrt{35}}{70} & 0 & \frac{\sqrt{70}}{20} & 0 & 0 \\
0 & -\frac{\sqrt{21}}{112} & 0 & -\frac{\sqrt{7}}{16} & \frac{\sqrt{35}}{70} & 0 & -\frac{\sqrt{14}}{28} & 0 & 0 & 0 \\
-\frac{\sqrt{14}}{112} & 0 & \frac{\sqrt{42}}{112} & 0 & 0 & -\frac{\sqrt{14}}{28} & 0 & 0 & 0 & -\frac{\sqrt{70}}{20} \\
0 & \frac{\sqrt{42}}{112} & 0 & -\frac{\sqrt{14}}{112} & \frac{\sqrt{70}}{20} & 0 & 0 & 0 & \frac{\sqrt{14}}{28} & 0 \\
-\frac{\sqrt{7}}{16} & 0 & -\frac{\sqrt{21}}{112} & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{28} & 0 & -\frac{\sqrt{35}}{70} \\
0 & \frac{\sqrt{105}}{80} & 0 & \frac{\sqrt{35}}{560} & 0 & 0 & -\frac{\sqrt{70}}{20} & 0 & -\frac{\sqrt{35}}{70} & 0
\end{bmatrix}$$

| 478 | symmetry | $1$ |
|---|---|---|

*continued ...*

Table 8

| No. | multipole | matrix | | | | | | | | | |
|-----|-----------|--------|---|---|---|---|---|---|---|---|---|
| | $\mathbb{Q}_0^{(1,1;a)}(A_{1g})$ | $-\frac{\sqrt{15}}{10}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{15}}{10}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{15}}{10}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{\sqrt{15}}{10}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{15}}{15}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{15}}{15}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{15}}{15}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{15}}{15}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{15}}{15}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{15}}{15}$ |

| 479 | symmetry | $-\frac{x^2}{2}-\frac{y^2}{2}+z^2$ | | | | | | | | | |
|-----|-----------|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{Q}_2^{(1,1;a)}(A_{1g})$ | $\frac{\sqrt{105}}{25}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{4\sqrt{105}}{175}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{105}}{25}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{70}}{175}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{105}}{25}$ | $0$ | $0$ | $0$ | $0$ | $\frac{2\sqrt{70}}{175}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{105}}{25}$ | $0$ | $0$ | $0$ | $0$ | $\frac{4\sqrt{105}}{175}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{105}}{70}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $-\frac{4\sqrt{105}}{175}$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{105}}{350}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{2\sqrt{70}}{175}$ | $0$ | $0$ | $0$ | $0$ | $\frac{2\sqrt{105}}{175}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $\frac{2\sqrt{70}}{175}$ | $0$ | $0$ | $0$ | $0$ | $\frac{2\sqrt{105}}{175}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{4\sqrt{105}}{175}$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{105}}{350}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{105}}{70}$ |

| 480 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |
|-----|-----------|---|

112

Table 8

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{Q}_2^{(1,1;a)}(B_{1g})$$

$$\begin{bmatrix}
0 & 0 & \frac{\sqrt{105}}{25} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{70}}{175} & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{105}}{25} & \frac{4\sqrt{21}}{105} & 0 & 0 & 0 & -\frac{8\sqrt{105}}{525} & 0 \\
\frac{\sqrt{105}}{25} & 0 & 0 & 0 & 0 & \frac{8\sqrt{105}}{525} & 0 & 0 & 0 & -\frac{4\sqrt{21}}{105} \\
0 & \frac{\sqrt{105}}{25} & 0 & 0 & 0 & 0 & \frac{2\sqrt{70}}{175} & 0 & 0 & 0 \\
0 & \frac{4\sqrt{21}}{105} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{14}}{140} & 0 & 0 & 0 \\
0 & 0 & \frac{8\sqrt{105}}{525} & 0 & 0 & 0 & 0 & -\frac{9\sqrt{70}}{700} & 0 & 0 \\
0 & 0 & 0 & \frac{2\sqrt{70}}{175} & -\frac{3\sqrt{14}}{140} & 0 & 0 & 0 & -\frac{9\sqrt{70}}{700} & 0 \\
-\frac{2\sqrt{70}}{175} & 0 & 0 & 0 & 0 & -\frac{9\sqrt{70}}{700} & 0 & 0 & 0 & -\frac{3\sqrt{14}}{140} \\
0 & -\frac{8\sqrt{105}}{525} & 0 & 0 & 0 & 0 & -\frac{9\sqrt{70}}{700} & 0 & 0 & 0 \\
0 & 0 & -\frac{4\sqrt{21}}{105} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{14}}{140} & 0 & 0
\end{bmatrix}$$

| 481 | symmetry | $\sqrt{3}xy$ |
|---|---|---|

$$\mathbb{Q}_2^{(1,1;a)}(B_{2g})$$

$$\begin{bmatrix}
0 & 0 & -\frac{\sqrt{105}i}{25} & 0 & 0 & 0 & 0 & \frac{2\sqrt{70}i}{175} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{105}i}{25} & \frac{4\sqrt{21}i}{105} & 0 & 0 & 0 & \frac{8\sqrt{105}i}{525} & 0 \\
\frac{\sqrt{105}i}{25} & 0 & 0 & 0 & 0 & \frac{8\sqrt{105}i}{525} & 0 & 0 & 0 & \frac{4\sqrt{21}i}{105} \\
0 & \frac{\sqrt{105}i}{25} & 0 & 0 & 0 & 0 & \frac{2\sqrt{70}i}{175} & 0 & 0 & 0 \\
0 & -\frac{4\sqrt{21}i}{105} & 0 & 0 & 0 & 0 & \frac{3\sqrt{14}i}{140} & 0 & 0 & 0 \\
0 & 0 & -\frac{8\sqrt{105}i}{525} & 0 & 0 & 0 & 0 & \frac{9\sqrt{70}i}{700} & 0 & 0 \\
0 & 0 & 0 & -\frac{2\sqrt{70}i}{175} & -\frac{3\sqrt{14}i}{140} & 0 & 0 & 0 & \frac{9\sqrt{70}i}{700} & 0 \\
-\frac{2\sqrt{70}i}{175} & 0 & 0 & 0 & 0 & -\frac{9\sqrt{70}i}{700} & 0 & 0 & 0 & \frac{3\sqrt{14}i}{140} \\
0 & -\frac{8\sqrt{105}i}{525} & 0 & 0 & 0 & 0 & -\frac{9\sqrt{70}i}{700} & 0 & 0 & 0 \\
0 & 0 & -\frac{4\sqrt{21}i}{105} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{14}i}{140} & 0 & 0
\end{bmatrix}$$

| 482 | symmetry | $\sqrt{3}yz$ |
|---|---|---|

*continued ...*

Table 8

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{Q}_{2,1}^{(1,1;a)}(E_g)$$

$$\begin{bmatrix}
0 & -\frac{\sqrt{105}i}{25} & 0 & 0 & \frac{2\sqrt{7}i}{35} & 0 & \frac{3\sqrt{70}i}{175} & 0 & 0 & 0 \\
\frac{\sqrt{105}i}{25} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{105}i}{525} & 0 & \frac{\sqrt{210}i}{105} & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{105}i}{25} & 0 & 0 & -\frac{\sqrt{210}i}{105} & 0 & \frac{2\sqrt{105}i}{525} & 0 \\
0 & 0 & -\frac{\sqrt{105}i}{25} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{70}i}{175} & 0 & -\frac{2\sqrt{7}i}{35} \\
-\frac{2\sqrt{7}i}{35} & 0 & 0 & 0 & 0 & \frac{3\sqrt{7}i}{70} & 0 & 0 & 0 & 0 \\
0 & \frac{2\sqrt{105}i}{525} & 0 & 0 & -\frac{3\sqrt{7}i}{70} & 0 & \frac{3\sqrt{70}i}{350} & 0 & 0 & 0 \\
-\frac{3\sqrt{70}i}{175} & 0 & \frac{\sqrt{210}i}{105} & 0 & 0 & -\frac{3\sqrt{70}i}{350} & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{210}i}{105} & 0 & \frac{3\sqrt{70}i}{175} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{70}i}{350} & 0 \\
0 & 0 & -\frac{2\sqrt{105}i}{525} & 0 & 0 & 0 & 0 & \frac{3\sqrt{70}i}{350} & 0 & -\frac{3\sqrt{7}i}{70} \\
0 & 0 & 0 & \frac{2\sqrt{7}i}{35} & 0 & 0 & 0 & 0 & \frac{3\sqrt{7}i}{70} & 0
\end{bmatrix}$$

| 483 | symmetry | $\sqrt{3}xz$ |
|---|---|---|

$$\mathbb{Q}_{2,2}^{(1,1;a)}(E_g)$$

$$\begin{bmatrix}
0 & \frac{\sqrt{105}}{25} & 0 & 0 & \frac{2\sqrt{7}}{35} & 0 & -\frac{3\sqrt{70}}{175} & 0 & 0 & 0 \\
\frac{\sqrt{105}}{25} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{105}}{525} & 0 & -\frac{\sqrt{210}}{105} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{105}}{25} & 0 & 0 & -\frac{\sqrt{210}}{105} & 0 & -\frac{2\sqrt{105}}{525} & 0 \\
0 & 0 & -\frac{\sqrt{105}}{25} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{70}}{175} & 0 & \frac{2\sqrt{7}}{35} \\
\frac{2\sqrt{7}}{35} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{7}}{70} & 0 & 0 & 0 & 0 \\
0 & -\frac{2\sqrt{105}}{525} & 0 & 0 & -\frac{3\sqrt{7}}{70} & 0 & -\frac{3\sqrt{70}}{350} & 0 & 0 & 0 \\
-\frac{3\sqrt{70}}{175} & 0 & -\frac{\sqrt{210}}{105} & 0 & 0 & -\frac{3\sqrt{70}}{350} & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{210}}{105} & 0 & -\frac{3\sqrt{70}}{175} & 0 & 0 & 0 & 0 & \frac{3\sqrt{70}}{350} & 0 \\
0 & 0 & -\frac{2\sqrt{105}}{525} & 0 & 0 & 0 & 0 & \frac{3\sqrt{70}}{350} & 0 & \frac{3\sqrt{7}}{70} \\
0 & 0 & 0 & \frac{2\sqrt{7}}{35} & 0 & 0 & 0 & 0 & \frac{3\sqrt{7}}{70} & 0
\end{bmatrix}$$

| 484 | symmetry | $z$ |
|---|---|---|

Table 8

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_1^{(1,0;a)}(A_{2g})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{10} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{10} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{10} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{10} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{10}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{15}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{15}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{10}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

| 485 | symmetry | $x$ |
|---|---|---|

$\mathbb{G}_{1,1}^{(1,0;a)}(E_g)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{4} & 0 & -\frac{\sqrt{5}i}{20} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{20} & 0 & -\frac{\sqrt{15}i}{20} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{20} & 0 & -\frac{\sqrt{30}i}{20} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}i}{20} & 0 & -\frac{\sqrt{2}i}{4} \\
-\frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{30}i}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{5}i}{20} & 0 & -\frac{\sqrt{15}i}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{15}i}{20} & 0 & -\frac{\sqrt{5}i}{20} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{30}i}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

| 486 | symmetry | $-y$ |
|---|---|---|

*continued ...*

115

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_{1,2}^{(1,0;a)}(E_g)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & \frac{\sqrt{2}}{4} & 0 & \frac{\sqrt{5}}{20} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{20} & 0 & \frac{\sqrt{15}}{20} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{20} & 0 & \frac{\sqrt{30}}{20} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{20} & 0 & \frac{\sqrt{2}}{4} \\
\frac{\sqrt{2}}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{30}}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{5}}{20} & 0 & \frac{\sqrt{15}}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{15}}{20} & 0 & \frac{\sqrt{5}}{20} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{30}}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{2}}{4} & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

| 487 | symmetry | $-\frac{z\left(3x^2+3y^2-2z^2\right)}{2}$ |

$\mathbb{G}_3^{(1,0;a)}(A_{2g})$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{10} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{10} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{10} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{10} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{15}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{10}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{10}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{15}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

| 488 | symmetry | $\sqrt{15}xyz$ |

*continued …*

Table 8

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{G}_3^{(1,0;a)}(B_{1g}) \quad \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{4} & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{12} & 0 & 0 & 0 & \frac{\sqrt{3}}{12} & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{12} & 0 & 0 & 0 & -\frac{\sqrt{15}}{12} \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{4} & 0 & 0 & 0 \\ 0 & \frac{\sqrt{15}}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{3}}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{2}}{4} & 0 & 0 & 0 & 0 & 0 & 0 \\ \frac{\sqrt{2}}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{3}}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{15}}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

| 489 | symmetry | $\frac{\sqrt{15}z(x-y)(x+y)}{2}$ |
|---|---|---|

$$\mathbb{G}_3^{(1,0;a)}(B_{2g}) \quad \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{4} & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{12} & 0 & 0 & 0 & \frac{\sqrt{3}i}{12} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{12} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{12} \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{4} & 0 & 0 & 0 \\ 0 & \frac{\sqrt{15}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{3}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 & 0 & 0 \\ -\frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{3}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{15}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

| 490 | symmetry | $\frac{x\left(2x^2-3y^2-3z^2\right)}{2}$ |
|---|---|---|

Table 8

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{G}_{3,1}^{(1,0;a)}(E_g,1)$$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{16} & 0 & -\frac{3\sqrt{30}i}{80} & 0 & \frac{\sqrt{15}i}{16} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{7\sqrt{5}i}{80} & 0 & \frac{\sqrt{10}i}{80} & 0 & \frac{5i}{16} \\
0 & 0 & 0 & 0 & -\frac{5i}{16} & 0 & -\frac{\sqrt{10}i}{80} & 0 & \frac{7\sqrt{5}i}{80} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{16} & 0 & \frac{3\sqrt{30}i}{80} & 0 & -\frac{\sqrt{3}i}{16} \\
-\frac{\sqrt{3}i}{16} & 0 & \frac{5i}{16} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{7\sqrt{5}i}{80} & 0 & \frac{\sqrt{15}i}{16} & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{3\sqrt{30}i}{80} & 0 & \frac{\sqrt{10}i}{80} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{10}i}{80} & 0 & -\frac{3\sqrt{30}i}{80} & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{15}i}{16} & 0 & -\frac{7\sqrt{5}i}{80} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{5i}{16} & 0 & \frac{\sqrt{3}i}{16} & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

| 491 | symmetry | $\dfrac{y\left(3x^2-2y^2+3z^2\right)}{2}$ |
|---|---|---|

$$\mathbb{G}_{3,2}^{(1,0;a)}(E_g,1)$$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & \frac{\sqrt{3}}{16} & 0 & \frac{3\sqrt{30}}{80} & 0 & \frac{\sqrt{15}}{16} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{7\sqrt{5}}{80} & 0 & -\frac{\sqrt{10}}{80} & 0 & \frac{5}{16} \\
0 & 0 & 0 & 0 & \frac{5}{16} & 0 & -\frac{\sqrt{10}}{80} & 0 & -\frac{7\sqrt{5}}{80} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{16} & 0 & \frac{3\sqrt{30}}{80} & 0 & \frac{\sqrt{3}}{16} \\
\frac{\sqrt{3}}{16} & 0 & \frac{5}{16} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{7\sqrt{5}}{80} & 0 & \frac{\sqrt{15}}{16} & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{3\sqrt{30}}{80} & 0 & -\frac{\sqrt{10}}{80} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{10}}{80} & 0 & \frac{3\sqrt{30}}{80} & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{15}}{16} & 0 & -\frac{7\sqrt{5}}{80} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{5}{16} & 0 & \frac{\sqrt{3}}{16} & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

| 492 | symmetry | $\dfrac{\sqrt{15}x(y-z)(y+z)}{2}$ |
|---|---|---|

*continued ...*

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Table 8

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{G}_{3,1}^{(1,0;a)}(E_g,2)$$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & \frac{\sqrt{5}i}{16} & 0 & -\frac{3\sqrt{2}i}{16} & 0 & -\frac{3i}{16} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{7\sqrt{3}i}{48} & 0 & \frac{\sqrt{6}i}{48} & 0 & -\frac{\sqrt{15}i}{16} \\
0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{16} & 0 & -\frac{\sqrt{6}i}{48} & 0 & \frac{7\sqrt{3}i}{48} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{3i}{16} & 0 & \frac{3\sqrt{2}i}{16} & 0 & -\frac{\sqrt{5}i}{16} \\
-\frac{\sqrt{5}i}{16} & 0 & -\frac{\sqrt{15}i}{16} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{7\sqrt{3}i}{48} & 0 & -\frac{3i}{16} & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{3\sqrt{2}i}{16} & 0 & \frac{\sqrt{6}i}{48} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{6}i}{48} & 0 & -\frac{3\sqrt{2}i}{16} & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{3i}{16} & 0 & -\frac{7\sqrt{3}i}{48} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{15}i}{16} & 0 & \frac{\sqrt{5}i}{16} & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

| 493 | symmetry | $-\frac{\sqrt{15}y(x-z)(x+z)}{2}$ |

$$\mathbb{G}_{3,2}^{(1,0;a)}(E_g,2)$$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & \frac{\sqrt{5}}{16} & 0 & \frac{3\sqrt{2}}{16} & 0 & -\frac{3}{16} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{7\sqrt{3}}{48} & 0 & -\frac{\sqrt{6}}{48} & 0 & -\frac{\sqrt{15}}{16} \\
0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{16} & 0 & -\frac{\sqrt{6}}{48} & 0 & -\frac{7\sqrt{3}}{48} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{3}{16} & 0 & \frac{3\sqrt{2}}{16} & 0 & \frac{\sqrt{5}}{16} \\
\frac{\sqrt{5}}{16} & 0 & -\frac{\sqrt{15}}{16} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{7\sqrt{3}}{48} & 0 & -\frac{3}{16} & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{3\sqrt{2}}{16} & 0 & -\frac{\sqrt{6}}{48} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{6}}{48} & 0 & \frac{3\sqrt{2}}{16} & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{3}{16} & 0 & -\frac{7\sqrt{3}}{48} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{15}}{16} & 0 & \frac{\sqrt{5}}{16} & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

| 494 | symmetry | $-\frac{x^2}{2} - \frac{y^2}{2} + z^2$ |

*continued ...*

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Table 8

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_2^{(1,0;a)}(A_{1g})$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{14} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{14} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{14} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}i}{14} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{42}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{7}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{7}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{42}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

**495**  symmetry  $\dfrac{\sqrt{3}(x-y)(x+y)}{2}$

$\mathbb{T}_2^{(1,0;a)}(B_{1g})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{14} & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{42} & 0 & 0 & 0 & \frac{\sqrt{42}i}{21} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}i}{21} & 0 & 0 & 0 & \frac{\sqrt{210}i}{42} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{14} & 0 & 0 & 0 \\
0 & \frac{\sqrt{210}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{42}i}{21} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{7}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{7}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{42}i}{21} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{210}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

**496**  symmetry  $\sqrt{3}xy$

*continued ...*

Table 8

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{T}_2^{(1,0;a)}(B_{2g})$$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{14} & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{210}}{42} & 0 & 0 & 0 & \frac{\sqrt{42}}{21} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{21} & 0 & 0 & 0 & \frac{\sqrt{210}}{42} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{14} & 0 & 0 & 0 \\
0 & \frac{\sqrt{210}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{42}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{7}}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{7}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{42}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{210}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & 0 
\end{bmatrix}$$

| 497 | symmetry | $\sqrt{3}yz$ |
|---|---|---|

$$\mathbb{T}_{2,1}^{(1,0;a)}(E_g)$$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & \frac{\sqrt{70}}{28} & 0 & \frac{3\sqrt{7}}{28} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}}{84} & 0 & \frac{5\sqrt{21}}{84} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{21}}{84} & 0 & \frac{\sqrt{42}}{84} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{7}}{28} & 0 & -\frac{\sqrt{70}}{28} \\
\frac{\sqrt{70}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{42}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{3\sqrt{7}}{28} & 0 & -\frac{5\sqrt{21}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{5\sqrt{21}}{84} & 0 & -\frac{3\sqrt{7}}{28} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{42}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{70}}{28} & 0 & 0 & 0 & 0 & 0 & 0 
\end{bmatrix}$$

| 498 | symmetry | $\sqrt{3}xz$ |
|---|---|---|

Table 8

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_{2,2}^{(1,0;a)}(E_g)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{28} & 0 & \frac{3\sqrt{7}i}{28} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{84} & 0 & \frac{5\sqrt{21}i}{84} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{21}i}{84} & 0 & \frac{\sqrt{42}i}{84} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{7}i}{28} & 0 & -\frac{\sqrt{70}i}{28} \\
\frac{\sqrt{70}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{42}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{3\sqrt{7}i}{28} & 0 & -\frac{5\sqrt{21}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{5\sqrt{21}i}{84} & 0 & -\frac{3\sqrt{7}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{42}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{70}i}{28} & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

| 499 | symmetry | $\dfrac{\sqrt{21}\left(x^4-3x^2y^2-3x^2z^2+y^4-3y^2z^2+z^4\right)}{6}$ |

$\mathbb{T}_{4}^{(1,0;a)}(A_{1g},1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{12} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{12} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{4} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{4} & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{12} & 0 & 0 & 0 & \frac{\sqrt{3}i}{12} & 0 \\
0 & 0 & 0 & -\frac{\sqrt{15}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{3}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{3}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{15}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

| 500 | symmetry | $-\dfrac{\sqrt{15}\left(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4\right)}{12}$ |

*continued …*

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# Table 8

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_4^{(1,0;a)}(A_{1g},2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}i}{84} & 0 & 0 & 0 & \frac{\sqrt{21}i}{12} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{28} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{28} & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{12} & 0 & 0 & 0 & \frac{\sqrt{105}i}{84} & 0 \\
0 & 0 & 0 & \frac{\sqrt{21}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{105}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{70}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{70}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{105}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{21}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

| 501 | symmetry | $\frac{\sqrt{35}xy(x-y)(x+y)}{2}$ |
|---|---|---|

$\mathbb{T}_4^{(1,0;a)}(A_{2g})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{2} \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{1}{2} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{1}{2} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{1}{2} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

| 502 | symmetry | $\frac{\sqrt{5}(x-y)(x+y)\left(x^2+y^2-6z^2\right)}{4}$ |
|---|---|---|

*continued ...*

Table 8

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{T}_4^{(1,0;a)}(B_{1g})$$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{28} & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{105}i}{28} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}i}{28} & 0 & 0 & 0 & \frac{\sqrt{21}i}{28} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{28} & 0 & 0 & 0 \\
0 & \frac{\sqrt{21}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{105}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{70}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{70}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{105}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{21}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

| 503 | symmetry | $-\frac{\sqrt{5}xy\left(x^2+y^2-6z^2\right)}{2}$ |
|---|---|---|

$$\mathbb{T}_4^{(1,0;a)}(B_{2g})$$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{28} & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{21}}{28} & 0 & 0 & 0 & \frac{\sqrt{105}}{28} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}}{28} & 0 & 0 & 0 & -\frac{\sqrt{21}}{28} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{28} & 0 & 0 & 0 \\
0 & -\frac{\sqrt{21}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{105}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{70}}{28} & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{70}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{105}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{21}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

| 504 | symmetry | $\frac{\sqrt{35}yz(y-z)(y+z)}{2}$ |
|---|---|---|

*continued ...*

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Table 8

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{T}_{4,1}^{(1,0;a)}(E_g,1)$ | $$\begin{bmatrix} 0 & 0 & 0 & 0 & \frac{1}{16} & 0 & \frac{\sqrt{10}}{16} & 0 & \frac{\sqrt{5}}{16} & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{16} & 0 & -\frac{\sqrt{30}}{16} & 0 & -\frac{\sqrt{3}}{16} \\ 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{16} & 0 & \frac{\sqrt{30}}{16} & 0 & \frac{\sqrt{15}}{16} & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}}{16} & 0 & -\frac{\sqrt{10}}{16} & 0 & -\frac{1}{16} \\ \frac{1}{16} & 0 & \frac{\sqrt{3}}{16} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{15}}{16} & 0 & -\frac{\sqrt{5}}{16} & 0 & 0 & 0 & 0 & 0 & 0 \\ \frac{\sqrt{10}}{16} & 0 & \frac{\sqrt{30}}{16} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{30}}{16} & 0 & -\frac{\sqrt{10}}{16} & 0 & 0 & 0 & 0 & 0 & 0 \\ \frac{\sqrt{5}}{16} & 0 & \frac{\sqrt{15}}{16} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{3}}{16} & 0 & -\frac{1}{16} & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$ |
| 505 | symmetry | $\dfrac{\sqrt{35}xz(x-z)(x+z)}{2}$ |
| | $\mathbb{T}_{4,2}^{(1,0;a)}(E_g,1)$ | $$\begin{bmatrix} 0 & 0 & 0 & 0 & -\frac{i}{16} & 0 & \frac{\sqrt{10}i}{16} & 0 & -\frac{\sqrt{5}i}{16} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{16} & 0 & -\frac{\sqrt{30}i}{16} & 0 & \frac{\sqrt{3}i}{16} \\ 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{16} & 0 & -\frac{\sqrt{30}i}{16} & 0 & \frac{\sqrt{15}i}{16} & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}i}{16} & 0 & \frac{\sqrt{10}i}{16} & 0 & -\frac{i}{16} \\ \frac{i}{16} & 0 & -\frac{\sqrt{3}i}{16} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{15}i}{16} & 0 & \frac{\sqrt{5}i}{16} & 0 & 0 & 0 & 0 & 0 & 0 \\ -\frac{\sqrt{10}i}{16} & 0 & \frac{\sqrt{30}i}{16} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{30}i}{16} & 0 & -\frac{\sqrt{10}i}{16} & 0 & 0 & 0 & 0 & 0 & 0 \\ \frac{\sqrt{5}i}{16} & 0 & -\frac{\sqrt{15}i}{16} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{3}i}{16} & 0 & \frac{i}{16} & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$ |
| 506 | symmetry | $\dfrac{\sqrt{5}yz\left(6x^2-y^2-z^2\right)}{2}$ |

*continued …*

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Table 8

| No. | multipole | matrix |
|-----|-----------|--------|

$$\mathbb{T}_{4,1}^{(1,0;a)}(E_g,2)$$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & \frac{\sqrt{7}}{112} & 0 & \frac{\sqrt{70}}{112} & 0 & -\frac{\sqrt{35}}{16} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}}{112} & 0 & -\frac{\sqrt{210}}{112} & 0 & \frac{\sqrt{21}}{16} \\
0 & 0 & 0 & 0 & -\frac{\sqrt{21}}{16} & 0 & \frac{\sqrt{210}}{112} & 0 & \frac{\sqrt{105}}{112} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{35}}{16} & 0 & -\frac{\sqrt{70}}{112} & 0 & -\frac{\sqrt{7}}{112} \\
\frac{\sqrt{7}}{112} & 0 & -\frac{\sqrt{21}}{16} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{105}}{112} & 0 & \frac{\sqrt{35}}{16} & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{70}}{112} & 0 & \frac{\sqrt{210}}{112} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{210}}{112} & 0 & -\frac{\sqrt{70}}{112} & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{35}}{16} & 0 & \frac{\sqrt{105}}{112} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{21}}{16} & 0 & -\frac{\sqrt{7}}{112} & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

| 507 | symmetry | $-\frac{\sqrt{5}xz\left(x^2-6y^2+z^2\right)}{2}$ |

$$\mathbb{T}_{4,2}^{(1,0;a)}(E_g,2)$$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{112} & 0 & \frac{\sqrt{70}i}{112} & 0 & \frac{\sqrt{35}i}{16} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}i}{112} & 0 & -\frac{\sqrt{210}i}{112} & 0 & -\frac{\sqrt{21}i}{16} \\
0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{16} & 0 & -\frac{\sqrt{210}i}{112} & 0 & \frac{\sqrt{105}i}{112} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{35}i}{16} & 0 & \frac{\sqrt{70}i}{112} & 0 & -\frac{\sqrt{7}i}{112} \\
\frac{\sqrt{7}i}{112} & 0 & \frac{\sqrt{21}i}{16} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{105}i}{112} & 0 & -\frac{\sqrt{35}i}{16} & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{70}i}{112} & 0 & \frac{\sqrt{210}i}{112} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{210}i}{112} & 0 & -\frac{\sqrt{70}i}{112} & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{35}i}{16} & 0 & -\frac{\sqrt{105}i}{112} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{21}i}{16} & 0 & \frac{\sqrt{7}i}{112} & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

| 508 | symmetry | $z$ |

*continued ...*

Table 8

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{M}_1^{(a)}(A_{2g})$

$$\begin{bmatrix}
\frac{9\sqrt{5}}{50} & 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{25} & 0 & 0 & 0 & 0 \\
0 & \frac{3\sqrt{5}}{50} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{50} & 0 & 0 & 0 \\
0 & 0 & -\frac{3\sqrt{5}}{50} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{50} & 0 & 0 \\
0 & 0 & 0 & -\frac{9\sqrt{5}}{50} & 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{25} & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{5}}{5} & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{5}}{25} & 0 & 0 & 0 & 0 & \frac{3\sqrt{5}}{25} & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{30}}{50} & 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{25} & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{30}}{50} & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}}{25} & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{5}}{25} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{5}}{25} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}}{5}
\end{bmatrix}$$

| 509 | symmetry | $x$ |
|-----|----------|-----|

$\mathbb{M}_{1,1}^{(a)}(E_g)$

$$\begin{bmatrix}
0 & \frac{3\sqrt{15}}{50} & 0 & 0 & -\frac{1}{10} & 0 & \frac{\sqrt{10}}{100} & 0 & 0 & 0 \\
\frac{3\sqrt{15}}{50} & 0 & \frac{3\sqrt{5}}{25} & 0 & 0 & -\frac{\sqrt{15}}{50} & 0 & \frac{\sqrt{30}}{100} & 0 & 0 \\
0 & \frac{3\sqrt{5}}{25} & 0 & \frac{3\sqrt{15}}{50} & 0 & 0 & -\frac{\sqrt{30}}{100} & 0 & \frac{\sqrt{15}}{50} & 0 \\
0 & 0 & \frac{3\sqrt{15}}{50} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{100} & 0 & \frac{1}{10} \\
-\frac{1}{10} & 0 & 0 & 0 & 0 & \frac{1}{5} & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{15}}{50} & 0 & 0 & \frac{1}{5} & 0 & \frac{2\sqrt{10}}{25} & 0 & 0 & 0 \\
\frac{\sqrt{10}}{100} & 0 & -\frac{\sqrt{30}}{100} & 0 & 0 & \frac{2\sqrt{10}}{25} & 0 & \frac{3\sqrt{5}}{25} & 0 & 0 \\
0 & \frac{\sqrt{30}}{100} & 0 & -\frac{\sqrt{10}}{100} & 0 & 0 & \frac{3\sqrt{5}}{25} & 0 & \frac{2\sqrt{10}}{25} & 0 \\
0 & 0 & \frac{\sqrt{15}}{50} & 0 & 0 & 0 & 0 & \frac{2\sqrt{10}}{25} & 0 & \frac{1}{5} \\
0 & 0 & 0 & \frac{1}{10} & 0 & 0 & 0 & 0 & \frac{1}{5} & 0
\end{bmatrix}$$

| 510 | symmetry | $-y$ |
|-----|----------|------|

*continued ...*

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| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_{1,2}^{(a)}(E_g)$

$$\begin{bmatrix}
0 & \frac{3\sqrt{15}i}{50} & 0 & 0 & \frac{i}{10} & 0 & \frac{\sqrt{10}i}{100} & 0 & 0 & 0 \\
-\frac{3\sqrt{15}i}{50} & 0 & \frac{3\sqrt{5}i}{25} & 0 & 0 & \frac{\sqrt{15}i}{50} & 0 & \frac{\sqrt{30}i}{100} & 0 & 0 \\
0 & -\frac{3\sqrt{5}i}{25} & 0 & \frac{3\sqrt{15}i}{50} & 0 & 0 & \frac{\sqrt{30}i}{100} & 0 & \frac{\sqrt{15}i}{50} & 0 \\
0 & 0 & -\frac{3\sqrt{15}i}{50} & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{100} & 0 & \frac{i}{10} \\
-\frac{i}{10} & 0 & 0 & 0 & 0 & \frac{i}{5} & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{15}i}{50} & 0 & 0 & -\frac{i}{5} & 0 & \frac{2\sqrt{10}i}{25} & 0 & 0 & 0 \\
-\frac{\sqrt{10}i}{100} & 0 & -\frac{\sqrt{30}i}{100} & 0 & 0 & -\frac{2\sqrt{10}i}{25} & 0 & \frac{3\sqrt{5}i}{25} & 0 & 0 \\
0 & -\frac{\sqrt{30}i}{100} & 0 & -\frac{\sqrt{10}i}{100} & 0 & 0 & -\frac{3\sqrt{5}i}{25} & 0 & \frac{2\sqrt{10}i}{25} & 0 \\
0 & 0 & -\frac{\sqrt{15}i}{50} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{10}i}{25} & 0 & \frac{i}{5} \\
0 & 0 & 0 & -\frac{i}{10} & 0 & 0 & 0 & 0 & -\frac{i}{5} & 0
\end{bmatrix}$$

| 511 | symmetry | $-\frac{z\left(3x^2+3y^2-2z^2\right)}{2}$ |

$\mathbb{M}_{3}^{(a)}(A_{2g})$

$$\begin{bmatrix}
-\frac{\sqrt{5}}{25} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{5}}{25} & 0 & 0 & 0 & 0 \\
0 & \frac{3\sqrt{5}}{25} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{25} & 0 & 0 & 0 \\
0 & 0 & -\frac{3\sqrt{5}}{25} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{25} & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{5}}{25} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{5}}{25} & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{5}}{10} & 0 & 0 & 0 & 0 & 0 \\
-\frac{3\sqrt{5}}{25} & 0 & 0 & 0 & 0 & \frac{7\sqrt{5}}{50} & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{30}}{25} & 0 & 0 & 0 & 0 & \frac{2\sqrt{5}}{25} & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{30}}{25} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{5}}{25} & 0 & 0 \\
0 & 0 & 0 & -\frac{3\sqrt{5}}{25} & 0 & 0 & 0 & 0 & -\frac{7\sqrt{5}}{50} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{10}
\end{bmatrix}$$

| 512 | symmetry | $\sqrt{15}xyz$ |

*continued ...*

Table  8

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_3^{(a)}(B_{1g})$$

$$\begin{bmatrix} 0 & 0 & \frac{i}{5} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{10} & 0 & 0 \\ 0 & 0 & 0 & -\frac{i}{5} & \frac{\sqrt{5}i}{10} & 0 & 0 & 0 & \frac{i}{10} & 0 \\ -\frac{i}{5} & 0 & 0 & 0 & 0 & -\frac{i}{10} & 0 & 0 & 0 & -\frac{\sqrt{5}i}{10} \\ 0 & \frac{i}{5} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{10} & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{5}i}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{20} & 0 & 0 & 0 \\ 0 & 0 & \frac{i}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{20} & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{6}i}{10} & -\frac{\sqrt{30}i}{20} & 0 & 0 & 0 & -\frac{\sqrt{6}i}{20} & 0 \\ -\frac{\sqrt{6}i}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{20} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{20} \\ 0 & -\frac{i}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{20} & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{5}i}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{20} & 0 & 0 \end{bmatrix}$$

| 513 | symmetry | $\dfrac{\sqrt{15}z(x-y)(x+y)}{2}$ |

$$\mathbb{M}_3^{(a)}(B_{2g})$$

$$\begin{bmatrix} 0 & 0 & -\frac{1}{5} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{10} & 0 & 0 \\ 0 & 0 & 0 & \frac{1}{5} & \frac{\sqrt{5}}{10} & 0 & 0 & 0 & -\frac{1}{10} & 0 \\ -\frac{1}{5} & 0 & 0 & 0 & 0 & -\frac{1}{10} & 0 & 0 & 0 & \frac{\sqrt{5}}{10} \\ 0 & \frac{1}{5} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{10} & 0 & 0 & 0 \\ 0 & \frac{\sqrt{5}}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{20} & 0 & 0 & 0 \\ 0 & 0 & -\frac{1}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{20} & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{6}}{10} & -\frac{\sqrt{30}}{20} & 0 & 0 & 0 & \frac{\sqrt{6}}{20} & 0 \\ -\frac{\sqrt{6}}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{20} & 0 & 0 & 0 & \frac{\sqrt{30}}{20} \\ 0 & -\frac{1}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{20} & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{5}}{10} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{20} & 0 & 0 \end{bmatrix}$$

| 514 | symmetry | $\dfrac{x\left(2x^2-3y^2-3z^2\right)}{2}$ |

Table 8

| No. | multipole | matrix |
|---|---|---|
|  | $\mathbb{M}_{3,1}^{(a)}(E_g,1)$ | $$\begin{bmatrix} 0 & \frac{\sqrt{15}}{50} & 0 & -\frac{\sqrt{5}}{10} & -\frac{3}{40} & 0 & \frac{9\sqrt{10}}{200} & 0 & -\frac{3\sqrt{5}}{40} & 0 \\ \frac{\sqrt{15}}{50} & 0 & -\frac{3\sqrt{5}}{50} & 0 & 0 & \frac{7\sqrt{15}}{200} & 0 & -\frac{\sqrt{30}}{200} & 0 & -\frac{\sqrt{3}}{8} \\ 0 & -\frac{3\sqrt{5}}{50} & 0 & \frac{\sqrt{15}}{50} & \frac{\sqrt{3}}{8} & 0 & \frac{\sqrt{30}}{200} & 0 & -\frac{7\sqrt{15}}{200} & 0 \\ -\frac{\sqrt{5}}{10} & 0 & \frac{\sqrt{15}}{50} & 0 & 0 & \frac{3\sqrt{5}}{40} & 0 & -\frac{9\sqrt{10}}{200} & 0 & \frac{3}{40} \\ -\frac{3}{40} & 0 & \frac{\sqrt{3}}{8} & 0 & 0 & \frac{3}{20} & 0 & -\frac{\sqrt{2}}{8} & 0 & 0 \\ 0 & \frac{7\sqrt{15}}{200} & 0 & \frac{3\sqrt{5}}{40} & \frac{3}{20} & 0 & -\frac{3\sqrt{10}}{200} & 0 & -\frac{\sqrt{5}}{10} & 0 \\ \frac{9\sqrt{10}}{200} & 0 & \frac{\sqrt{30}}{200} & 0 & 0 & -\frac{3\sqrt{10}}{200} & 0 & -\frac{3\sqrt{5}}{50} & 0 & -\frac{\sqrt{2}}{8} \\ 0 & -\frac{\sqrt{30}}{200} & 0 & -\frac{9\sqrt{10}}{200} & -\frac{\sqrt{2}}{8} & 0 & -\frac{3\sqrt{5}}{50} & 0 & -\frac{3\sqrt{10}}{200} & 0 \\ -\frac{3\sqrt{5}}{40} & 0 & -\frac{7\sqrt{15}}{200} & 0 & 0 & -\frac{\sqrt{5}}{10} & 0 & -\frac{3\sqrt{10}}{200} & 0 & \frac{3}{20} \\ 0 & -\frac{\sqrt{3}}{8} & 0 & \frac{3}{40} & 0 & 0 & -\frac{\sqrt{2}}{8} & 0 & \frac{3}{20} & 0 \end{bmatrix}$$ |
| 515 | symmetry | $\frac{y\left(3x^2-2y^2+3z^2\right)}{2}$ |
|  | $\mathbb{M}_{3,2}^{(a)}(E_g,1)$ | $$\begin{bmatrix} 0 & \frac{\sqrt{15}i}{50} & 0 & \frac{\sqrt{5}i}{10} & \frac{3i}{40} & 0 & \frac{9\sqrt{10}i}{200} & 0 & \frac{3\sqrt{5}i}{40} & 0 \\ -\frac{\sqrt{15}i}{50} & 0 & -\frac{3\sqrt{5}i}{50} & 0 & 0 & -\frac{7\sqrt{15}i}{200} & 0 & -\frac{\sqrt{30}i}{200} & 0 & \frac{\sqrt{3}i}{8} \\ 0 & \frac{3\sqrt{5}i}{50} & 0 & \frac{\sqrt{15}i}{50} & \frac{\sqrt{3}i}{8} & 0 & -\frac{\sqrt{30}i}{200} & 0 & -\frac{7\sqrt{15}i}{200} & 0 \\ -\frac{\sqrt{5}i}{10} & 0 & -\frac{\sqrt{15}i}{50} & 0 & 0 & \frac{3\sqrt{5}i}{40} & 0 & \frac{9\sqrt{10}i}{200} & 0 & \frac{3i}{40} \\ -\frac{3i}{40} & 0 & -\frac{\sqrt{3}i}{8} & 0 & 0 & \frac{3i}{20} & 0 & \frac{\sqrt{2}i}{8} & 0 & 0 \\ 0 & \frac{7\sqrt{15}i}{200} & 0 & -\frac{3\sqrt{5}i}{40} & -\frac{3i}{20} & 0 & -\frac{3\sqrt{10}i}{200} & 0 & \frac{\sqrt{5}i}{10} & 0 \\ -\frac{9\sqrt{10}i}{200} & 0 & \frac{\sqrt{30}i}{200} & 0 & 0 & \frac{3\sqrt{10}i}{200} & 0 & -\frac{3\sqrt{5}i}{50} & 0 & \frac{\sqrt{2}i}{8} \\ 0 & \frac{\sqrt{30}i}{200} & 0 & -\frac{9\sqrt{10}i}{200} & -\frac{\sqrt{2}i}{8} & 0 & \frac{3\sqrt{5}i}{50} & 0 & -\frac{3\sqrt{10}i}{200} & 0 \\ -\frac{3\sqrt{5}i}{40} & 0 & \frac{7\sqrt{15}i}{200} & 0 & 0 & -\frac{\sqrt{5}i}{10} & 0 & \frac{3\sqrt{10}i}{200} & 0 & \frac{3i}{20} \\ 0 & -\frac{\sqrt{3}i}{8} & 0 & -\frac{3i}{40} & 0 & 0 & -\frac{\sqrt{2}i}{8} & 0 & -\frac{3i}{20} & 0 \end{bmatrix}$$ |
| 516 | symmetry | $\frac{\sqrt{15}x(y-z)(y+z)}{2}$ |

*continued ...*

Table 8

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_{3,1}^{(a)}(E_g,2)$

$$\begin{bmatrix}
0 & \frac{1}{10} & 0 & \frac{\sqrt{3}}{10} & -\frac{\sqrt{15}}{40} & 0 & \frac{3\sqrt{6}}{40} & 0 & \frac{3\sqrt{3}}{40} & 0 \\
\frac{1}{10} & 0 & -\frac{\sqrt{3}}{10} & 0 & 0 & \frac{7}{40} & 0 & -\frac{\sqrt{2}}{40} & 0 & \frac{3\sqrt{5}}{40} \\
0 & -\frac{\sqrt{3}}{10} & 0 & \frac{1}{10} & -\frac{3\sqrt{5}}{40} & 0 & \frac{\sqrt{2}}{40} & 0 & -\frac{7}{40} & 0 \\
\frac{\sqrt{3}}{10} & 0 & \frac{1}{10} & 0 & 0 & -\frac{3\sqrt{3}}{40} & 0 & -\frac{3\sqrt{6}}{40} & 0 & \frac{\sqrt{15}}{40} \\
-\frac{\sqrt{15}}{40} & 0 & -\frac{3\sqrt{5}}{40} & 0 & 0 & \frac{\sqrt{15}}{20} & 0 & \frac{\sqrt{30}}{40} & 0 & 0 \\
0 & \frac{7}{40} & 0 & -\frac{3\sqrt{3}}{40} & \frac{\sqrt{15}}{20} & 0 & -\frac{\sqrt{6}}{40} & 0 & \frac{\sqrt{3}}{10} & 0 \\
\frac{3\sqrt{6}}{40} & 0 & \frac{\sqrt{2}}{40} & 0 & 0 & -\frac{\sqrt{6}}{40} & 0 & -\frac{\sqrt{3}}{10} & 0 & \frac{\sqrt{30}}{40} \\
0 & -\frac{\sqrt{2}}{40} & 0 & -\frac{3\sqrt{6}}{40} & \frac{\sqrt{30}}{40} & 0 & -\frac{\sqrt{3}}{10} & 0 & -\frac{\sqrt{6}}{40} & 0 \\
\frac{3\sqrt{3}}{40} & 0 & -\frac{7}{40} & 0 & 0 & \frac{\sqrt{3}}{10} & 0 & -\frac{\sqrt{6}}{40} & 0 & \frac{\sqrt{15}}{20} \\
0 & \frac{3\sqrt{5}}{40} & 0 & \frac{\sqrt{15}}{40} & 0 & 0 & \frac{\sqrt{30}}{40} & 0 & \frac{\sqrt{15}}{20} & 0
\end{bmatrix}$$

| 517 | symmetry | $-\frac{\sqrt{15}y(x-z)(x+z)}{2}$ |
|---|---|---|

$\mathbb{M}_{3,2}^{(a)}(E_g,2)$

$$\begin{bmatrix}
0 & \frac{i}{10} & 0 & -\frac{\sqrt{3}i}{10} & \frac{\sqrt{15}i}{40} & 0 & \frac{3\sqrt{6}i}{40} & 0 & -\frac{3\sqrt{3}i}{40} & 0 \\
-\frac{i}{10} & 0 & -\frac{\sqrt{3}i}{10} & 0 & 0 & -\frac{7i}{40} & 0 & -\frac{\sqrt{2}i}{40} & 0 & -\frac{3\sqrt{5}i}{40} \\
0 & \frac{\sqrt{3}i}{10} & 0 & \frac{i}{10} & -\frac{3\sqrt{5}i}{40} & 0 & -\frac{\sqrt{2}i}{40} & 0 & -\frac{7i}{40} & 0 \\
\frac{\sqrt{3}i}{10} & 0 & -\frac{i}{10} & 0 & 0 & -\frac{3\sqrt{3}i}{40} & 0 & \frac{3\sqrt{6}i}{40} & 0 & \frac{\sqrt{15}i}{40} \\
-\frac{\sqrt{15}i}{40} & 0 & \frac{3\sqrt{5}i}{40} & 0 & 0 & \frac{\sqrt{15}i}{20} & 0 & -\frac{\sqrt{30}i}{40} & 0 & 0 \\
0 & \frac{7i}{40} & 0 & \frac{3\sqrt{3}i}{40} & -\frac{\sqrt{15}i}{20} & 0 & -\frac{\sqrt{6}i}{40} & 0 & -\frac{\sqrt{3}i}{10} & 0 \\
-\frac{3\sqrt{6}i}{40} & 0 & \frac{\sqrt{2}i}{40} & 0 & 0 & \frac{\sqrt{6}i}{40} & 0 & -\frac{\sqrt{3}i}{10} & 0 & -\frac{\sqrt{30}i}{40} \\
0 & \frac{\sqrt{2}i}{40} & 0 & -\frac{3\sqrt{6}i}{40} & \frac{\sqrt{30}i}{40} & 0 & \frac{\sqrt{3}i}{10} & 0 & -\frac{\sqrt{6}i}{40} & 0 \\
\frac{3\sqrt{3}i}{40} & 0 & \frac{7i}{40} & 0 & 0 & \frac{\sqrt{3}i}{10} & 0 & \frac{\sqrt{6}i}{40} & 0 & \frac{\sqrt{15}i}{20} \\
0 & \frac{3\sqrt{5}i}{40} & 0 & -\frac{\sqrt{15}i}{40} & 0 & 0 & \frac{\sqrt{30}i}{40} & 0 & -\frac{\sqrt{15}i}{20} & 0
\end{bmatrix}$$

| 518 | symmetry | $z$ |
|---|---|---|

*continued ...*

Table 8

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_1^{(1,-1;a)}(A_{2g})$

$$\begin{bmatrix}
-\frac{3\sqrt{10}}{50} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{10}}{25} & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{10}}{50} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{15}}{25} & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{10}}{50} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{15}}{25} & 0 & 0 \\
0 & 0 & 0 & \frac{3\sqrt{10}}{50} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{10}}{25} & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{10}}{10} & 0 & 0 & 0 & 0 & 0 \\
-\frac{2\sqrt{10}}{25} & 0 & 0 & 0 & 0 & \frac{3\sqrt{10}}{50} & 0 & 0 & 0 & 0 \\
0 & -\frac{2\sqrt{15}}{25} & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{50} & 0 & 0 & 0 \\
0 & 0 & -\frac{2\sqrt{15}}{25} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{50} & 0 & 0 \\
0 & 0 & 0 & -\frac{2\sqrt{10}}{25} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}}{50} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{10}
\end{bmatrix}$$

| 519 | symmetry | $x$ |
|---|---|---|

$\mathbb{M}_{1,1}^{(1,-1;a)}(E_g)$

$$\begin{bmatrix}
0 & -\frac{\sqrt{30}}{50} & 0 & 0 & \frac{\sqrt{2}}{5} & 0 & -\frac{\sqrt{5}}{25} & 0 & 0 & 0 \\
-\frac{\sqrt{30}}{50} & 0 & -\frac{\sqrt{10}}{25} & 0 & 0 & \frac{\sqrt{30}}{25} & 0 & -\frac{\sqrt{15}}{25} & 0 & 0 \\
0 & -\frac{\sqrt{10}}{25} & 0 & -\frac{\sqrt{30}}{50} & 0 & 0 & \frac{\sqrt{15}}{25} & 0 & -\frac{\sqrt{30}}{25} & 0 \\
0 & 0 & -\frac{\sqrt{30}}{50} & 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{25} & 0 & -\frac{\sqrt{2}}{5} \\
\frac{\sqrt{2}}{5} & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{10} & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{30}}{25} & 0 & 0 & \frac{\sqrt{2}}{10} & 0 & \frac{2\sqrt{5}}{25} & 0 & 0 & 0 \\
-\frac{\sqrt{5}}{25} & 0 & \frac{\sqrt{15}}{25} & 0 & 0 & \frac{2\sqrt{5}}{25} & 0 & \frac{3\sqrt{10}}{50} & 0 & 0 \\
0 & -\frac{\sqrt{15}}{25} & 0 & \frac{\sqrt{5}}{25} & 0 & 0 & \frac{3\sqrt{10}}{50} & 0 & \frac{2\sqrt{5}}{25} & 0 \\
0 & 0 & -\frac{\sqrt{30}}{25} & 0 & 0 & 0 & 0 & \frac{2\sqrt{5}}{25} & 0 & \frac{\sqrt{2}}{10} \\
0 & 0 & 0 & -\frac{\sqrt{2}}{5} & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{10} & 0
\end{bmatrix}$$

| 520 | symmetry | $-y$ |
|---|---|---|

*continued …*

132

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_{1,2}^{(1,-1;a)}(E_g)$

$$\begin{pmatrix}
0 & -\frac{\sqrt{30}i}{50} & 0 & 0 & -\frac{\sqrt{2}i}{5} & 0 & -\frac{\sqrt{5}i}{25} & 0 & 0 & 0 \\
\frac{\sqrt{30}i}{50} & 0 & -\frac{\sqrt{10}i}{25} & 0 & 0 & -\frac{\sqrt{30}i}{25} & 0 & -\frac{\sqrt{15}i}{25} & 0 & 0 \\
0 & \frac{\sqrt{10}i}{25} & 0 & -\frac{\sqrt{30}i}{50} & 0 & 0 & -\frac{\sqrt{15}i}{25} & 0 & -\frac{\sqrt{30}i}{25} & 0 \\
0 & 0 & \frac{\sqrt{30}i}{50} & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}i}{25} & 0 & -\frac{\sqrt{2}i}{5} \\
\frac{\sqrt{2}i}{5} & 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{10} & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{30}i}{25} & 0 & 0 & -\frac{\sqrt{2}i}{10} & 0 & \frac{2\sqrt{5}i}{25} & 0 & 0 & 0 \\
\frac{\sqrt{5}i}{25} & 0 & \frac{\sqrt{15}i}{25} & 0 & 0 & -\frac{2\sqrt{5}i}{25} & 0 & \frac{3\sqrt{10}i}{50} & 0 & 0 \\
0 & \frac{\sqrt{15}i}{25} & 0 & \frac{\sqrt{5}i}{25} & 0 & 0 & -\frac{3\sqrt{10}i}{50} & 0 & \frac{2\sqrt{5}i}{25} & 0 \\
0 & 0 & \frac{\sqrt{30}i}{25} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{5}i}{25} & 0 & \frac{\sqrt{2}i}{10} \\
0 & 0 & 0 & \frac{\sqrt{2}i}{5} & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{10} & 0
\end{pmatrix}$$

| 521 | symmetry | $-\frac{z\left(3x^2+3y^2-2z^2\right)}{2}$ |
|---|---|---|

$\mathbb{M}_3^{(1,-1;a)}(A_{2g})$

$$\begin{pmatrix}
\frac{\sqrt{105}}{350} & 0 & 0 & 0 & 0 & \frac{4\sqrt{105}}{175} & 0 & 0 & 0 & 0 \\
0 & -\frac{3\sqrt{105}}{350} & 0 & 0 & 0 & 0 & -\frac{4\sqrt{70}}{175} & 0 & 0 & 0 \\
0 & 0 & \frac{3\sqrt{105}}{350} & 0 & 0 & 0 & 0 & -\frac{4\sqrt{70}}{175} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{105}}{350} & 0 & 0 & 0 & 0 & \frac{4\sqrt{105}}{175} & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{105}}{35} & 0 & 0 & 0 & 0 & 0 \\
\frac{4\sqrt{105}}{175} & 0 & 0 & 0 & 0 & \frac{\sqrt{105}}{25} & 0 & 0 & 0 & 0 \\
0 & -\frac{4\sqrt{70}}{175} & 0 & 0 & 0 & 0 & \frac{4\sqrt{105}}{175} & 0 & 0 & 0 \\
0 & 0 & -\frac{4\sqrt{70}}{175} & 0 & 0 & 0 & 0 & -\frac{4\sqrt{105}}{175} & 0 & 0 \\
0 & 0 & 0 & \frac{4\sqrt{105}}{175} & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}}{25} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}}{35}
\end{pmatrix}$$

| 522 | symmetry | $\sqrt{15}xyz$ |
|---|---|---|

*continued ...*

Table 8

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_3^{(1,-1;a)}(B_{1g})$

$$\begin{pmatrix}
0 & 0 & -\frac{\sqrt{21}i}{70} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{14}i}{35} & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{21}i}{70} & -\frac{2\sqrt{105}i}{105} & 0 & 0 & 0 & -\frac{2\sqrt{21}i}{105} & 0 \\
\frac{\sqrt{21}i}{70} & 0 & 0 & 0 & 0 & \frac{2\sqrt{21}i}{105} & 0 & 0 & 0 & \frac{2\sqrt{105}i}{105} \\
0 & -\frac{\sqrt{21}i}{70} & 0 & 0 & 0 & 0 & \frac{2\sqrt{14}i}{35} & 0 & 0 & 0 \\
0 & \frac{2\sqrt{105}i}{105} & 0 & 0 & 0 & 0 & \frac{3\sqrt{70}i}{70} & 0 & 0 & 0 \\
0 & 0 & -\frac{2\sqrt{21}i}{105} & 0 & 0 & 0 & 0 & \frac{3\sqrt{14}i}{70} & 0 & 0 \\
0 & 0 & 0 & -\frac{2\sqrt{14}i}{35} & -\frac{3\sqrt{70}i}{70} & 0 & 0 & 0 & -\frac{3\sqrt{14}i}{70} & 0 \\
\frac{2\sqrt{14}i}{35} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{14}i}{70} & 0 & 0 & 0 & -\frac{3\sqrt{70}i}{70} \\
0 & \frac{2\sqrt{21}i}{105} & 0 & 0 & 0 & 0 & \frac{3\sqrt{14}i}{70} & 0 & 0 & 0 \\
0 & 0 & -\frac{2\sqrt{105}i}{105} & 0 & 0 & 0 & 0 & \frac{3\sqrt{70}i}{70} & 0 & 0
\end{pmatrix}$$

| 523 | symmetry | $\frac{\sqrt{15}z(x-y)(x+y)}{2}$ |

$\mathbb{M}_3^{(1,-1;a)}(B_{2g})$

$$\begin{bmatrix}
0 & 0 & \frac{\sqrt{21}}{70} & 0 & 0 & 0 & 0 & \frac{2\sqrt{14}}{35} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{21}}{70} & -\frac{2\sqrt{105}}{105} & 0 & 0 & 0 & \frac{2\sqrt{21}}{105} & 0 \\
\frac{\sqrt{21}}{70} & 0 & 0 & 0 & 0 & \frac{2\sqrt{21}}{105} & 0 & 0 & 0 & -\frac{2\sqrt{105}}{105} \\
0 & -\frac{\sqrt{21}}{70} & 0 & 0 & 0 & 0 & \frac{2\sqrt{14}}{35} & 0 & 0 & 0 \\
0 & -\frac{2\sqrt{105}}{105} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{70}}{70} & 0 & 0 & 0 \\
0 & 0 & \frac{2\sqrt{21}}{105} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{14}}{70} & 0 & 0 \\
0 & 0 & 0 & \frac{2\sqrt{14}}{35} & -\frac{3\sqrt{70}}{70} & 0 & 0 & 0 & \frac{3\sqrt{14}}{70} & 0 \\
\frac{2\sqrt{14}}{35} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{14}}{70} & 0 & 0 & 0 & \frac{3\sqrt{70}}{70} \\
0 & \frac{2\sqrt{21}}{105} & 0 & 0 & 0 & 0 & \frac{3\sqrt{14}}{70} & 0 & 0 & 0 \\
0 & 0 & -\frac{2\sqrt{105}}{105} & 0 & 0 & 0 & 0 & \frac{3\sqrt{70}}{70} & 0 & 0
\end{bmatrix}$$

| 524 | symmetry | $\frac{x\left(2x^2-3y^2-3z^2\right)}{2}$ |

*continued ...*

Table 8

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_{3,1}^{(1,-1;a)}(E_g,1)$

$$\begin{bmatrix}
0 & -\frac{3\sqrt{35}}{700} & 0 & \frac{\sqrt{105}}{140} & \frac{\sqrt{21}}{70} & 0 & -\frac{3\sqrt{210}}{350} & 0 & \frac{\sqrt{105}}{70} & 0 \\
-\frac{3\sqrt{35}}{700} & 0 & \frac{3\sqrt{105}}{700} & 0 & 0 & -\frac{\sqrt{35}}{50} & 0 & \frac{\sqrt{70}}{350} & 0 & \frac{\sqrt{7}}{14} \\
0 & \frac{3\sqrt{105}}{700} & 0 & -\frac{3\sqrt{35}}{700} & -\frac{\sqrt{7}}{14} & 0 & -\frac{\sqrt{70}}{350} & 0 & \frac{\sqrt{35}}{50} & 0 \\
\frac{\sqrt{105}}{140} & 0 & -\frac{3\sqrt{35}}{700} & 0 & 0 & -\frac{\sqrt{105}}{70} & 0 & \frac{3\sqrt{210}}{350} & 0 & -\frac{\sqrt{21}}{70} \\
\frac{\sqrt{21}}{70} & 0 & -\frac{\sqrt{7}}{14} & 0 & 0 & \frac{3\sqrt{21}}{70} & 0 & -\frac{\sqrt{42}}{28} & 0 & 0 \\
0 & -\frac{\sqrt{35}}{50} & 0 & -\frac{\sqrt{105}}{70} & \frac{3\sqrt{21}}{70} & 0 & -\frac{3\sqrt{210}}{700} & 0 & -\frac{\sqrt{105}}{35} & 0 \\
-\frac{3\sqrt{210}}{350} & 0 & -\frac{\sqrt{70}}{350} & 0 & 0 & -\frac{3\sqrt{210}}{700} & 0 & -\frac{3\sqrt{105}}{175} & 0 & -\frac{\sqrt{42}}{28} \\
0 & \frac{\sqrt{70}}{350} & 0 & \frac{3\sqrt{210}}{350} & -\frac{\sqrt{42}}{28} & 0 & -\frac{3\sqrt{105}}{175} & 0 & -\frac{3\sqrt{210}}{700} & 0 \\
\frac{\sqrt{105}}{70} & 0 & \frac{\sqrt{35}}{50} & 0 & 0 & -\frac{\sqrt{105}}{35} & 0 & -\frac{3\sqrt{210}}{700} & 0 & \frac{3\sqrt{21}}{70} \\
0 & \frac{\sqrt{7}}{14} & 0 & -\frac{\sqrt{21}}{70} & 0 & 0 & -\frac{\sqrt{42}}{28} & 0 & \frac{3\sqrt{21}}{70} & 0
\end{bmatrix}$$

| 525 | symmetry | $\dfrac{y\left(3x^2-2y^2+3z^2\right)}{2}$ |
|---|---|---|

$\mathbb{M}_{3,2}^{(1,-1;a)}(E_g,1)$

$$\begin{bmatrix}
0 & -\frac{3\sqrt{35}i}{700} & 0 & -\frac{\sqrt{105}i}{140} & -\frac{\sqrt{21}i}{70} & 0 & -\frac{3\sqrt{210}i}{350} & 0 & -\frac{\sqrt{105}i}{70} & 0 \\
\frac{3\sqrt{35}i}{700} & 0 & \frac{3\sqrt{105}i}{700} & 0 & 0 & \frac{\sqrt{35}i}{50} & 0 & \frac{\sqrt{70}i}{350} & 0 & -\frac{\sqrt{7}i}{14} \\
0 & -\frac{3\sqrt{105}i}{700} & 0 & -\frac{3\sqrt{35}i}{700} & -\frac{\sqrt{7}i}{14} & 0 & \frac{\sqrt{70}i}{350} & 0 & \frac{\sqrt{35}i}{50} & 0 \\
\frac{\sqrt{105}i}{140} & 0 & \frac{3\sqrt{35}i}{700} & 0 & 0 & -\frac{\sqrt{105}i}{70} & 0 & -\frac{3\sqrt{210}i}{350} & 0 & -\frac{\sqrt{21}i}{70} \\
\frac{\sqrt{21}i}{70} & 0 & \frac{\sqrt{7}i}{14} & 0 & 0 & \frac{3\sqrt{21}i}{70} & 0 & \frac{\sqrt{42}i}{28} & 0 & 0 \\
0 & -\frac{\sqrt{35}i}{50} & 0 & \frac{\sqrt{105}i}{70} & -\frac{3\sqrt{21}i}{70} & 0 & -\frac{3\sqrt{210}i}{700} & 0 & \frac{\sqrt{105}i}{35} & 0 \\
\frac{3\sqrt{210}i}{350} & 0 & -\frac{\sqrt{70}i}{350} & 0 & 0 & \frac{3\sqrt{210}i}{700} & 0 & -\frac{3\sqrt{105}i}{175} & 0 & \frac{\sqrt{42}i}{28} \\
0 & -\frac{\sqrt{70}i}{350} & 0 & \frac{3\sqrt{210}i}{350} & -\frac{\sqrt{42}i}{28} & 0 & \frac{3\sqrt{105}i}{175} & 0 & -\frac{3\sqrt{210}i}{700} & 0 \\
\frac{\sqrt{105}i}{70} & 0 & -\frac{\sqrt{35}i}{50} & 0 & 0 & -\frac{\sqrt{105}i}{35} & 0 & \frac{3\sqrt{210}i}{700} & 0 & \frac{3\sqrt{21}i}{70} \\
0 & \frac{\sqrt{7}i}{14} & 0 & \frac{\sqrt{21}i}{70} & 0 & 0 & -\frac{\sqrt{42}i}{28} & 0 & -\frac{3\sqrt{21}i}{70} & 0
\end{bmatrix}$$

| 526 | symmetry | $\dfrac{\sqrt{15}x(y-z)(y+z)}{2}$ |
|---|---|---|

Table 8

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_{3,1}^{(1,-1;a)}(E_g,2)$$

$$\begin{bmatrix}
0 & -\frac{\sqrt{21}}{140} & 0 & -\frac{3\sqrt{7}}{140} & \frac{\sqrt{35}}{70} & 0 & -\frac{3\sqrt{14}}{70} & 0 & -\frac{3\sqrt{7}}{70} & 0 \\
-\frac{\sqrt{21}}{140} & 0 & \frac{3\sqrt{7}}{140} & 0 & 0 & -\frac{\sqrt{21}}{30} & 0 & \frac{\sqrt{42}}{210} & 0 & -\frac{\sqrt{105}}{70} \\
0 & \frac{3\sqrt{7}}{140} & 0 & -\frac{\sqrt{21}}{140} & \frac{\sqrt{105}}{70} & 0 & -\frac{\sqrt{42}}{210} & 0 & \frac{\sqrt{21}}{30} & 0 \\
-\frac{3\sqrt{7}}{140} & 0 & -\frac{\sqrt{21}}{140} & 0 & 0 & \frac{3\sqrt{7}}{70} & 0 & \frac{3\sqrt{14}}{70} & 0 & -\frac{\sqrt{35}}{70} \\
\frac{\sqrt{35}}{70} & 0 & \frac{\sqrt{105}}{70} & 0 & 0 & \frac{3\sqrt{35}}{70} & 0 & \frac{3\sqrt{70}}{140} & 0 & 0 \\
0 & -\frac{\sqrt{21}}{30} & 0 & \frac{3\sqrt{7}}{70} & \frac{3\sqrt{35}}{70} & 0 & -\frac{3\sqrt{14}}{140} & 0 & \frac{3\sqrt{7}}{35} & 0 \\
-\frac{3\sqrt{14}}{70} & 0 & -\frac{\sqrt{42}}{210} & 0 & 0 & -\frac{3\sqrt{14}}{140} & 0 & -\frac{3\sqrt{7}}{35} & 0 & \frac{3\sqrt{70}}{140} \\
0 & \frac{\sqrt{42}}{210} & 0 & \frac{3\sqrt{14}}{70} & \frac{3\sqrt{70}}{140} & 0 & -\frac{3\sqrt{7}}{35} & 0 & -\frac{3\sqrt{14}}{140} & 0 \\
-\frac{3\sqrt{7}}{70} & 0 & \frac{\sqrt{21}}{30} & 0 & 0 & \frac{3\sqrt{7}}{35} & 0 & -\frac{3\sqrt{14}}{140} & 0 & \frac{3\sqrt{35}}{70} \\
0 & -\frac{\sqrt{105}}{70} & 0 & -\frac{\sqrt{35}}{70} & 0 & 0 & \frac{3\sqrt{70}}{140} & 0 & \frac{3\sqrt{35}}{70} & 0
\end{bmatrix}$$

527    symmetry    $-\frac{\sqrt{15}y(x-z)(x+z)}{2}$

$$\mathbb{M}_{3,2}^{(1,-1;a)}(E_g,2)$$

$$\begin{bmatrix}
0 & -\frac{\sqrt{21}i}{140} & 0 & \frac{3\sqrt{7}i}{140} & -\frac{\sqrt{35}i}{70} & 0 & -\frac{3\sqrt{14}i}{70} & 0 & \frac{3\sqrt{7}i}{70} & 0 \\
\frac{\sqrt{21}i}{140} & 0 & \frac{3\sqrt{7}i}{140} & 0 & 0 & \frac{\sqrt{21}i}{30} & 0 & \frac{\sqrt{42}i}{210} & 0 & \frac{\sqrt{105}i}{70} \\
0 & -\frac{3\sqrt{7}i}{140} & 0 & -\frac{\sqrt{21}i}{140} & \frac{\sqrt{105}i}{70} & 0 & \frac{\sqrt{42}i}{210} & 0 & \frac{\sqrt{21}i}{30} & 0 \\
-\frac{3\sqrt{7}i}{140} & 0 & \frac{\sqrt{21}i}{140} & 0 & 0 & \frac{3\sqrt{7}i}{70} & 0 & -\frac{3\sqrt{14}i}{70} & 0 & -\frac{\sqrt{35}i}{70} \\
\frac{\sqrt{35}i}{70} & 0 & -\frac{\sqrt{105}i}{70} & 0 & 0 & \frac{3\sqrt{35}i}{70} & 0 & -\frac{3\sqrt{70}i}{140} & 0 & 0 \\
0 & -\frac{\sqrt{21}i}{30} & 0 & -\frac{3\sqrt{7}i}{70} & -\frac{3\sqrt{35}i}{70} & 0 & -\frac{3\sqrt{14}i}{140} & 0 & -\frac{3\sqrt{7}i}{35} & 0 \\
\frac{3\sqrt{14}i}{70} & 0 & -\frac{\sqrt{42}i}{210} & 0 & 0 & \frac{3\sqrt{14}i}{140} & 0 & -\frac{3\sqrt{7}i}{35} & 0 & -\frac{3\sqrt{70}i}{140} \\
0 & -\frac{\sqrt{42}i}{210} & 0 & \frac{3\sqrt{14}i}{70} & \frac{3\sqrt{70}i}{140} & 0 & \frac{3\sqrt{7}i}{35} & 0 & -\frac{3\sqrt{14}i}{140} & 0 \\
-\frac{3\sqrt{7}i}{70} & 0 & -\frac{\sqrt{21}i}{30} & 0 & 0 & \frac{3\sqrt{7}i}{35} & 0 & \frac{3\sqrt{14}i}{140} & 0 & \frac{3\sqrt{35}i}{70} \\
0 & -\frac{\sqrt{105}i}{70} & 0 & \frac{\sqrt{35}i}{70} & 0 & 0 & \frac{3\sqrt{70}i}{140} & 0 & -\frac{3\sqrt{35}i}{70} & 0
\end{bmatrix}$$

528    symmetry    $\frac{3\sqrt{35}xyz(x-y)(x+y)}{2}$

Table 8

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{M}_5^{(1,-1;a)}(A_{1g})$ | $\begin{array}{cccccccccc} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{i}{2} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{i}{2} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{i}{2} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{i}{2} & 0 & 0 & 0 & 0 \end{array}$ |
| 529 | symmetry | $\dfrac{z\left(15x^4+30x^2y^2-40x^2z^2+15y^4-40y^2z^2+8z^4\right)}{8}$ |
| | $\mathbb{M}_5^{(1,-1;a)}(A_{2g},1)$ | $\begin{array}{cccccccccc} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{42} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{7}}{42} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{7}}{21} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{7}}{21} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{7}}{42} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{42} \end{array}$ |
| 530 | symmetry | $\dfrac{3\sqrt{35}z\left(x^2-2xy-y^2\right)\left(x^2+2xy-y^2\right)}{8}$ |

*continued …*

Table 8

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{M}_5^{(1,-1;a)}(A_{2g},2)$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{2} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{2} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{1}{2} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{1}{2} & 0 & 0 & 0 & 0 \end{bmatrix}$ |
| 531 | symmetry | $\frac{\sqrt{105}xyz\left(x^2+y^2-2z^2\right)}{2}$ |
| | $\mathbb{M}_5^{(1,-1;a)}(B_{1g})$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{12} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{12} & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{12} & 0 & 0 & 0 & \frac{\sqrt{30}i}{12} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{12} & 0 & 0 & 0 & -\frac{\sqrt{6}i}{12} \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{12} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{12} & 0 & 0 \end{bmatrix}$ |
| 532 | symmetry | $-\frac{\sqrt{105}z(x-y)(x+y)\left(x^2+y^2-2z^2\right)}{4}$ |

*continued …*

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_5^{(1,-1;a)}(B_{2g})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{12} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{12} & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{6}}{12} & 0 & 0 & 0 & \frac{\sqrt{30}}{12} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{12} & 0 & 0 & 0 & -\frac{\sqrt{6}}{12} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{12} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{12} & 0 & 0
\end{bmatrix}$$

| 533 | symmetry | $\dfrac{x\left(8x^4-40x^2y^2-40x^2z^2+15y^4+30y^2z^2+15z^4\right)}{8}$ |

$\mathbb{M}_{5,1}^{(1,-1;a)}(E_g,1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{35}}{112} & 0 & -\frac{\sqrt{70}}{48} & 0 & \frac{3\sqrt{7}}{16} \\
0 & 0 & 0 & 0 & \frac{\sqrt{35}}{112} & 0 & -\frac{5\sqrt{14}}{112} & 0 & \frac{5\sqrt{7}}{48} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{14}}{112} & 0 & \frac{5\sqrt{7}}{56} & 0 & -\frac{\sqrt{70}}{48} \\
0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{48} & 0 & \frac{5\sqrt{7}}{56} & 0 & -\frac{5\sqrt{14}}{112} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{7}}{48} & 0 & -\frac{5\sqrt{14}}{112} & 0 & \frac{\sqrt{35}}{112} \\
0 & 0 & 0 & 0 & \frac{3\sqrt{7}}{16} & 0 & -\frac{\sqrt{70}}{48} & 0 & \frac{\sqrt{35}}{112} & 0
\end{bmatrix}$$

| 534 | symmetry | $-\dfrac{y\left(15x^4-40x^2y^2+30x^2z^2+8y^4-40y^2z^2+15z^4\right)}{8}$ |

*continued …*

Table 8

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{M}_{5,2}^{(1,-1;a)}(E_g,1)$

$$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{35}i}{112} & 0 & \frac{\sqrt{70}i}{48} & 0 & \frac{3\sqrt{7}i}{16} \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{35}i}{112} & 0 & -\frac{5\sqrt{14}i}{112} & 0 & -\frac{5\sqrt{7}i}{48} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{14}i}{112} & 0 & \frac{5\sqrt{7}i}{56} & 0 & \frac{\sqrt{70}i}{48} \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{48} & 0 & -\frac{5\sqrt{7}i}{56} & 0 & -\frac{5\sqrt{14}i}{112} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{7}i}{48} & 0 & \frac{5\sqrt{14}i}{112} & 0 & \frac{\sqrt{35}i}{112} \\ 0 & 0 & 0 & 0 & -\frac{3\sqrt{7}i}{16} & 0 & -\frac{\sqrt{70}i}{48} & 0 & -\frac{\sqrt{35}i}{112} & 0 \end{pmatrix}$$

| 535 | symmetry | $\dfrac{3\sqrt{35}x\left(y^2-2yz-z^2\right)\left(y^2+2yz-z^2\right)}{8}$ |

$\mathbb{M}_{5,1}^{(1,-1;a)}(E_g,2)$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{1}{16} & 0 & \frac{3\sqrt{2}}{16} & 0 & \frac{\sqrt{5}}{16} \\ 0 & 0 & 0 & 0 & \frac{1}{16} & 0 & -\frac{\sqrt{10}}{16} & 0 & -\frac{3\sqrt{5}}{16} & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{16} & 0 & \frac{\sqrt{5}}{8} & 0 & \frac{3\sqrt{2}}{16} \\ 0 & 0 & 0 & 0 & \frac{3\sqrt{2}}{16} & 0 & \frac{\sqrt{5}}{8} & 0 & -\frac{\sqrt{10}}{16} & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{5}}{16} & 0 & -\frac{\sqrt{10}}{16} & 0 & \frac{1}{16} \\ 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{16} & 0 & \frac{3\sqrt{2}}{16} & 0 & \frac{1}{16} & 0 \end{bmatrix}$$

| 536 | symmetry | $-\dfrac{3\sqrt{35}y\left(x^2-2xz-z^2\right)\left(x^2+2xz-z^2\right)}{8}$ |

*continued …*

140

Table 8

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_{5,2}^{(1,-1;a)}(E_g, 2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{i}{16} & 0 & -\frac{3\sqrt{2}i}{16} & 0 & \frac{\sqrt{5}i}{16} \\
0 & 0 & 0 & 0 & -\frac{i}{16} & 0 & -\frac{\sqrt{10}i}{16} & 0 & \frac{3\sqrt{5}i}{16} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{16} & 0 & \frac{\sqrt{5}i}{8} & 0 & -\frac{3\sqrt{2}i}{16} \\
0 & 0 & 0 & 0 & \frac{3\sqrt{2}i}{16} & 0 & -\frac{\sqrt{5}i}{8} & 0 & -\frac{\sqrt{10}i}{16} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{5}i}{16} & 0 & \frac{\sqrt{10}i}{16} & 0 & \frac{i}{16} \\
0 & 0 & 0 & 0 & -\frac{\sqrt{5}i}{16} & 0 & \frac{3\sqrt{2}i}{16} & 0 & -\frac{i}{16} & 0
\end{bmatrix}$$

| 537 | symmetry | $\dfrac{\sqrt{105}x(y-z)(y+z)\left(2x^2-y^2-z^2\right)}{4}$ |

$\mathbb{M}_{5,1}^{(1,-1;a)}(E_g, 3)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{24} & 0 & -\frac{\sqrt{6}}{24} & 0 & -\frac{\sqrt{15}}{8} \\
0 & 0 & 0 & 0 & \frac{\sqrt{3}}{24} & 0 & -\frac{\sqrt{30}}{24} & 0 & \frac{\sqrt{15}}{24} & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{24} & 0 & \frac{\sqrt{15}}{12} & 0 & -\frac{\sqrt{6}}{24} \\
0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{24} & 0 & \frac{\sqrt{15}}{12} & 0 & -\frac{\sqrt{30}}{24} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{24} & 0 & -\frac{\sqrt{30}}{24} & 0 & \frac{\sqrt{3}}{24} \\
0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{8} & 0 & -\frac{\sqrt{6}}{24} & 0 & \frac{\sqrt{3}}{24} & 0
\end{bmatrix}$$

| 538 | symmetry | $\dfrac{\sqrt{105}y(x-z)(x+z)\left(x^2-2y^2+z^2\right)}{4}$ |

*continued ...*

Table 8

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_{5,2}^{(1,-1;a)}(E_g,3)$$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{24} & 0 & \frac{\sqrt{6}i}{24} & 0 & -\frac{\sqrt{15}i}{8} \\
0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{24} & 0 & -\frac{\sqrt{30}i}{24} & 0 & -\frac{\sqrt{15}i}{24} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{24} & 0 & \frac{\sqrt{15}i}{12} & 0 & \frac{\sqrt{6}i}{24} \\
0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{24} & 0 & -\frac{\sqrt{15}i}{12} & 0 & -\frac{\sqrt{30}i}{24} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{24} & 0 & \frac{\sqrt{30}i}{24} & 0 & \frac{\sqrt{3}i}{24} \\
0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{8} & 0 & -\frac{\sqrt{6}i}{24} & 0 & -\frac{\sqrt{3}i}{24} & 0
\end{bmatrix}$$

| 539 | symmetry | $z$ |
|---|---|---|

$$\mathbb{M}_1^{(1,1;a)}(A_{2g})$$

$$\begin{bmatrix}
\frac{3\sqrt{70}}{50} & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{50} & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{70}}{50} & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}}{50} & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{70}}{50} & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}}{50} & 0 & 0 \\
0 & 0 & 0 & -\frac{3\sqrt{70}}{50} & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{50} & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{35} & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{70}}{50} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{70}}{175} & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{105}}{50} & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{175} & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{105}}{50} & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{175} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{70}}{50} & 0 & 0 & 0 & 0 & \frac{3\sqrt{70}}{175} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{35}
\end{bmatrix}$$

| 540 | symmetry | $x$ |
|---|---|---|

*continued …*

Table 8

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_{1,1}^{(1,1;a)}(E_g) = \begin{pmatrix}
0 & \frac{\sqrt{210}}{50} & 0 & 0 & \frac{\sqrt{14}}{20} & 0 & -\frac{\sqrt{35}}{100} & 0 & 0 & 0 \\[4pt]
\frac{\sqrt{210}}{50} & 0 & \frac{\sqrt{70}}{25} & 0 & 0 & \frac{\sqrt{210}}{100} & 0 & -\frac{\sqrt{105}}{100} & 0 & 0 \\[4pt]
0 & \frac{\sqrt{70}}{25} & 0 & \frac{\sqrt{210}}{50} & 0 & 0 & \frac{\sqrt{105}}{100} & 0 & -\frac{\sqrt{210}}{100} & 0 \\[4pt]
0 & 0 & \frac{\sqrt{210}}{50} & 0 & 0 & 0 & 0 & \frac{\sqrt{35}}{100} & 0 & -\frac{\sqrt{14}}{20} \\[4pt]
\frac{\sqrt{14}}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{35} & 0 & 0 & 0 & 0 \\[4pt]
0 & \frac{\sqrt{210}}{100} & 0 & 0 & -\frac{\sqrt{14}}{35} & 0 & -\frac{4\sqrt{35}}{175} & 0 & 0 & 0 \\[4pt]
-\frac{\sqrt{35}}{100} & 0 & \frac{\sqrt{105}}{100} & 0 & 0 & -\frac{4\sqrt{35}}{175} & 0 & -\frac{3\sqrt{70}}{175} & 0 & 0 \\[4pt]
0 & -\frac{\sqrt{105}}{100} & 0 & \frac{\sqrt{35}}{100} & 0 & 0 & -\frac{3\sqrt{70}}{175} & 0 & -\frac{4\sqrt{35}}{175} & 0 \\[4pt]
0 & 0 & -\frac{\sqrt{210}}{100} & 0 & 0 & 0 & 0 & -\frac{4\sqrt{35}}{175} & 0 & -\frac{\sqrt{14}}{35} \\[4pt]
0 & 0 & 0 & -\frac{\sqrt{14}}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{35} & 0
\end{pmatrix}$$

| 541 | symmetry | $-y$ |
|---|---|---|

$$\mathbb{M}_{1,2}^{(1,1;a)}(E_g) = \begin{pmatrix}
0 & \frac{\sqrt{210}i}{50} & 0 & 0 & -\frac{\sqrt{14}i}{20} & 0 & -\frac{\sqrt{35}i}{100} & 0 & 0 & 0 \\[4pt]
-\frac{\sqrt{210}i}{50} & 0 & \frac{\sqrt{70}i}{25} & 0 & 0 & -\frac{\sqrt{210}i}{100} & 0 & -\frac{\sqrt{105}i}{100} & 0 & 0 \\[4pt]
0 & -\frac{\sqrt{70}i}{25} & 0 & \frac{\sqrt{210}i}{50} & 0 & 0 & -\frac{\sqrt{105}i}{100} & 0 & -\frac{\sqrt{210}i}{100} & 0 \\[4pt]
0 & 0 & -\frac{\sqrt{210}i}{50} & 0 & 0 & 0 & 0 & -\frac{\sqrt{35}i}{100} & 0 & -\frac{\sqrt{14}i}{20} \\[4pt]
\frac{\sqrt{14}i}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}i}{35} & 0 & 0 & 0 & 0 \\[4pt]
0 & \frac{\sqrt{210}i}{100} & 0 & 0 & \frac{\sqrt{14}i}{35} & 0 & -\frac{4\sqrt{35}i}{175} & 0 & 0 & 0 \\[4pt]
\frac{\sqrt{35}i}{100} & 0 & \frac{\sqrt{105}i}{100} & 0 & 0 & \frac{4\sqrt{35}i}{175} & 0 & -\frac{3\sqrt{70}i}{175} & 0 & 0 \\[4pt]
0 & \frac{\sqrt{105}i}{100} & 0 & \frac{\sqrt{35}i}{100} & 0 & 0 & \frac{3\sqrt{70}i}{175} & 0 & -\frac{4\sqrt{35}i}{175} & 0 \\[4pt]
0 & 0 & \frac{\sqrt{210}i}{100} & 0 & 0 & 0 & 0 & \frac{4\sqrt{35}i}{175} & 0 & -\frac{\sqrt{14}i}{35} \\[4pt]
0 & 0 & 0 & \frac{\sqrt{14}i}{20} & 0 & 0 & 0 & 0 & \frac{\sqrt{14}i}{35} & 0
\end{pmatrix}$$

| 542 | symmetry | $-\dfrac{z\left(3x^2+3y^2-2z^2\right)}{2}$ |
|---|---|---|

No. | multipole | matrix

$\mathbb{M}_3^{(1,1;a)}(A_{2g})$

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $-\frac{6\sqrt{35}}{175}$ | 0 | 0 | 0 | 0 | $\frac{9\sqrt{35}}{350}$ | 0 | 0 | 0 |
| 0 | $\frac{18\sqrt{35}}{175}$ | 0 | 0 | 0 | 0 | $-\frac{3\sqrt{210}}{350}$ | 0 | 0 |
| 0 | 0 | $-\frac{18\sqrt{35}}{175}$ | 0 | 0 | 0 | 0 | $-\frac{3\sqrt{210}}{350}$ | 0 |
| 0 | 0 | 0 | $\frac{6\sqrt{35}}{175}$ | 0 | 0 | 0 | 0 | $\frac{9\sqrt{35}}{350}$ |
| 0 | 0 | 0 | 0 | $\frac{\sqrt{35}}{105}$ | 0 | 0 | 0 | 0 |
| $\frac{9\sqrt{35}}{350}$ | 0 | 0 | 0 | 0 | $-\frac{\sqrt{35}}{75}$ | 0 | 0 | 0 |
| 0 | $-\frac{3\sqrt{210}}{350}$ | 0 | 0 | 0 | 0 | $-\frac{4\sqrt{35}}{525}$ | 0 | 0 |
| 0 | 0 | $-\frac{3\sqrt{210}}{350}$ | 0 | 0 | 0 | 0 | $\frac{4\sqrt{35}}{525}$ | 0 |
| 0 | 0 | 0 | $\frac{9\sqrt{35}}{350}$ | 0 | 0 | 0 | 0 | $\frac{\sqrt{35}}{75}$ |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{35}}{105}$ |

| 543 | symmetry | $\sqrt{15}xyz$ |
|---|---|---|

$\mathbb{M}_3^{(1,1;a)}(B_{1g})$

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | $\frac{6\sqrt{7}i}{35}$ | 0 | 0 | 0 | 0 | $-\frac{3\sqrt{42}i}{140}$ | 0 | 0 |
| 0 | 0 | 0 | $-\frac{6\sqrt{7}i}{35}$ | $-\frac{3\sqrt{35}i}{140}$ | 0 | 0 | 0 | $-\frac{3\sqrt{7}i}{140}$ | 0 |
| $-\frac{6\sqrt{7}i}{35}$ | 0 | 0 | 0 | 0 | $\frac{3\sqrt{7}i}{140}$ | 0 | 0 | 0 | $\frac{3\sqrt{35}i}{140}$ |
| 0 | $\frac{6\sqrt{7}i}{35}$ | 0 | 0 | 0 | 0 | $\frac{3\sqrt{42}i}{140}$ | 0 | 0 | 0 |
| 0 | $\frac{3\sqrt{35}i}{140}$ | 0 | 0 | 0 | 0 | $-\frac{\sqrt{210}i}{210}$ | 0 | 0 | 0 |
| 0 | 0 | $-\frac{3\sqrt{7}i}{140}$ | 0 | 0 | 0 | 0 | $-\frac{\sqrt{42}i}{210}$ | 0 | 0 |
| 0 | 0 | 0 | $-\frac{3\sqrt{42}i}{140}$ | $\frac{\sqrt{210}i}{210}$ | 0 | 0 | 0 | $\frac{\sqrt{42}i}{210}$ | 0 |
| $\frac{3\sqrt{42}i}{140}$ | 0 | 0 | 0 | 0 | $\frac{\sqrt{42}i}{210}$ | 0 | 0 | 0 | $\frac{\sqrt{210}i}{210}$ |
| 0 | $\frac{3\sqrt{7}i}{140}$ | 0 | 0 | 0 | 0 | $-\frac{\sqrt{42}i}{210}$ | 0 | 0 | 0 |
| 0 | 0 | $-\frac{3\sqrt{35}i}{140}$ | 0 | 0 | 0 | 0 | $-\frac{\sqrt{210}i}{210}$ | 0 | 0 |

| 544 | symmetry | $\frac{\sqrt{15}z(x-y)(x+y)}{2}$ |
|---|---|---|

Table 8

| No. | multipole | matrix | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{M}_3^{(1,1;a)}(B_{2g})$ | $0$ | $0$ | $-\frac{6\sqrt{7}}{35}$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{42}}{140}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{6\sqrt{7}}{35}$ | $-\frac{3\sqrt{35}}{140}$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{7}}{140}$ | $0$ |
| | | $-\frac{6\sqrt{7}}{35}$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{7}}{140}$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{35}}{140}$ |
| | | $0$ | $\frac{6\sqrt{7}}{35}$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{42}}{140}$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{3\sqrt{35}}{140}$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{210}}{210}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $\frac{3\sqrt{7}}{140}$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{42}}{210}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{3\sqrt{42}}{140}$ | $\frac{\sqrt{210}}{210}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{42}}{210}$ | $0$ |
| | | $\frac{3\sqrt{42}}{140}$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{42}}{210}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{210}}{210}$ |
| | | $0$ | $\frac{3\sqrt{7}}{140}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{42}}{210}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $-\frac{3\sqrt{35}}{140}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{210}}{210}$ | $0$ | $0$ |
| 545 | symmetry | $\frac{x\left(2x^2-3y^2-3z^2\right)}{2}$ | | | | | | | | | | |
| | $\mathbb{M}_{3,1}^{(1,1;a)}(E_g,1)$ | $0$ | $\frac{3\sqrt{105}}{175}$ | $0$ | $-\frac{3\sqrt{35}}{35}$ | $\frac{9\sqrt{7}}{560}$ | $0$ | $-\frac{27\sqrt{70}}{2800}$ | $0$ | $\frac{9\sqrt{35}}{560}$ | $0$ |
| | | $\frac{3\sqrt{105}}{175}$ | $0$ | $-\frac{9\sqrt{35}}{175}$ | $0$ | $0$ | $-\frac{3\sqrt{105}}{400}$ | $0$ | $\frac{3\sqrt{210}}{2800}$ | $0$ | $\frac{3\sqrt{21}}{112}$ |
| | | $0$ | $-\frac{9\sqrt{35}}{175}$ | $0$ | $\frac{3\sqrt{105}}{175}$ | $-\frac{3\sqrt{21}}{112}$ | $0$ | $-\frac{3\sqrt{210}}{2800}$ | $0$ | $\frac{3\sqrt{105}}{400}$ | $0$ |
| | | $-\frac{3\sqrt{35}}{35}$ | $0$ | $\frac{3\sqrt{105}}{175}$ | $0$ | $0$ | $-\frac{9\sqrt{35}}{560}$ | $0$ | $\frac{27\sqrt{70}}{2800}$ | $0$ | $-\frac{9\sqrt{7}}{560}$ |
| | | $\frac{9\sqrt{7}}{560}$ | $0$ | $-\frac{3\sqrt{21}}{112}$ | $0$ | $0$ | $-\frac{\sqrt{7}}{70}$ | $0$ | $\frac{\sqrt{14}}{84}$ | $0$ | $0$ |
| | | $0$ | $-\frac{3\sqrt{105}}{400}$ | $0$ | $-\frac{9\sqrt{35}}{560}$ | $-\frac{\sqrt{7}}{70}$ | $0$ | $\frac{\sqrt{70}}{700}$ | $0$ | $\frac{\sqrt{35}}{105}$ | $0$ |
| | | $-\frac{27\sqrt{70}}{2800}$ | $0$ | $-\frac{3\sqrt{210}}{2800}$ | $0$ | $0$ | $\frac{\sqrt{70}}{700}$ | $0$ | $\frac{\sqrt{35}}{175}$ | $0$ | $\frac{\sqrt{14}}{84}$ |
| | | $0$ | $\frac{3\sqrt{210}}{2800}$ | $0$ | $\frac{27\sqrt{70}}{2800}$ | $\frac{\sqrt{14}}{84}$ | $0$ | $\frac{\sqrt{35}}{175}$ | $0$ | $\frac{\sqrt{70}}{700}$ | $0$ |
| | | $\frac{9\sqrt{35}}{560}$ | $0$ | $\frac{3\sqrt{105}}{400}$ | $0$ | $0$ | $\frac{\sqrt{35}}{105}$ | $0$ | $\frac{\sqrt{70}}{700}$ | $0$ | $-\frac{\sqrt{7}}{70}$ |
| | | $0$ | $\frac{3\sqrt{21}}{112}$ | $0$ | $-\frac{9\sqrt{7}}{560}$ | $0$ | $0$ | $\frac{\sqrt{14}}{84}$ | $0$ | $-\frac{\sqrt{7}}{70}$ | $0$ |
| 546 | symmetry | $\frac{y\left(3x^2-2y^2+3z^2\right)}{2}$ | | | | | | | | | | |

*continued ...*

Table  8

| No. | multipole | matrix | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{M}_{3,2}^{(1,1;a)}(E_g,1)$ | $0$ | $\frac{3\sqrt{105}i}{175}$ | $0$ | $\frac{3\sqrt{35}i}{35}$ | $-\frac{9\sqrt{7}i}{560}$ | $0$ | $-\frac{27\sqrt{70}i}{2800}$ | $0$ | $-\frac{9\sqrt{35}i}{560}$ | $0$ |
| | | $-\frac{3\sqrt{105}i}{175}$ | $0$ | $-\frac{9\sqrt{35}i}{175}$ | $0$ | $0$ | $\frac{3\sqrt{105}i}{400}$ | $0$ | $\frac{3\sqrt{210}i}{2800}$ | $0$ | $-\frac{3\sqrt{21}i}{112}$ |
| | | $0$ | $\frac{9\sqrt{35}i}{175}$ | $0$ | $\frac{3\sqrt{105}i}{175}$ | $-\frac{3\sqrt{21}i}{112}$ | $0$ | $\frac{3\sqrt{210}i}{2800}$ | $0$ | $\frac{3\sqrt{105}i}{400}$ | $0$ |
| | | $-\frac{3\sqrt{35}i}{35}$ | $0$ | $-\frac{3\sqrt{105}i}{175}$ | $0$ | $0$ | $-\frac{9\sqrt{35}i}{560}$ | $0$ | $-\frac{27\sqrt{70}i}{2800}$ | $0$ | $-\frac{9\sqrt{7}i}{560}$ |
| | | $\frac{9\sqrt{7}i}{560}$ | $0$ | $\frac{3\sqrt{21}i}{112}$ | $0$ | $0$ | $-\frac{\sqrt{7}i}{70}$ | $0$ | $-\frac{\sqrt{14}i}{84}$ | $0$ | $0$ |
| | | $0$ | $-\frac{3\sqrt{105}i}{400}$ | $0$ | $\frac{9\sqrt{35}i}{560}$ | $\frac{\sqrt{7}i}{70}$ | $0$ | $\frac{\sqrt{70}i}{700}$ | $0$ | $-\frac{\sqrt{35}i}{105}$ | $0$ |
| | | $\frac{27\sqrt{70}i}{2800}$ | $0$ | $-\frac{3\sqrt{210}i}{2800}$ | $0$ | $0$ | $-\frac{\sqrt{70}i}{700}$ | $0$ | $\frac{\sqrt{35}i}{175}$ | $0$ | $-\frac{\sqrt{14}i}{84}$ |
| | | $0$ | $-\frac{3\sqrt{210}i}{2800}$ | $0$ | $\frac{27\sqrt{70}i}{2800}$ | $\frac{\sqrt{14}i}{84}$ | $0$ | $-\frac{\sqrt{35}i}{175}$ | $0$ | $\frac{\sqrt{70}i}{700}$ | $0$ |
| | | $\frac{9\sqrt{35}i}{560}$ | $0$ | $-\frac{3\sqrt{105}i}{400}$ | $0$ | $0$ | $\frac{\sqrt{35}i}{105}$ | $0$ | $-\frac{\sqrt{70}i}{700}$ | $0$ | $-\frac{\sqrt{7}i}{70}$ |
| | | $0$ | $\frac{3\sqrt{21}i}{112}$ | $0$ | $\frac{9\sqrt{7}i}{560}$ | $0$ | $0$ | $\frac{\sqrt{14}i}{84}$ | $0$ | $\frac{\sqrt{7}i}{70}$ | $0$ |

| 547 | symmetry | $\frac{\sqrt{15}x(y-z)(y+z)}{2}$ |
|---|---|---|

| | $\mathbb{M}_{3,1}^{(1,1;a)}(E_g,2)$ | $0$ | $\frac{3\sqrt{7}}{35}$ | $0$ | $\frac{3\sqrt{21}}{35}$ | $\frac{3\sqrt{105}}{560}$ | $0$ | $-\frac{9\sqrt{42}}{560}$ | $0$ | $-\frac{9\sqrt{21}}{560}$ | $0$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $\frac{3\sqrt{7}}{35}$ | $0$ | $-\frac{3\sqrt{21}}{35}$ | $0$ | $0$ | $-\frac{3\sqrt{7}}{80}$ | $0$ | $\frac{3\sqrt{14}}{560}$ | $0$ | $-\frac{9\sqrt{35}}{560}$ |
| | | $0$ | $-\frac{3\sqrt{21}}{35}$ | $0$ | $\frac{3\sqrt{7}}{35}$ | $\frac{9\sqrt{35}}{560}$ | $0$ | $-\frac{3\sqrt{14}}{560}$ | $0$ | $\frac{3\sqrt{7}}{80}$ | $0$ |
| | | $\frac{3\sqrt{21}}{35}$ | $0$ | $\frac{3\sqrt{7}}{35}$ | $0$ | $0$ | $\frac{9\sqrt{21}}{560}$ | $0$ | $\frac{9\sqrt{42}}{560}$ | $0$ | $-\frac{3\sqrt{105}}{560}$ |
| | | $\frac{3\sqrt{105}}{560}$ | $0$ | $\frac{9\sqrt{35}}{560}$ | $0$ | $0$ | $-\frac{\sqrt{105}}{210}$ | $0$ | $-\frac{\sqrt{210}}{420}$ | $0$ | $0$ |
| | | $0$ | $-\frac{3\sqrt{7}}{80}$ | $0$ | $\frac{9\sqrt{21}}{560}$ | $-\frac{\sqrt{105}}{210}$ | $0$ | $\frac{\sqrt{42}}{420}$ | $0$ | $-\frac{\sqrt{21}}{105}$ | $0$ |
| | | $-\frac{9\sqrt{42}}{560}$ | $0$ | $-\frac{3\sqrt{14}}{560}$ | $0$ | $0$ | $\frac{\sqrt{42}}{420}$ | $0$ | $\frac{\sqrt{21}}{105}$ | $0$ | $-\frac{\sqrt{210}}{420}$ |
| | | $0$ | $\frac{3\sqrt{14}}{560}$ | $0$ | $\frac{9\sqrt{42}}{560}$ | $-\frac{\sqrt{210}}{420}$ | $0$ | $\frac{\sqrt{21}}{105}$ | $0$ | $\frac{\sqrt{42}}{420}$ | $0$ |
| | | $-\frac{9\sqrt{21}}{560}$ | $0$ | $\frac{3\sqrt{7}}{80}$ | $0$ | $0$ | $-\frac{\sqrt{21}}{105}$ | $0$ | $\frac{\sqrt{42}}{420}$ | $0$ | $-\frac{\sqrt{105}}{210}$ |
| | | $0$ | $-\frac{9\sqrt{35}}{560}$ | $0$ | $-\frac{3\sqrt{105}}{560}$ | $0$ | $0$ | $-\frac{\sqrt{210}}{420}$ | $0$ | $-\frac{\sqrt{105}}{210}$ | $0$ |

| 548 | symmetry | $-\frac{\sqrt{15}y(x-z)(x+z)}{2}$ |
|---|---|---|

Table 8

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{M}_{3,2}^{(1,1;a)}(E_g,2)$ | $\begin{bmatrix} 0 & \frac{3\sqrt{7}i}{35} & 0 & -\frac{3\sqrt{21}i}{35} & -\frac{3\sqrt{105}i}{560} & 0 & -\frac{9\sqrt{42}i}{560} & 0 & \frac{9\sqrt{21}i}{560} & 0 \\ -\frac{3\sqrt{7}i}{35} & 0 & -\frac{3\sqrt{21}i}{35} & 0 & 0 & \frac{3\sqrt{7}i}{80} & 0 & \frac{3\sqrt{14}i}{560} & 0 & \frac{9\sqrt{35}i}{560} \\ 0 & \frac{3\sqrt{21}i}{35} & 0 & \frac{3\sqrt{7}i}{35} & \frac{9\sqrt{35}i}{560} & 0 & \frac{3\sqrt{14}i}{560} & 0 & \frac{3\sqrt{7}i}{80} & 0 \\ \frac{3\sqrt{21}i}{35} & 0 & -\frac{3\sqrt{7}i}{35} & 0 & 0 & \frac{9\sqrt{21}i}{560} & 0 & -\frac{9\sqrt{42}i}{560} & 0 & -\frac{3\sqrt{105}i}{560} \\ \frac{3\sqrt{105}i}{560} & 0 & -\frac{9\sqrt{35}i}{560} & 0 & 0 & -\frac{\sqrt{105}i}{210} & 0 & \frac{\sqrt{210}i}{420} & 0 & 0 \\ 0 & -\frac{3\sqrt{7}i}{80} & 0 & -\frac{9\sqrt{21}i}{560} & \frac{\sqrt{105}i}{210} & 0 & \frac{\sqrt{42}i}{420} & 0 & \frac{\sqrt{21}i}{105} & 0 \\ \frac{9\sqrt{42}i}{560} & 0 & -\frac{3\sqrt{14}i}{560} & 0 & 0 & -\frac{\sqrt{42}i}{420} & 0 & \frac{\sqrt{21}i}{105} & 0 & \frac{\sqrt{210}i}{420} \\ 0 & -\frac{3\sqrt{14}i}{560} & 0 & \frac{9\sqrt{42}i}{560} & -\frac{\sqrt{210}i}{420} & 0 & -\frac{\sqrt{21}i}{105} & 0 & \frac{\sqrt{42}i}{420} & 0 \\ -\frac{9\sqrt{21}i}{560} & 0 & -\frac{3\sqrt{7}i}{80} & 0 & 0 & -\frac{\sqrt{21}i}{105} & 0 & -\frac{\sqrt{42}i}{420} & 0 & -\frac{\sqrt{105}i}{210} \\ 0 & -\frac{9\sqrt{35}i}{560} & 0 & \frac{3\sqrt{105}i}{560} & 0 & 0 & -\frac{\sqrt{210}i}{420} & 0 & \frac{\sqrt{105}i}{210} & 0 \end{bmatrix}$ |

bra: $= \langle\frac{3}{2},\frac{3}{2};d|,\langle\frac{3}{2},\frac{1}{2};d|,\langle\frac{3}{2},-\frac{1}{2};d|,\langle\frac{3}{2},-\frac{3}{2};d|,\langle\frac{5}{2},\frac{5}{2};d|,\langle\frac{5}{2},\frac{3}{2};d|,\langle\frac{5}{2},\frac{1}{2};d|,\langle\frac{5}{2},-\frac{1}{2};d|,\langle\frac{5}{2},-\frac{3}{2};d|,\langle\frac{5}{2},-\frac{5}{2};d|$

ket: $= |\frac{5}{2},\frac{5}{2};f\rangle,|\frac{5}{2},\frac{3}{2};f\rangle,|\frac{5}{2},\frac{1}{2};f\rangle,|\frac{5}{2},-\frac{1}{2};f\rangle,|\frac{5}{2},-\frac{3}{2};f\rangle,|\frac{5}{2},-\frac{5}{2};f\rangle,|\frac{7}{2},\frac{7}{2};f\rangle,|\frac{7}{2},\frac{5}{2};f\rangle,|\frac{7}{2},\frac{3}{2};f\rangle,|\frac{7}{2},\frac{1}{2};f\rangle,|\frac{7}{2},-\frac{1}{2};f\rangle,|\frac{7}{2},-\frac{3}{2};f\rangle,|\frac{7}{2},-\frac{5}{2};f\rangle,|\frac{7}{2},-\frac{7}{2};f\rangle$

Table 9: (d,f) block.

| No. | multipole | matrix |
|---|---|---|
| 549 | symmetry | $z$ |
| | $\mathbb{Q}_1^{(a)}(A_{2u})$ | $\begin{bmatrix} 0 & \frac{1}{5} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{6}}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{6}}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{1}{5} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ -\frac{1}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{3}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{14} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{1}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{7} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{1}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{7} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{3}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{14} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{1}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{14} & 0 \end{bmatrix}$ |

Table  9

| No. | multipole | matrix |
|---|---|---|

**550**  symmetry  $x$

$\mathbb{Q}_{1,1}^{(a)}(E_u)$

$$\begin{bmatrix}
-\frac{\sqrt5}{10} & 0 & \frac{\sqrt2}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt3}{10} & 0 & \frac{\sqrt6}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt6}{20} & 0 & \frac{\sqrt3}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt2}{20} & 0 & \frac{\sqrt5}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt5}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}}{28} & 0 & \frac{\sqrt2}{28} & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt5}{70} & 0 & -\frac{\sqrt2}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{28} & 0 & \frac{\sqrt6}{28} & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt2}{35} & 0 & -\frac{3}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt5}{14} & 0 & \frac{\sqrt3}{14} & 0 & 0 & 0 \\
0 & 0 & -\frac{3}{70} & 0 & -\frac{\sqrt2}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt3}{14} & 0 & \frac{\sqrt5}{14} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt2}{35} & 0 & -\frac{\sqrt5}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt6}{28} & 0 & \frac{\sqrt{30}}{28} & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt5}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt2}{28} & 0 & \frac{\sqrt{42}}{28}
\end{bmatrix}$$

**551**  symmetry  $y$

$\mathbb{Q}_{1,2}^{(a)}(E_u)$

$$\begin{bmatrix}
-\frac{\sqrt5 i}{10} & 0 & -\frac{\sqrt2 i}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt3 i}{10} & 0 & -\frac{\sqrt6 i}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt6 i}{20} & 0 & -\frac{\sqrt3 i}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt2 i}{20} & 0 & -\frac{\sqrt5 i}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt5 i}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}i}{28} & 0 & -\frac{\sqrt2 i}{28} & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt5 i}{70} & 0 & \frac{\sqrt2 i}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{28} & 0 & -\frac{\sqrt6 i}{28} & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt2 i}{35} & 0 & \frac{3i}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt5 i}{14} & 0 & -\frac{\sqrt3 i}{14} & 0 & 0 & 0 \\
0 & 0 & -\frac{3i}{70} & 0 & \frac{\sqrt2 i}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt3 i}{14} & 0 & -\frac{\sqrt5 i}{14} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt2 i}{35} & 0 & \frac{\sqrt5 i}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt6 i}{28} & 0 & -\frac{\sqrt{30}i}{28} & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt5 i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt2 i}{28} & 0 & -\frac{\sqrt{42}i}{28}
\end{bmatrix}$$

**552**  symmetry  $-\frac{z\left(3x^2+3y^2-2z^2\right)}{2}$

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Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_3^{(a)}(A_{2u})$

$$\begin{pmatrix}
0 & -\frac{3\sqrt{21}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{84} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{3\sqrt{14}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}}{84} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{3\sqrt{14}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{84} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{3\sqrt{21}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{84} & 0 & 0 \\
\frac{\sqrt{21}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{21}}{30} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{2\sqrt{21}}{105} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{14} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{2\sqrt{21}}{105} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{14} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{21}}{30} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{14} & 0
\end{pmatrix}$$

| 553 | symmetry | $\sqrt{15}xyz$ |
|---|---|---|

$\mathbb{Q}_3^{(a)}(B_{1u})$

$$\begin{pmatrix}
0 & 0 & 0 & \frac{3\sqrt{70}i}{140} & 0 & 0 & -\frac{\sqrt{6}i}{24} & 0 & 0 & 0 & \frac{\sqrt{210}i}{168} & 0 & 0 & 0 \\
\frac{\sqrt{21}i}{28} & 0 & 0 & 0 & \frac{\sqrt{105}i}{140} & 0 & 0 & \frac{\sqrt{14}i}{56} & 0 & 0 & 0 & \frac{\sqrt{42}i}{56} & 0 & 0 \\
0 & -\frac{\sqrt{105}i}{140} & 0 & 0 & 0 & -\frac{\sqrt{21}i}{28} & 0 & 0 & \frac{\sqrt{42}i}{56} & 0 & 0 & 0 & \frac{\sqrt{14}i}{56} & 0 \\
0 & 0 & -\frac{3\sqrt{70}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{168} & 0 & 0 & 0 & -\frac{\sqrt{6}i}{24} \\
0 & 0 & -\frac{\sqrt{14}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{42} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{70}i}{140} & 0 & 0 & \frac{\sqrt{6}i}{12} & 0 & 0 & 0 & \frac{\sqrt{210}i}{84} & 0 & 0 & 0 \\
\frac{\sqrt{14}i}{28} & 0 & 0 & 0 & \frac{\sqrt{70}i}{140} & 0 & 0 & \frac{\sqrt{21}i}{84} & 0 & 0 & 0 & \frac{\sqrt{7}i}{28} & 0 & 0 \\
0 & \frac{\sqrt{70}i}{140} & 0 & 0 & 0 & \frac{\sqrt{14}i}{28} & 0 & 0 & -\frac{\sqrt{7}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{21}i}{84} & 0 \\
0 & 0 & -\frac{\sqrt{70}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{84} & 0 & 0 & 0 & -\frac{\sqrt{6}i}{12} \\
0 & 0 & 0 & -\frac{\sqrt{14}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}i}{42} & 0 & 0 & 0
\end{pmatrix}$$

| 554 | symmetry | $\frac{\sqrt{15}z(x-y)(x+y)}{2}$ |
|---|---|---|

Table 9

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{Q}_3^{(a)}(B_{2u})$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{70}}{140}$ | $0$ | $0$ | $-\frac{\sqrt6}{24}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{210}}{168}$ | $0$ | $0$ | $0$ |
| | | $\frac{\sqrt{21}}{28}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{105}}{140}$ | $0$ | $0$ | $\frac{\sqrt{14}}{56}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{42}}{56}$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{105}}{140}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{21}}{28}$ | $0$ | $0$ | $\frac{\sqrt{42}}{56}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{14}}{56}$ | $0$ |
| | | $0$ | $0$ | $-\frac{3\sqrt{70}}{140}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{210}}{168}$ | $0$ | $0$ | $0$ | $\frac{\sqrt6}{24}$ |
| | | $0$ | $0$ | $\frac{\sqrt{14}}{28}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{42}}{42}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{70}}{140}$ | $0$ | $0$ | $\frac{\sqrt6}{12}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{210}}{84}$ | $0$ | $0$ | $0$ |
| | | $\frac{\sqrt{14}}{28}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{70}}{140}$ | $0$ | $0$ | $\frac{\sqrt{21}}{84}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt7}{28}$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{70}}{140}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{14}}{28}$ | $0$ | $0$ | $-\frac{\sqrt7}{28}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{21}}{84}$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{70}}{140}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{210}}{84}$ | $0$ | $0$ | $0$ | $\frac{\sqrt6}{12}$ |
| | | $0$ | $0$ | $0$ | $-\frac{\sqrt{14}}{28}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{42}}{42}$ | $0$ | $0$ | $0$ |

| 555 | symmetry | $\dfrac{x\left(2x^2-3y^2-3z^2\right)}{2}$ |
|---|---|---|

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{Q}_{3,1}^{(a)}(E_u,1)$ | $-\frac{3\sqrt{105}}{560}$ | $0$ | $\frac{9\sqrt{42}}{560}$ | $0$ | $-\frac{3\sqrt{21}}{112}$ | $0$ | $0$ | $-\frac{\sqrt{70}}{112}$ | $0$ | $\frac{\sqrt{14}}{56}$ | $0$ | $-\frac{\sqrt{210}}{336}$ | $0$ | $0$ |
| | | $0$ | $\frac{3\sqrt7}{80}$ | $0$ | $-\frac{3\sqrt{14}}{560}$ | $0$ | $-\frac{3\sqrt{35}}{112}$ | $-\frac{\sqrt{30}}{48}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{42}}{112}$ | $0$ | $-\frac{\sqrt{210}}{168}$ | $0$ |
| | | $\frac{3\sqrt{35}}{112}$ | $0$ | $\frac{3\sqrt{14}}{560}$ | $0$ | $-\frac{3\sqrt7}{80}$ | $0$ | $0$ | $-\frac{\sqrt{210}}{168}$ | $0$ | $\frac{\sqrt{42}}{112}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{30}}{48}$ |
| | | $0$ | $\frac{3\sqrt{21}}{112}$ | $0$ | $-\frac{9\sqrt{42}}{560}$ | $0$ | $\frac{3\sqrt{105}}{560}$ | $0$ | $0$ | $-\frac{\sqrt{210}}{336}$ | $0$ | $\frac{\sqrt{14}}{56}$ | $0$ | $-\frac{\sqrt{70}}{112}$ | $0$ |
| | | $0$ | $-\frac{\sqrt{105}}{140}$ | $0$ | $\frac{\sqrt{210}}{168}$ | $0$ | $0$ | $-\frac{\sqrt2}{16}$ | $0$ | $\frac{\sqrt{42}}{56}$ | $0$ | $-\frac{\sqrt{70}}{112}$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{105}}{140}$ | $0$ | $\frac{\sqrt{42}}{280}$ | $0$ | $\frac{\sqrt{21}}{42}$ | $0$ | $0$ | $\frac{\sqrt{70}}{112}$ | $0$ | $\frac{\sqrt{14}}{56}$ | $0$ | $-\frac{\sqrt{210}}{112}$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{42}}{280}$ | $0$ | $\frac{\sqrt{21}}{70}$ | $0$ | $\frac{\sqrt{210}}{168}$ | $\frac{\sqrt5}{16}$ | $0$ | $\frac{\sqrt{105}}{112}$ | $0$ | $-\frac{\sqrt7}{112}$ | $0$ | $-\frac{3\sqrt{35}}{112}$ | $0$ |
| | | $\frac{\sqrt{210}}{168}$ | $0$ | $\frac{\sqrt{21}}{70}$ | $0$ | $\frac{\sqrt{42}}{280}$ | $0$ | $0$ | $\frac{3\sqrt{35}}{112}$ | $0$ | $\frac{\sqrt7}{112}$ | $0$ | $-\frac{\sqrt{105}}{112}$ | $0$ | $-\frac{\sqrt5}{16}$ |
| | | $0$ | $\frac{\sqrt{21}}{42}$ | $0$ | $\frac{\sqrt{42}}{280}$ | $0$ | $-\frac{\sqrt{105}}{140}$ | $0$ | $0$ | $\frac{\sqrt{210}}{112}$ | $0$ | $-\frac{\sqrt{14}}{56}$ | $0$ | $-\frac{\sqrt{70}}{112}$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{210}}{168}$ | $0$ | $-\frac{\sqrt{105}}{140}$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{70}}{112}$ | $0$ | $-\frac{\sqrt{42}}{56}$ | $0$ | $\frac{\sqrt2}{16}$ |

| 556 | symmetry | $-\dfrac{y\left(3x^2-2y^2+3z^2\right)}{2}$ |
|---|---|---|

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{3,2}^{(a)}(E_u,1)$

$$\begin{bmatrix}
-\frac{3\sqrt{105}i}{560} & 0 & -\frac{9\sqrt{42}i}{560} & 0 & -\frac{3\sqrt{21}i}{112} & 0 & 0 & -\frac{\sqrt{70}i}{112} & 0 & -\frac{\sqrt{14}i}{56} & 0 & -\frac{\sqrt{210}i}{336} & 0 & 0 \\
0 & \frac{3\sqrt{7}i}{80} & 0 & \frac{3\sqrt{14}i}{560} & 0 & -\frac{3\sqrt{35}i}{112} & \frac{\sqrt{30}i}{48} & 0 & 0 & 0 & -\frac{\sqrt{42}i}{112} & 0 & -\frac{\sqrt{210}i}{168} & 0 \\
-\frac{3\sqrt{35}i}{112} & 0 & \frac{3\sqrt{14}i}{560} & 0 & \frac{3\sqrt{7}i}{80} & 0 & 0 & \frac{\sqrt{210}i}{168} & 0 & \frac{\sqrt{42}i}{112} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{48} \\
0 & -\frac{3\sqrt{21}i}{112} & 0 & -\frac{9\sqrt{42}i}{560} & 0 & -\frac{3\sqrt{105}i}{560} & 0 & 0 & \frac{\sqrt{210}i}{336} & 0 & \frac{\sqrt{14}i}{56} & 0 & \frac{\sqrt{70}i}{112} & 0 \\
0 & \frac{\sqrt{105}i}{140} & 0 & \frac{\sqrt{210}i}{168} & 0 & 0 & -\frac{\sqrt{2}i}{16} & 0 & -\frac{\sqrt{42}i}{56} & 0 & -\frac{\sqrt{70}i}{112} & 0 & 0 & 0 \\
-\frac{\sqrt{105}i}{140} & 0 & -\frac{\sqrt{42}i}{280} & 0 & \frac{\sqrt{21}i}{42} & 0 & 0 & \frac{\sqrt{70}i}{112} & 0 & -\frac{\sqrt{14}i}{56} & 0 & -\frac{\sqrt{210}i}{112} & 0 & 0 \\
0 & \frac{\sqrt{42}i}{280} & 0 & -\frac{\sqrt{21}i}{70} & 0 & \frac{\sqrt{210}i}{168} & -\frac{\sqrt{5}i}{16} & 0 & \frac{\sqrt{105}i}{112} & 0 & \frac{\sqrt{7}i}{112} & 0 & -\frac{3\sqrt{35}i}{112} & 0 \\
-\frac{\sqrt{210}i}{168} & 0 & \frac{\sqrt{21}i}{70} & 0 & -\frac{\sqrt{42}i}{280} & 0 & 0 & -\frac{3\sqrt{35}i}{112} & 0 & \frac{\sqrt{7}i}{112} & 0 & \frac{\sqrt{105}i}{112} & 0 & -\frac{\sqrt{5}i}{16} \\
0 & -\frac{\sqrt{21}i}{42} & 0 & \frac{\sqrt{42}i}{280} & 0 & \frac{\sqrt{105}i}{140} & 0 & 0 & -\frac{\sqrt{210}i}{112} & 0 & -\frac{\sqrt{14}i}{56} & 0 & \frac{\sqrt{70}i}{112} & 0 \\
0 & 0 & -\frac{\sqrt{210}i}{168} & 0 & -\frac{\sqrt{105}i}{140} & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{112} & 0 & -\frac{\sqrt{42}i}{56} & 0 & -\frac{\sqrt{2}i}{16}
\end{bmatrix}$$

| 557 | symmetry | $\frac{\sqrt{15}x(y-z)(y+z)}{2}$ |

$\mathbb{Q}_{3,1}^{(a)}(E_u,2)$

$$\begin{bmatrix}
-\frac{3\sqrt{7}}{112} & 0 & \frac{9\sqrt{70}}{560} & 0 & \frac{9\sqrt{35}}{560} & 0 & 0 & -\frac{5\sqrt{42}}{336} & 0 & \frac{\sqrt{210}}{168} & 0 & \frac{\sqrt{14}}{112} & 0 & 0 \\
0 & \frac{\sqrt{105}}{80} & 0 & -\frac{\sqrt{210}}{560} & 0 & \frac{3\sqrt{21}}{112} & \frac{\sqrt{2}}{16} & 0 & 0 & 0 & \frac{\sqrt{70}}{112} & 0 & \frac{\sqrt{14}}{56} & 0 \\
-\frac{3\sqrt{21}}{112} & 0 & \frac{\sqrt{210}}{560} & 0 & -\frac{\sqrt{105}}{80} & 0 & 0 & \frac{\sqrt{14}}{56} & 0 & \frac{\sqrt{70}}{112} & 0 & 0 & 0 & \frac{\sqrt{2}}{16} \\
0 & -\frac{9\sqrt{35}}{560} & 0 & -\frac{9\sqrt{70}}{560} & 0 & \frac{3\sqrt{7}}{112} & 0 & 0 & \frac{\sqrt{14}}{112} & 0 & \frac{\sqrt{210}}{168} & 0 & -\frac{5\sqrt{42}}{336} & 0 \\
0 & -\frac{\sqrt{7}}{28} & 0 & -\frac{\sqrt{14}}{56} & 0 & 0 & -\frac{\sqrt{30}}{48} & 0 & \frac{\sqrt{70}}{56} & 0 & \frac{\sqrt{42}}{112} & 0 & 0 & 0 \\
-\frac{\sqrt{7}}{28} & 0 & \frac{\sqrt{70}}{280} & 0 & -\frac{\sqrt{35}}{70} & 0 & 0 & \frac{5\sqrt{42}}{336} & 0 & \frac{\sqrt{210}}{168} & 0 & \frac{3\sqrt{14}}{112} & 0 & 0 \\
0 & \frac{\sqrt{70}}{280} & 0 & \frac{\sqrt{35}}{70} & 0 & -\frac{\sqrt{14}}{56} & -\frac{\sqrt{3}}{16} & 0 & \frac{5\sqrt{7}}{112} & 0 & -\frac{\sqrt{105}}{336} & 0 & \frac{3\sqrt{21}}{112} & 0 \\
-\frac{\sqrt{14}}{56} & 0 & \frac{\sqrt{35}}{70} & 0 & \frac{\sqrt{70}}{280} & 0 & 0 & -\frac{3\sqrt{21}}{112} & 0 & \frac{\sqrt{105}}{336} & 0 & -\frac{5\sqrt{7}}{112} & 0 & \frac{\sqrt{3}}{16} \\
0 & -\frac{\sqrt{35}}{70} & 0 & \frac{\sqrt{70}}{280} & 0 & -\frac{\sqrt{7}}{28} & 0 & 0 & -\frac{3\sqrt{14}}{112} & 0 & -\frac{\sqrt{210}}{168} & 0 & -\frac{5\sqrt{42}}{336} & 0 \\
0 & 0 & -\frac{\sqrt{14}}{56} & 0 & -\frac{\sqrt{7}}{28} & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}}{112} & 0 & -\frac{\sqrt{70}}{56} & 0 & \frac{\sqrt{30}}{48}
\end{bmatrix}$$

| 558 | symmetry | $\frac{\sqrt{15}y(x-z)(x+z)}{2}$ |

*continued ...*

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Table 9

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{Q}_{3,2}^{(a)}(E_u, 2)$

$$\begin{bmatrix} -\frac{3\sqrt{7}i}{112} & 0 & -\frac{9\sqrt{70}i}{560} & 0 & \frac{9\sqrt{35}i}{560} & 0 & 0 & -\frac{5\sqrt{42}i}{336} & 0 & -\frac{\sqrt{210}i}{168} & 0 & \frac{\sqrt{14}i}{112} & 0 & 0 \\ 0 & \frac{\sqrt{105}i}{80} & 0 & \frac{\sqrt{210}i}{560} & 0 & \frac{3\sqrt{21}i}{112} & -\frac{\sqrt{2}i}{16} & 0 & 0 & 0 & -\frac{\sqrt{70}i}{112} & 0 & \frac{\sqrt{14}i}{56} & 0 \\ \frac{3\sqrt{21}i}{112} & 0 & \frac{\sqrt{210}i}{560} & 0 & \frac{\sqrt{105}i}{80} & 0 & 0 & -\frac{\sqrt{14}i}{56} & 0 & \frac{\sqrt{70}i}{112} & 0 & 0 & 0 & \frac{\sqrt{2}i}{16} \\ 0 & \frac{9\sqrt{35}i}{560} & 0 & -\frac{9\sqrt{70}i}{560} & 0 & -\frac{3\sqrt{7}i}{112} & 0 & 0 & -\frac{\sqrt{14}i}{112} & 0 & \frac{\sqrt{210}i}{168} & 0 & \frac{5\sqrt{42}i}{336} & 0 \\ 0 & \frac{\sqrt{7}i}{28} & 0 & -\frac{\sqrt{14}i}{56} & 0 & 0 & -\frac{\sqrt{30}i}{48} & 0 & -\frac{\sqrt{70}i}{56} & 0 & \frac{\sqrt{42}i}{112} & 0 & 0 & 0 \\ -\frac{\sqrt{7}i}{28} & 0 & -\frac{\sqrt{70}i}{280} & 0 & -\frac{\sqrt{35}i}{70} & 0 & 0 & \frac{5\sqrt{42}i}{336} & 0 & -\frac{\sqrt{210}i}{168} & 0 & \frac{3\sqrt{14}i}{112} & 0 & 0 \\ 0 & \frac{\sqrt{70}i}{280} & 0 & -\frac{\sqrt{35}i}{70} & 0 & -\frac{\sqrt{14}i}{56} & \frac{\sqrt{3}i}{16} & 0 & \frac{5\sqrt{7}i}{112} & 0 & \frac{\sqrt{105}i}{336} & 0 & \frac{3\sqrt{21}i}{112} & 0 \\ \frac{\sqrt{14}i}{56} & 0 & \frac{\sqrt{35}i}{70} & 0 & -\frac{\sqrt{70}i}{280} & 0 & 0 & \frac{3\sqrt{21}i}{112} & 0 & \frac{\sqrt{105}i}{336} & 0 & \frac{5\sqrt{7}i}{112} & 0 & \frac{\sqrt{3}i}{16} \\ 0 & \frac{\sqrt{35}i}{70} & 0 & \frac{\sqrt{70}i}{280} & 0 & \frac{\sqrt{7}i}{28} & 0 & 0 & \frac{3\sqrt{14}i}{112} & 0 & -\frac{\sqrt{210}i}{168} & 0 & \frac{5\sqrt{42}i}{336} & 0 \\ 0 & 0 & \frac{\sqrt{14}i}{56} & 0 & -\frac{\sqrt{7}i}{28} & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{112} & 0 & -\frac{\sqrt{70}i}{56} & 0 & -\frac{\sqrt{30}i}{48} \end{bmatrix}$$

| 559 | symmetry | $\frac{3\sqrt{35}xyz(x-y)(x+y)}{2}$ |

$\mathbb{Q}_5^{(a)}(A_{1u})$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{10} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{10} \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}i}{70} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{70} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{10} \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ -\frac{\sqrt{42}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{42}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}i}{70} & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

| 560 | symmetry | $\frac{z\left(15x^4 + 30x^2y^2 - 40x^2z^2 + 15y^4 - 40y^2z^2 + 8z^4\right)}{8}$ |

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_5^{(a)}(A_{2u},1)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{30} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{6} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{6} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{30} & 0 & 0 \\
-\frac{\sqrt{6}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{5\sqrt{6}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{15}}{70} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{5\sqrt{6}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{14} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{5\sqrt{6}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{14} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{5\sqrt{6}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{15}}{70} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{14} & 0
\end{pmatrix}$$

561 symmetry

$$\frac{3\sqrt{35}\,z\left(x^2-2xy-y^2\right)\left(x^2+2xy-y^2\right)}{8}$$

$\mathbb{Q}_5^{(a)}(A_{2u},2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{10} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{10} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{10} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{42}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}}{70} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{70} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{10} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{42}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{70} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{42}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}}{70} & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

562 symmetry

$$\frac{\sqrt{105}\,xyz\left(x^2+y^2-2z^2\right)}{2}$$

*continued ...*

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_5^{(a)}(B_{1u})$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{60} & 0 & 0 & 0 & \frac{\sqrt{105}i}{60} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{20} & 0 & 0 & 0 & -\frac{\sqrt{21}i}{20} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{20} & 0 & 0 & 0 & \frac{\sqrt{7}i}{20} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}i}{60} & 0 & 0 & 0 & -\frac{\sqrt{3}i}{60} \\
0 & 0 & -\frac{\sqrt{7}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}i}{42} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{35}i}{28} & 0 & 0 & \frac{\sqrt{3}i}{30} & 0 & 0 & 0 & -\frac{\sqrt{105}i}{105} & 0 & 0 & 0 \\
\frac{\sqrt{7}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{35}i}{28} & 0 & 0 & -\frac{2\sqrt{42}i}{105} & 0 & 0 & 0 & -\frac{\sqrt{14}i}{70} & 0 & 0 \\
0 & -\frac{\sqrt{35}i}{28} & 0 & 0 & 0 & \frac{\sqrt{7}i}{28} & 0 & 0 & \frac{\sqrt{14}i}{70} & 0 & 0 & 0 & \frac{2\sqrt{42}i}{105} & 0 \\
0 & 0 & \frac{\sqrt{35}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}i}{105} & 0 & 0 & 0 & -\frac{\sqrt{3}i}{30} \\
0 & 0 & 0 & -\frac{\sqrt{7}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{42} & 0 & 0 & 0
\end{pmatrix}$$

| 563 | symmetry | $-\dfrac{\sqrt{105}z(x-y)(x+y)\left(x^2+y^2-2z^2\right)}{4}$ |
|---|---|---|

$\mathbb{Q}_5^{(a)}(B_{2u})$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{60} & 0 & 0 & 0 & \frac{\sqrt{105}}{60} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{20} & 0 & 0 & 0 & -\frac{\sqrt{21}}{20} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}}{20} & 0 & 0 & 0 & \frac{\sqrt{7}}{20} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}}{60} & 0 & 0 & 0 & -\frac{\sqrt{3}}{60} \\
0 & 0 & -\frac{\sqrt{7}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}}{42} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{35}}{28} & 0 & 0 & -\frac{\sqrt{3}}{30} & 0 & 0 & 0 & -\frac{\sqrt{105}}{105} & 0 & 0 & 0 \\
-\frac{\sqrt{7}}{28} & 0 & 0 & 0 & -\frac{\sqrt{35}}{28} & 0 & 0 & \frac{2\sqrt{42}}{105} & 0 & 0 & 0 & -\frac{\sqrt{14}}{70} & 0 & 0 \\
0 & \frac{\sqrt{35}}{28} & 0 & 0 & 0 & \frac{\sqrt{7}}{28} & 0 & 0 & -\frac{\sqrt{14}}{70} & 0 & 0 & 0 & \frac{2\sqrt{42}}{105} & 0 \\
0 & 0 & -\frac{\sqrt{35}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}}{105} & 0 & 0 & 0 & -\frac{\sqrt{3}}{30} \\
0 & 0 & 0 & \frac{\sqrt{7}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}}{42} & 0 & 0 & 0
\end{pmatrix}$$

| 564 | symmetry | $\dfrac{x\left(8x^4-40x^2y^2-40x^2z^2+15y^4+30y^2z^2+15z^4\right)}{8}$ |
|---|---|---|

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{5,1}^{(a)}(E_u,1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt5}{80} & 0 & \frac{1}{16} & 0 & -\frac{7\sqrt{15}}{240} & 0 & \frac{3\sqrt{35}}{80} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}}{240} & 0 & \frac{3\sqrt5}{80} & 0 & -\frac{\sqrt3}{16} & 0 & \frac{7\sqrt{15}}{240} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{7\sqrt{15}}{240} & 0 & -\frac{\sqrt3}{16} & 0 & \frac{3\sqrt5}{80} & 0 & -\frac{\sqrt{105}}{240} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{35}}{80} & 0 & -\frac{7\sqrt{15}}{240} & 0 & \frac{1}{16} & 0 & -\frac{\sqrt5}{80} & 0 \\
0 & -\frac{\sqrt{30}}{224} & 0 & \frac{\sqrt{15}}{48} & 0 & -\frac{3\sqrt6}{32} & -\frac{\sqrt7}{224} & 0 & \frac{5\sqrt3}{224} & 0 & -\frac{\sqrt5}{32} & 0 & \frac{3}{32} & 0 \\
-\frac{\sqrt{30}}{224} & 0 & \frac{5\sqrt3}{112} & 0 & -\frac{5\sqrt6}{96} & 0 & 0 & \frac{23\sqrt5}{1120} & 0 & -\frac{13}{224} & 0 & \frac{\sqrt{15}}{160} & 0 & \frac{3\sqrt{35}}{160} \\
0 & \frac{5\sqrt3}{112} & 0 & -\frac{5\sqrt6}{112} & 0 & \frac{\sqrt{15}}{48} & \frac{\sqrt{70}}{160} & 0 & -\frac{11\sqrt{30}}{1120} & 0 & \frac{\sqrt2}{224} & 0 & \frac{3\sqrt{10}}{160} & 0 \\
\frac{\sqrt{15}}{48} & 0 & -\frac{5\sqrt6}{112} & 0 & \frac{5\sqrt3}{112} & 0 & 0 & -\frac{3\sqrt{10}}{160} & 0 & -\frac{\sqrt2}{224} & 0 & \frac{11\sqrt{30}}{1120} & 0 & -\frac{\sqrt{70}}{160} \\
0 & -\frac{5\sqrt6}{96} & 0 & \frac{5\sqrt3}{112} & 0 & -\frac{\sqrt{30}}{224} & -\frac{3\sqrt{35}}{160} & 0 & -\frac{\sqrt{15}}{160} & 0 & \frac{13}{224} & 0 & -\frac{23\sqrt5}{1120} & 0 \\
-\frac{3\sqrt6}{32} & 0 & \frac{\sqrt{15}}{48} & 0 & -\frac{\sqrt{30}}{224} & 0 & 0 & -\frac{3}{32} & 0 & \frac{\sqrt5}{32} & 0 & -\frac{5\sqrt3}{224} & 0 & \frac{\sqrt7}{224}
\end{bmatrix}$$

| 565 | symmetry | $\dfrac{y\left(15x^4-40x^2y^2+30x^2z^2+8y^4-40y^2z^2+15z^4\right)}{8}$ |

$\mathbb{Q}_{5,2}^{(a)}(E_u,1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt5 i}{80} & 0 & -\frac{i}{16} & 0 & -\frac{7\sqrt{15}i}{240} & 0 & -\frac{3\sqrt{35}i}{80} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}i}{240} & 0 & \frac{3\sqrt5 i}{80} & 0 & \frac{\sqrt3 i}{16} & 0 & \frac{7\sqrt{15}i}{240} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{7\sqrt{15}i}{240} & 0 & -\frac{\sqrt3 i}{16} & 0 & -\frac{3\sqrt5 i}{80} & 0 & -\frac{\sqrt{105}i}{240} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{35}i}{80} & 0 & \frac{7\sqrt{15}i}{240} & 0 & \frac{i}{16} & 0 & \frac{\sqrt5 i}{80} & 0 \\
0 & \frac{\sqrt{30}i}{224} & 0 & \frac{\sqrt{15}i}{48} & 0 & \frac{3\sqrt6 i}{32} & -\frac{\sqrt7 i}{224} & 0 & -\frac{5\sqrt3 i}{224} & 0 & -\frac{\sqrt5 i}{32} & 0 & -\frac{3i}{32} & 0 \\
-\frac{\sqrt{30}i}{224} & 0 & -\frac{5\sqrt3 i}{112} & 0 & -\frac{5\sqrt6 i}{96} & 0 & 0 & \frac{23\sqrt5 i}{1120} & 0 & \frac{13i}{224} & 0 & \frac{\sqrt{15}i}{160} & 0 & -\frac{3\sqrt{35}i}{160} \\
0 & \frac{5\sqrt3 i}{112} & 0 & \frac{5\sqrt6 i}{112} & 0 & \frac{\sqrt{15}i}{48} & -\frac{\sqrt{70}i}{160} & 0 & -\frac{11\sqrt{30}i}{1120} & 0 & -\frac{\sqrt2 i}{224} & 0 & \frac{3\sqrt{10}i}{160} & 0 \\
-\frac{\sqrt{15}i}{48} & 0 & -\frac{5\sqrt6 i}{112} & 0 & -\frac{5\sqrt3 i}{112} & 0 & 0 & \frac{3\sqrt{10}i}{160} & 0 & -\frac{\sqrt2 i}{224} & 0 & -\frac{11\sqrt{30}i}{1120} & 0 & -\frac{\sqrt{70}i}{160} \\
0 & \frac{5\sqrt6 i}{96} & 0 & \frac{5\sqrt3 i}{112} & 0 & \frac{\sqrt{30}i}{224} & -\frac{3\sqrt{35}i}{160} & 0 & \frac{\sqrt{15}i}{160} & 0 & \frac{13i}{224} & 0 & \frac{23\sqrt5 i}{1120} & 0 \\
-\frac{3\sqrt6 i}{32} & 0 & -\frac{\sqrt{15}i}{48} & 0 & -\frac{\sqrt{30}i}{224} & 0 & 0 & -\frac{3i}{32} & 0 & -\frac{\sqrt5 i}{32} & 0 & -\frac{5\sqrt3 i}{224} & 0 & -\frac{\sqrt7 i}{224}
\end{bmatrix}$$

| 566 | symmetry | $\dfrac{3\sqrt{35}x\left(y^2-2yz-z^2\right)\left(y^2+2yz-z^2\right)}{8}$ |

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{Q}_{5,1}^{(a)}(E_u,2) = \begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{80} & 0 & \frac{\sqrt{35}}{80} & 0 & \frac{3\sqrt{21}}{80} & 0 & \frac{1}{16} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{3}}{80} & 0 & \frac{3\sqrt{7}}{80} & 0 & -\frac{\sqrt{105}}{80} & 0 & -\frac{3\sqrt{21}}{80} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{21}}{80} & 0 & -\frac{\sqrt{105}}{80} & 0 & \frac{3\sqrt{7}}{80} & 0 & \frac{3\sqrt{3}}{80} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{16} & 0 & \frac{3\sqrt{21}}{80} & 0 & \frac{\sqrt{35}}{80} & 0 & -\frac{\sqrt{7}}{80} & 0 \\
0 & -\frac{\sqrt{42}}{224} & 0 & -\frac{3\sqrt{21}}{112} & 0 & -\frac{\sqrt{210}}{224} & -\frac{\sqrt{5}}{160} & 0 & \frac{\sqrt{105}}{224} & 0 & \frac{9\sqrt{7}}{224} & 0 & \frac{\sqrt{35}}{224} & 0 \\
-\frac{\sqrt{42}}{224} & 0 & \frac{\sqrt{105}}{112} & 0 & \frac{3\sqrt{210}}{224} & 0 & 0 & \frac{23\sqrt{7}}{1120} & 0 & -\frac{13\sqrt{35}}{1120} & 0 & -\frac{9\sqrt{21}}{1120} & 0 & \frac{1}{32} \\
0 & \frac{\sqrt{105}}{112} & 0 & -\frac{\sqrt{210}}{112} & 0 & -\frac{3\sqrt{21}}{112} & -\frac{9\sqrt{2}}{160} & 0 & -\frac{11\sqrt{42}}{1120} & 0 & \frac{\sqrt{70}}{1120} & 0 & -\frac{27\sqrt{14}}{1120} & 0 \\
-\frac{3\sqrt{21}}{112} & 0 & -\frac{\sqrt{210}}{112} & 0 & \frac{\sqrt{105}}{112} & 0 & 0 & \frac{27\sqrt{14}}{1120} & 0 & -\frac{\sqrt{70}}{1120} & 0 & \frac{11\sqrt{42}}{1120} & 0 & \frac{9\sqrt{2}}{160} \\
0 & \frac{3\sqrt{210}}{224} & 0 & \frac{\sqrt{105}}{112} & 0 & -\frac{\sqrt{42}}{224} & -\frac{1}{32} & 0 & \frac{9\sqrt{21}}{1120} & 0 & \frac{13\sqrt{35}}{1120} & 0 & -\frac{23\sqrt{7}}{1120} & 0 \\
-\frac{\sqrt{210}}{224} & 0 & -\frac{3\sqrt{21}}{112} & 0 & -\frac{\sqrt{42}}{224} & 0 & 0 & -\frac{\sqrt{35}}{224} & 0 & -\frac{9\sqrt{7}}{224} & 0 & -\frac{\sqrt{105}}{224} & 0 & \frac{\sqrt{5}}{160}
\end{pmatrix}$$

| 567 | symmetry | $\dfrac{3\sqrt{35}\,y\left(x^2-2xz-z^2\right)\left(x^2+2xz-z^2\right)}{8}$ |

$$\mathbb{Q}_{5,2}^{(a)}(E_u,2) = \begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{80} & 0 & -\frac{\sqrt{35}i}{80} & 0 & \frac{3\sqrt{21}i}{80} & 0 & -\frac{i}{16} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{3}i}{80} & 0 & \frac{3\sqrt{7}i}{80} & 0 & \frac{\sqrt{105}i}{80} & 0 & -\frac{3\sqrt{21}i}{80} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{21}i}{80} & 0 & -\frac{\sqrt{105}i}{80} & 0 & -\frac{3\sqrt{7}i}{80} & 0 & \frac{3\sqrt{3}i}{80} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{i}{16} & 0 & -\frac{3\sqrt{21}i}{80} & 0 & \frac{\sqrt{35}i}{80} & 0 & \frac{\sqrt{7}i}{80} & 0 \\
0 & \frac{\sqrt{42}i}{224} & 0 & -\frac{3\sqrt{21}i}{112} & 0 & \frac{\sqrt{210}i}{224} & -\frac{\sqrt{5}i}{160} & 0 & -\frac{\sqrt{105}i}{224} & 0 & \frac{9\sqrt{7}i}{224} & 0 & -\frac{\sqrt{35}i}{224} & 0 \\
-\frac{\sqrt{42}i}{224} & 0 & -\frac{\sqrt{105}i}{112} & 0 & \frac{3\sqrt{210}i}{224} & 0 & 0 & \frac{23\sqrt{7}i}{1120} & 0 & \frac{13\sqrt{35}i}{1120} & 0 & -\frac{9\sqrt{21}i}{1120} & 0 & -\frac{i}{32} \\
0 & \frac{\sqrt{105}i}{112} & 0 & \frac{\sqrt{210}i}{112} & 0 & -\frac{3\sqrt{21}i}{112} & \frac{9\sqrt{2}i}{160} & 0 & -\frac{11\sqrt{42}i}{1120} & 0 & -\frac{\sqrt{70}i}{1120} & 0 & -\frac{27\sqrt{14}i}{1120} & 0 \\
\frac{3\sqrt{21}i}{112} & 0 & -\frac{\sqrt{210}i}{112} & 0 & -\frac{\sqrt{105}i}{112} & 0 & 0 & -\frac{27\sqrt{14}i}{1120} & 0 & -\frac{\sqrt{70}i}{1120} & 0 & -\frac{11\sqrt{42}i}{1120} & 0 & \frac{9\sqrt{2}i}{160} \\
0 & -\frac{3\sqrt{210}i}{224} & 0 & \frac{\sqrt{105}i}{112} & 0 & \frac{\sqrt{42}i}{224} & -\frac{i}{32} & 0 & -\frac{9\sqrt{21}i}{1120} & 0 & \frac{13\sqrt{35}i}{1120} & 0 & \frac{23\sqrt{7}i}{1120} & 0 \\
-\frac{\sqrt{210}i}{224} & 0 & \frac{3\sqrt{21}i}{112} & 0 & -\frac{\sqrt{42}i}{224} & 0 & 0 & -\frac{\sqrt{35}i}{224} & 0 & \frac{9\sqrt{7}i}{224} & 0 & -\frac{\sqrt{105}i}{224} & 0 & -\frac{\sqrt{5}i}{160}
\end{bmatrix}$$

| 568 | symmetry | $\dfrac{\sqrt{105}\,x(y-z)(y+z)\left(2x^2-y^2-z^2\right)}{4}$ |

continued ...

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{5,1}^{(a)}(E_u,3)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}}{120} & 0 & \frac{\sqrt{105}}{120} & 0 & -\frac{\sqrt{7}}{40} & 0 & -\frac{\sqrt{3}}{8} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{40} & 0 & \frac{\sqrt{21}}{40} & 0 & -\frac{\sqrt{35}}{40} & 0 & \frac{\sqrt{7}}{40} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{40} & 0 & -\frac{\sqrt{35}}{40} & 0 & \frac{\sqrt{21}}{40} & 0 & -\frac{1}{40} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{8} & 0 & -\frac{\sqrt{7}}{40} & 0 & \frac{\sqrt{105}}{120} & 0 & -\frac{\sqrt{21}}{120} & 0 \\
0 & -\frac{\sqrt{14}}{112} & 0 & \frac{\sqrt{7}}{56} & 0 & \frac{3\sqrt{70}}{112} & -\frac{\sqrt{15}}{240} & 0 & \frac{\sqrt{35}}{112} & 0 & -\frac{\sqrt{21}}{112} & 0 & -\frac{\sqrt{105}}{112} & 0 \\
-\frac{\sqrt{14}}{112} & 0 & \frac{\sqrt{35}}{56} & 0 & -\frac{\sqrt{70}}{112} & 0 & 0 & \frac{23\sqrt{21}}{1680} & 0 & -\frac{13\sqrt{105}}{1680} & 0 & \frac{3\sqrt{7}}{560} & 0 & -\frac{\sqrt{3}}{16} \\
0 & \frac{\sqrt{35}}{56} & 0 & -\frac{\sqrt{70}}{56} & 0 & \frac{\sqrt{7}}{56} & \frac{\sqrt{6}}{80} & 0 & -\frac{11\sqrt{14}}{560} & 0 & \frac{\sqrt{210}}{1680} & 0 & \frac{3\sqrt{42}}{560} & 0 \\
\frac{\sqrt{7}}{56} & 0 & -\frac{\sqrt{70}}{56} & 0 & \frac{\sqrt{35}}{56} & 0 & 0 & -\frac{3\sqrt{42}}{560} & 0 & -\frac{\sqrt{210}}{1680} & 0 & \frac{11\sqrt{14}}{560} & 0 & -\frac{\sqrt{6}}{80} \\
0 & -\frac{\sqrt{70}}{112} & 0 & \frac{\sqrt{35}}{56} & 0 & -\frac{\sqrt{14}}{112} & \frac{\sqrt{3}}{16} & 0 & -\frac{3\sqrt{7}}{560} & 0 & \frac{13\sqrt{105}}{1680} & 0 & -\frac{23\sqrt{21}}{1680} & 0 \\
\frac{3\sqrt{70}}{112} & 0 & \frac{\sqrt{7}}{56} & 0 & -\frac{\sqrt{14}}{112} & 0 & 0 & \frac{\sqrt{105}}{112} & 0 & \frac{\sqrt{21}}{112} & 0 & -\frac{\sqrt{35}}{112} & 0 & \frac{\sqrt{15}}{240}
\end{bmatrix}$$

| 569 | symmetry | $-\dfrac{\sqrt{105}\,y(x-z)(x+z)\left(x^2-2y^2+z^2\right)}{4}$ |
|---|---|---|

$\mathbb{Q}_{5,2}^{(a)}(E_u,3)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{120} & 0 & -\frac{\sqrt{105}i}{120} & 0 & -\frac{\sqrt{7}i}{40} & 0 & \frac{\sqrt{3}i}{8} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{i}{40} & 0 & \frac{\sqrt{21}i}{40} & 0 & \frac{\sqrt{35}i}{40} & 0 & \frac{\sqrt{7}i}{40} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{40} & 0 & -\frac{\sqrt{35}i}{40} & 0 & -\frac{\sqrt{21}i}{40} & 0 & -\frac{i}{40} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{8} & 0 & \frac{\sqrt{7}i}{40} & 0 & \frac{\sqrt{105}i}{120} & 0 & \frac{\sqrt{21}i}{120} & 0 \\
0 & \frac{\sqrt{14}i}{112} & 0 & \frac{\sqrt{7}i}{56} & 0 & -\frac{3\sqrt{70}i}{112} & -\frac{\sqrt{15}i}{240} & 0 & -\frac{\sqrt{35}i}{112} & 0 & -\frac{\sqrt{21}i}{112} & 0 & \frac{\sqrt{105}i}{112} & 0 \\
-\frac{\sqrt{14}i}{112} & 0 & -\frac{\sqrt{35}i}{56} & 0 & -\frac{\sqrt{70}i}{112} & 0 & 0 & \frac{23\sqrt{21}i}{1680} & 0 & \frac{13\sqrt{105}i}{1680} & 0 & \frac{3\sqrt{7}i}{560} & 0 & \frac{\sqrt{3}i}{16} \\
0 & \frac{\sqrt{35}i}{56} & 0 & \frac{\sqrt{70}i}{56} & 0 & \frac{\sqrt{7}i}{56} & -\frac{\sqrt{6}i}{80} & 0 & -\frac{11\sqrt{14}i}{560} & 0 & -\frac{\sqrt{210}i}{1680} & 0 & \frac{3\sqrt{42}i}{560} & 0 \\
-\frac{\sqrt{7}i}{56} & 0 & -\frac{\sqrt{70}i}{56} & 0 & -\frac{\sqrt{35}i}{56} & 0 & 0 & \frac{3\sqrt{42}i}{560} & 0 & -\frac{\sqrt{210}i}{1680} & 0 & -\frac{11\sqrt{14}i}{560} & 0 & -\frac{\sqrt{6}i}{80} \\
0 & \frac{\sqrt{70}i}{112} & 0 & \frac{\sqrt{35}i}{56} & 0 & \frac{\sqrt{14}i}{112} & \frac{\sqrt{3}i}{16} & 0 & \frac{3\sqrt{7}i}{560} & 0 & \frac{13\sqrt{105}i}{1680} & 0 & \frac{23\sqrt{21}i}{1680} & 0 \\
\frac{3\sqrt{70}i}{112} & 0 & -\frac{\sqrt{7}i}{56} & 0 & -\frac{\sqrt{14}i}{112} & 0 & 0 & \frac{\sqrt{105}i}{112} & 0 & -\frac{\sqrt{21}i}{112} & 0 & -\frac{\sqrt{35}i}{112} & 0 & -\frac{\sqrt{15}i}{240}
\end{bmatrix}$$

| 570 | symmetry | $-\dfrac{z\left(3x^2+3y^2-2z^2\right)}{2}$ |
|---|---|---|

Table 9

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{Q}_3^{(1,-1;a)}(A_{2u})$

$$\begin{bmatrix}
0 & -\frac{\sqrt{6}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{14} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{2}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{14} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{2}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{14} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{14} & 0 & 0 \\
\frac{\sqrt{6}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{2}{7} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{6}}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{6}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{7} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{6}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{7} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{6}}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{2}{7} & 0
\end{bmatrix}$$

| 571 | symmetry | $\sqrt{15}xyz$ |
|-----|----------|----------------|

$\mathbb{Q}_3^{(1,-1;a)}(B_{1u})$

$$\begin{bmatrix}
0 & 0 & 0 & \frac{\sqrt{5}i}{35} & 0 & 0 & -\frac{\sqrt{21}i}{28} & 0 & 0 & 0 & \frac{\sqrt{15}i}{28} & 0 & 0 & 0 \\
\frac{\sqrt{6}i}{42} & 0 & 0 & 0 & \frac{\sqrt{30}i}{210} & 0 & 0 & \frac{3i}{28} & 0 & 0 & 0 & \frac{3\sqrt{3}i}{28} & 0 & 0 \\
0 & -\frac{\sqrt{30}i}{210} & 0 & 0 & 0 & -\frac{\sqrt{6}i}{42} & 0 & 0 & \frac{3\sqrt{3}i}{28} & 0 & 0 & 0 & \frac{3i}{28} & 0 \\
0 & 0 & -\frac{\sqrt{5}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{21}i}{28} \\
0 & 0 & -\frac{3i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{3}i}{21} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{3\sqrt{5}i}{140} & 0 & 0 & -\frac{\sqrt{21}i}{21} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{21} & 0 & 0 & 0 \\
\frac{3i}{28} & 0 & 0 & 0 & \frac{3\sqrt{5}i}{140} & 0 & 0 & -\frac{\sqrt{6}i}{42} & 0 & 0 & 0 & -\frac{\sqrt{2}i}{14} & 0 & 0 \\
0 & \frac{3\sqrt{5}i}{140} & 0 & 0 & 0 & \frac{3i}{28} & 0 & 0 & \frac{\sqrt{2}i}{14} & 0 & 0 & 0 & \frac{\sqrt{6}i}{42} & 0 \\
0 & 0 & -\frac{3\sqrt{5}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{21} & 0 & 0 & 0 & \frac{\sqrt{21}i}{21} \\
0 & 0 & 0 & -\frac{3i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt{3}i}{21} & 0 & 0 & 0
\end{bmatrix}$$

| 572 | symmetry | $\frac{\sqrt{15}z(x-y)(x+y)}{2}$ |
|-----|----------|----------------------------------|

*continued ...*

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Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_3^{(1,-1;a)}(B_{2u})$

$$\begin{bmatrix}
0 & 0 & 0 & -\frac{\sqrt5}{35} & 0 & 0 & -\frac{\sqrt{21}}{28} & 0 & 0 & 0 & -\frac{\sqrt{15}}{28} & 0 & 0 & 0 \\
\frac{\sqrt6}{42} & 0 & 0 & 0 & -\frac{\sqrt{30}}{210} & 0 & 0 & \frac{3}{28} & 0 & 0 & 0 & -\frac{3\sqrt3}{28} & 0 & 0 \\
0 & -\frac{\sqrt{30}}{210} & 0 & 0 & 0 & \frac{\sqrt6}{42} & 0 & 0 & \frac{3\sqrt3}{28} & 0 & 0 & 0 & -\frac{3}{28} & 0 \\
0 & 0 & -\frac{\sqrt5}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{28} & 0 & 0 & 0 & \frac{\sqrt{21}}{28} \\
0 & 0 & \frac{3}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt3}{21} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{3\sqrt5}{140} & 0 & 0 & -\frac{\sqrt{21}}{21} & 0 & 0 & 0 & \frac{\sqrt{15}}{21} & 0 & 0 & 0 \\
\frac{3}{28} & 0 & 0 & 0 & -\frac{3\sqrt5}{140} & 0 & 0 & -\frac{\sqrt6}{42} & 0 & 0 & 0 & \frac{\sqrt2}{14} & 0 & 0 \\
0 & \frac{3\sqrt5}{140} & 0 & 0 & 0 & -\frac{3}{28} & 0 & 0 & \frac{\sqrt2}{14} & 0 & 0 & 0 & -\frac{\sqrt6}{42} & 0 \\
0 & 0 & -\frac{3\sqrt5}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{21} & 0 & 0 & 0 & -\frac{\sqrt{21}}{21} \\
0 & 0 & 0 & -\frac{3}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt3}{21} & 0 & 0 & 0
\end{bmatrix}$$

| 573 | symmetry | $\dfrac{x\left(2x^2-3y^2-3z^2\right)}{2}$ |
|---|---|---|

$\mathbb{Q}_{3,1}^{(1,-1;a)}(E_u,1)$

$$\begin{bmatrix}
-\frac{\sqrt{30}}{280} & 0 & \frac{3\sqrt3}{140} & 0 & -\frac{\sqrt6}{56} & 0 & 0 & -\frac{3\sqrt5}{56} & 0 & \frac{3}{28} & 0 & -\frac{\sqrt{15}}{56} & 0 & 0 \\
0 & \frac{\sqrt2}{40} & 0 & -\frac{1}{140} & 0 & -\frac{\sqrt{10}}{56} & -\frac{\sqrt{105}}{56} & 0 & 0 & 0 & \frac{3\sqrt3}{56} & 0 & -\frac{\sqrt{15}}{28} & 0 \\
\frac{\sqrt{10}}{56} & 0 & \frac{1}{140} & 0 & -\frac{\sqrt2}{40} & 0 & 0 & -\frac{\sqrt{15}}{28} & 0 & \frac{3\sqrt3}{56} & 0 & 0 & 0 & -\frac{\sqrt{105}}{56} \\
0 & \frac{\sqrt6}{56} & 0 & -\frac{3\sqrt3}{140} & 0 & \frac{\sqrt{30}}{280} & 0 & 0 & -\frac{\sqrt{15}}{56} & 0 & \frac{3}{28} & 0 & -\frac{3\sqrt5}{56} & 0 \\
0 & -\frac{3\sqrt{30}}{280} & 0 & \frac{\sqrt{15}}{56} & 0 & 0 & \frac{\sqrt7}{28} & 0 & -\frac{\sqrt3}{14} & 0 & \frac{\sqrt5}{28} & 0 & 0 & 0 \\
-\frac{3\sqrt{30}}{280} & 0 & \frac{3\sqrt3}{280} & 0 & \frac{\sqrt6}{28} & 0 & 0 & -\frac{\sqrt5}{28} & 0 & -\frac{1}{14} & 0 & \frac{\sqrt{15}}{28} & 0 & 0 \\
0 & \frac{3\sqrt3}{280} & 0 & \frac{3\sqrt6}{140} & 0 & \frac{\sqrt{15}}{56} & -\frac{\sqrt{70}}{56} & 0 & -\frac{\sqrt{30}}{56} & 0 & \frac{\sqrt2}{56} & 0 & \frac{3\sqrt{10}}{56} & 0 \\
\frac{\sqrt{15}}{56} & 0 & \frac{3\sqrt6}{140} & 0 & \frac{3\sqrt3}{280} & 0 & 0 & -\frac{3\sqrt{10}}{56} & 0 & -\frac{\sqrt2}{56} & 0 & \frac{\sqrt{30}}{56} & 0 & \frac{\sqrt{70}}{56} \\
0 & \frac{\sqrt6}{28} & 0 & \frac{3\sqrt3}{280} & 0 & -\frac{3\sqrt{30}}{280} & 0 & 0 & -\frac{\sqrt{15}}{28} & 0 & \frac{1}{14} & 0 & \frac{\sqrt5}{28} & 0 \\
0 & 0 & \frac{\sqrt{15}}{56} & 0 & -\frac{3\sqrt{30}}{280} & 0 & 0 & 0 & 0 & -\frac{\sqrt5}{28} & 0 & \frac{\sqrt3}{14} & 0 & -\frac{\sqrt7}{28}
\end{bmatrix}$$

| 574 | symmetry | $-\dfrac{y\left(3x^2-2y^2+3z^2\right)}{2}$ |
|---|---|---|

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{3,2}^{(1,-1;a)}(E_u,1)$

$$\begin{bmatrix}
-\frac{\sqrt{30}i}{280} & 0 & -\frac{3\sqrt{3}i}{140} & 0 & -\frac{\sqrt{6}i}{56} & 0 & 0 & -\frac{3\sqrt{5}i}{56} & 0 & -\frac{3i}{28} & 0 & -\frac{\sqrt{15}i}{56} & 0 & 0 \\
0 & \frac{\sqrt{2}i}{40} & 0 & \frac{i}{140} & 0 & -\frac{\sqrt{10}i}{56} & \frac{\sqrt{105}i}{56} & 0 & 0 & 0 & -\frac{3\sqrt{3}i}{56} & 0 & -\frac{\sqrt{15}i}{28} & 0 \\
-\frac{\sqrt{10}i}{56} & 0 & \frac{i}{140} & 0 & \frac{\sqrt{2}i}{40} & 0 & 0 & \frac{\sqrt{15}i}{28} & 0 & \frac{3\sqrt{3}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{105}i}{56} \\
0 & -\frac{\sqrt{6}i}{56} & 0 & -\frac{3\sqrt{3}i}{140} & 0 & -\frac{\sqrt{30}i}{280} & 0 & 0 & \frac{\sqrt{15}i}{56} & 0 & \frac{3i}{28} & 0 & \frac{3\sqrt{5}i}{56} & 0 \\
0 & \frac{3\sqrt{30}i}{280} & 0 & \frac{\sqrt{15}i}{56} & 0 & 0 & \frac{\sqrt{7}i}{28} & 0 & \frac{\sqrt{3}i}{14} & 0 & \frac{\sqrt{5}i}{28} & 0 & 0 & 0 \\
-\frac{3\sqrt{30}i}{280} & 0 & -\frac{3\sqrt{3}i}{280} & 0 & \frac{\sqrt{6}i}{28} & 0 & 0 & -\frac{\sqrt{5}i}{28} & 0 & \frac{i}{14} & 0 & \frac{\sqrt{15}i}{28} & 0 & 0 \\
0 & \frac{3\sqrt{3}i}{280} & 0 & -\frac{3\sqrt{6}i}{140} & 0 & \frac{\sqrt{15}i}{56} & \frac{\sqrt{70}i}{56} & 0 & -\frac{\sqrt{30}i}{56} & 0 & -\frac{\sqrt{2}i}{56} & 0 & \frac{3\sqrt{10}i}{56} & 0 \\
-\frac{\sqrt{15}i}{56} & 0 & \frac{3\sqrt{6}i}{140} & 0 & -\frac{3\sqrt{3}i}{280} & 0 & 0 & \frac{3\sqrt{10}i}{56} & 0 & -\frac{\sqrt{2}i}{56} & 0 & -\frac{\sqrt{30}i}{56} & 0 & \frac{\sqrt{70}i}{56} \\
0 & -\frac{\sqrt{6}i}{28} & 0 & \frac{3\sqrt{3}i}{280} & 0 & \frac{3\sqrt{30}i}{280} & 0 & 0 & \frac{\sqrt{15}i}{28} & 0 & \frac{i}{14} & 0 & -\frac{\sqrt{5}i}{28} & 0 \\
0 & 0 & -\frac{\sqrt{15}i}{56} & 0 & -\frac{3\sqrt{30}i}{280} & 0 & 0 & 0 & 0 & \frac{\sqrt{5}i}{28} & 0 & \frac{\sqrt{3}i}{14} & 0 & \frac{\sqrt{7}i}{28}
\end{bmatrix}$$

| No. | | |
|---|---|---|
| 575 | symmetry | $\dfrac{\sqrt{15}x(y-z)(y+z)}{2}$ |

$\mathbb{Q}_{3,1}^{(1,-1;a)}(E_u,2)$

$$\begin{bmatrix}
-\frac{\sqrt{2}}{56} & 0 & \frac{3\sqrt{5}}{140} & 0 & \frac{3\sqrt{10}}{280} & 0 & 0 & -\frac{5\sqrt{3}}{56} & 0 & \frac{\sqrt{15}}{28} & 0 & \frac{3}{56} & 0 & 0 \\
0 & \frac{\sqrt{30}}{120} & 0 & -\frac{\sqrt{15}}{420} & 0 & \frac{\sqrt{6}}{56} & \frac{3\sqrt{7}}{56} & 0 & 0 & 0 & \frac{3\sqrt{5}}{56} & 0 & \frac{3}{28} & 0 \\
-\frac{\sqrt{6}}{56} & 0 & \frac{\sqrt{15}}{420} & 0 & -\frac{\sqrt{30}}{120} & 0 & 0 & \frac{3}{28} & 0 & \frac{3\sqrt{5}}{56} & 0 & 0 & 0 & \frac{3\sqrt{7}}{56} \\
0 & -\frac{3\sqrt{10}}{280} & 0 & -\frac{3\sqrt{5}}{140} & 0 & \frac{\sqrt{2}}{56} & 0 & 0 & \frac{3}{56} & 0 & \frac{\sqrt{15}}{28} & 0 & -\frac{5\sqrt{3}}{56} & 0 \\
0 & -\frac{3\sqrt{2}}{56} & 0 & -\frac{3}{56} & 0 & 0 & \frac{\sqrt{105}}{84} & 0 & -\frac{\sqrt{5}}{14} & 0 & -\frac{\sqrt{3}}{28} & 0 & 0 & 0 \\
-\frac{3\sqrt{2}}{56} & 0 & \frac{3\sqrt{5}}{280} & 0 & -\frac{3\sqrt{10}}{140} & 0 & 0 & -\frac{5\sqrt{3}}{84} & 0 & -\frac{\sqrt{15}}{42} & 0 & -\frac{3}{28} & 0 & 0 \\
0 & \frac{3\sqrt{5}}{280} & 0 & \frac{3\sqrt{10}}{140} & 0 & -\frac{3}{56} & \frac{\sqrt{42}}{56} & 0 & -\frac{5\sqrt{2}}{56} & 0 & \frac{\sqrt{30}}{168} & 0 & -\frac{3\sqrt{6}}{56} & 0 \\
-\frac{3}{56} & 0 & \frac{3\sqrt{10}}{140} & 0 & \frac{3\sqrt{5}}{280} & 0 & 0 & \frac{3\sqrt{6}}{56} & 0 & -\frac{\sqrt{30}}{168} & 0 & \frac{5\sqrt{2}}{56} & 0 & -\frac{\sqrt{42}}{56} \\
0 & -\frac{3\sqrt{10}}{140} & 0 & \frac{3\sqrt{5}}{280} & 0 & -\frac{3\sqrt{2}}{56} & 0 & 0 & \frac{3}{28} & 0 & \frac{\sqrt{15}}{42} & 0 & \frac{5\sqrt{3}}{84} & 0 \\
0 & 0 & -\frac{3}{56} & 0 & -\frac{3\sqrt{2}}{56} & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{28} & 0 & \frac{\sqrt{5}}{14} & 0 & -\frac{\sqrt{105}}{84}
\end{bmatrix}$$

| No. | | |
|---|---|---|
| 576 | symmetry | $\dfrac{\sqrt{15}y(x-z)(x+z)}{2}$ |

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{3,2}^{(1,-1;a)}(E_u,2)$

$$\begin{bmatrix}
-\frac{\sqrt{2}i}{56} & 0 & -\frac{3\sqrt{5}i}{140} & 0 & \frac{3\sqrt{10}i}{280} & 0 & 0 & -\frac{5\sqrt{3}i}{56} & 0 & -\frac{\sqrt{15}i}{28} & 0 & \frac{3i}{56} & 0 & 0 \\[4pt]
0 & \frac{\sqrt{30}i}{120} & 0 & \frac{\sqrt{15}i}{420} & 0 & \frac{\sqrt{6}i}{56} & -\frac{3\sqrt{7}i}{56} & 0 & 0 & 0 & -\frac{3\sqrt{5}i}{56} & 0 & \frac{3i}{28} & 0 \\[4pt]
\frac{\sqrt{6}i}{56} & 0 & \frac{\sqrt{15}i}{420} & 0 & \frac{\sqrt{30}i}{120} & 0 & 0 & -\frac{3i}{28} & 0 & \frac{3\sqrt{5}i}{56} & 0 & 0 & 0 & \frac{3\sqrt{7}i}{56} \\[4pt]
0 & \frac{3\sqrt{10}i}{280} & 0 & -\frac{3\sqrt{5}i}{140} & 0 & -\frac{\sqrt{2}i}{56} & 0 & 0 & -\frac{3i}{56} & 0 & \frac{\sqrt{15}i}{28} & 0 & \frac{5\sqrt{3}i}{56} & 0 \\[4pt]
0 & \frac{3\sqrt{2}i}{56} & 0 & -\frac{3i}{56} & 0 & 0 & \frac{\sqrt{105}i}{84} & 0 & \frac{\sqrt{5}i}{14} & 0 & -\frac{\sqrt{3}i}{28} & 0 & 0 & 0 \\[4pt]
-\frac{3\sqrt{2}i}{56} & 0 & -\frac{3\sqrt{5}i}{280} & 0 & -\frac{3\sqrt{10}i}{140} & 0 & 0 & -\frac{5\sqrt{3}i}{84} & 0 & \frac{\sqrt{15}i}{42} & 0 & -\frac{3i}{28} & 0 & 0 \\[4pt]
0 & \frac{3\sqrt{5}i}{280} & 0 & -\frac{3\sqrt{10}i}{140} & 0 & -\frac{3i}{56} & -\frac{\sqrt{42}i}{56} & 0 & -\frac{5\sqrt{2}i}{56} & 0 & -\frac{\sqrt{30}i}{168} & 0 & -\frac{3\sqrt{6}i}{56} & 0 \\[4pt]
\frac{3i}{56} & 0 & \frac{3\sqrt{10}i}{140} & 0 & -\frac{3\sqrt{5}i}{280} & 0 & 0 & -\frac{3\sqrt{6}i}{56} & 0 & -\frac{\sqrt{30}i}{168} & 0 & -\frac{5\sqrt{2}i}{56} & 0 & -\frac{\sqrt{42}i}{56} \\[4pt]
0 & \frac{3\sqrt{10}i}{140} & 0 & \frac{3\sqrt{5}i}{280} & 0 & \frac{3\sqrt{2}i}{56} & 0 & 0 & -\frac{3i}{28} & 0 & \frac{\sqrt{15}i}{42} & 0 & -\frac{5\sqrt{3}i}{84} & 0 \\[4pt]
0 & 0 & \frac{3i}{56} & 0 & -\frac{3\sqrt{2}i}{56} & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{28} & 0 & \frac{\sqrt{5}i}{14} & 0 & \frac{\sqrt{105}i}{84}
\end{bmatrix}$$

| 577 | symmetry | $\dfrac{3\sqrt{35}\,xyz(x-y)(x+y)}{2}$ |
|---|---|---|

$\mathbb{Q}_5^{(1,-1;a)}(A_{1u})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{100} & 0 \\[4pt]
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{10}i}{100} \\[4pt]
0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{10}i}{100} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\[4pt]
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{100} & 0 & 0 & 0 & 0 & 0 & 0 \\[4pt]
0 & 0 & 0 & 0 & \frac{\sqrt{35}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{14}i}{35} & 0 & 0 \\[4pt]
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{35}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{175} & 0 \\[4pt]
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{15}i}{25} \\[4pt]
0 & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt{15}i}{25} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\[4pt]
-\frac{\sqrt{35}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{175} & 0 & 0 & 0 & 0 & 0 & 0 \\[4pt]
0 & \frac{\sqrt{35}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{14}i}{35} & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

| 578 | symmetry | $\dfrac{z\left(15x^4+30x^2y^2-40x^2z^2+15y^4-40y^2z^2+8z^4\right)}{8}$ |
|---|---|---|

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_5^{(1,-1;a)}(A_{2u},1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{20} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{20} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{20} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{20} & 0 & 0 \\
-\frac{\sqrt{5}}{210} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{35} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{5}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{9\sqrt{2}}{35} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{5}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{15}}{35} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{5}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{15}}{35} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{5}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{9\sqrt{2}}{35} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{210} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{35} & 0 \\
\end{bmatrix}$$

| 579 | symmetry | $\dfrac{3\sqrt{35}z\left(x^2-2xy-y^2\right)\left(x^2+2xy-y^2\right)}{8}$ |
|---|---|---|

$\mathbb{Q}_5^{(1,-1;a)}(A_{2u},2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{100} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}}{100} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{10}}{100} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{100} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{35}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{14}}{35} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{35}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{175} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt{15}}{25} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt{15}}{25} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{35}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{175} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{35}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{14}}{35} & 0 & 0 & 0 & 0 & 0 \\
\end{bmatrix}$$

| 580 | symmetry | $\dfrac{\sqrt{105}xyz\left(x^2+y^2-2z^2\right)}{2}$ |
|---|---|---|

# Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_5^{(1,-1;a)}(B_{1u})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{200} & 0 & 0 & 0 & \frac{\sqrt{14}i}{40} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{200} & 0 & 0 & 0 & -\frac{3\sqrt{70}i}{200} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{70}i}{200} & 0 & 0 & 0 & \frac{\sqrt{210}i}{200} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}i}{40} & 0 & 0 & 0 & -\frac{\sqrt{10}i}{200} \\
0 & 0 & -\frac{\sqrt{210}i}{420} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{35} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{42}i}{84} & 0 & 0 & -\frac{\sqrt{10}i}{25} & 0 & 0 & 0 & \frac{2\sqrt{14}i}{35} & 0 & 0 & 0 \\
\frac{\sqrt{210}i}{420} & 0 & 0 & 0 & -\frac{\sqrt{42}i}{84} & 0 & 0 & \frac{8\sqrt{35}i}{175} & 0 & 0 & 0 & \frac{2\sqrt{105}i}{175} & 0 & 0 \\
0 & -\frac{\sqrt{42}i}{84} & 0 & 0 & 0 & \frac{\sqrt{210}i}{420} & 0 & 0 & -\frac{2\sqrt{105}i}{175} & 0 & 0 & 0 & -\frac{8\sqrt{35}i}{175} & 0 \\
0 & 0 & \frac{\sqrt{42}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{14}i}{35} & 0 & 0 & 0 & \frac{\sqrt{10}i}{25} \\
0 & 0 & 0 & -\frac{\sqrt{210}i}{420} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{35} & 0 & 0 & 0
\end{bmatrix}$$

| 581 | symmetry | $-\frac{\sqrt{105}z(x-y)(x+y)\left(x^2+y^2-2z^2\right)}{4}$ |
|---|---|---|

$\mathbb{Q}_5^{(1,-1;a)}(B_{2u})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{200} & 0 & 0 & 0 & \frac{\sqrt{14}}{40} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{200} & 0 & 0 & 0 & -\frac{3\sqrt{70}}{200} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{70}}{200} & 0 & 0 & 0 & \frac{\sqrt{210}}{200} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{40} & 0 & 0 & 0 & -\frac{\sqrt{10}}{200} \\
0 & 0 & -\frac{\sqrt{210}}{420} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{35} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{42}}{84} & 0 & 0 & \frac{\sqrt{10}}{25} & 0 & 0 & 0 & \frac{2\sqrt{14}}{35} & 0 & 0 & 0 \\
-\frac{\sqrt{210}}{420} & 0 & 0 & 0 & -\frac{\sqrt{42}}{84} & 0 & 0 & -\frac{8\sqrt{35}}{175} & 0 & 0 & 0 & \frac{2\sqrt{105}}{175} & 0 & 0 \\
0 & \frac{\sqrt{42}}{84} & 0 & 0 & 0 & \frac{\sqrt{210}}{420} & 0 & 0 & \frac{2\sqrt{105}}{175} & 0 & 0 & 0 & -\frac{8\sqrt{35}}{175} & 0 \\
0 & 0 & -\frac{\sqrt{42}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt{14}}{35} & 0 & 0 & 0 & \frac{\sqrt{10}}{25} \\
0 & 0 & 0 & \frac{\sqrt{210}}{420} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{35} & 0 & 0 & 0
\end{bmatrix}$$

| 582 | symmetry | $\frac{x\left(8x^4-40x^2y^2-40x^2z^2+15y^4+30y^2z^2+15z^4\right)}{8}$ |
|---|---|---|

continued ...

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{5,1}^{(1,-1;a)}(E_u,1)$

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{6}}{160}$ | 0 | $\frac{\sqrt{30}}{160}$ | 0 | $-\frac{7\sqrt{2}}{160}$ | 0 | $\frac{3\sqrt{42}}{160}$ |
| 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{14}}{160}$ | 0 | $\frac{3\sqrt{6}}{160}$ | 0 | $-\frac{3\sqrt{10}}{160}$ | 0 | $\frac{7\sqrt{2}}{160}$ | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{7\sqrt{2}}{160}$ | 0 | $-\frac{3\sqrt{10}}{160}$ | 0 | $\frac{3\sqrt{6}}{160}$ | 0 | $-\frac{\sqrt{14}}{160}$ |
| 0 | 0 | 0 | 0 | 0 | 0 | $\frac{3\sqrt{42}}{160}$ | 0 | $-\frac{7\sqrt{2}}{160}$ | 0 | $\frac{\sqrt{30}}{160}$ | 0 | $-\frac{\sqrt{6}}{160}$ | 0 |
| 0 | $-\frac{1}{112}$ | 0 | $\frac{\sqrt{2}}{48}$ | 0 | $-\frac{3\sqrt{5}}{80}$ | $\frac{\sqrt{210}}{560}$ | 0 | $-\frac{3\sqrt{10}}{112}$ | 0 | $\frac{\sqrt{6}}{16}$ | 0 | $-\frac{3\sqrt{30}}{80}$ | 0 |
| $-\frac{1}{112}$ | 0 | $\frac{\sqrt{10}}{112}$ | 0 | $-\frac{\sqrt{5}}{48}$ | 0 | 0 | $-\frac{23\sqrt{6}}{560}$ | 0 | $\frac{13\sqrt{30}}{560}$ | 0 | $-\frac{3\sqrt{2}}{80}$ | 0 | $-\frac{3\sqrt{42}}{80}$ |
| 0 | $\frac{\sqrt{10}}{112}$ | 0 | $-\frac{\sqrt{5}}{56}$ | 0 | $\frac{\sqrt{2}}{48}$ | $-\frac{\sqrt{21}}{40}$ | 0 | $\frac{33}{280}$ | 0 | $-\frac{\sqrt{15}}{280}$ | 0 | $-\frac{3\sqrt{3}}{40}$ | 0 |
| $\frac{\sqrt{2}}{48}$ | 0 | $-\frac{\sqrt{5}}{56}$ | 0 | $\frac{\sqrt{10}}{112}$ | 0 | 0 | $\frac{3\sqrt{3}}{40}$ | 0 | $\frac{\sqrt{15}}{280}$ | 0 | $-\frac{33}{280}$ | 0 | $\frac{\sqrt{21}}{40}$ |
| 0 | $-\frac{\sqrt{5}}{48}$ | 0 | $\frac{\sqrt{10}}{112}$ | 0 | $-\frac{1}{112}$ | $\frac{3\sqrt{42}}{80}$ | 0 | $\frac{3\sqrt{2}}{80}$ | 0 | $-\frac{13\sqrt{30}}{560}$ | 0 | $\frac{23\sqrt{6}}{560}$ | 0 |
| $-\frac{3\sqrt{5}}{80}$ | 0 | $\frac{\sqrt{2}}{48}$ | 0 | $-\frac{1}{112}$ | 0 | 0 | $\frac{3\sqrt{30}}{80}$ | 0 | $-\frac{\sqrt{6}}{16}$ | 0 | $\frac{3\sqrt{10}}{112}$ | 0 | $-\frac{\sqrt{210}}{560}$ |

| No. | symmetry | |
|---|---|---|
| 583 | symmetry | $\dfrac{y\left(15x^4-40x^2y^2+30x^2z^2+8y^4-40y^2z^2+15z^4\right)}{8}$ |

$\mathbb{Q}_{5,2}^{(1,-1;a)}(E_u,1)$

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{6}i}{160}$ | 0 | $-\frac{\sqrt{30}i}{160}$ | 0 | $-\frac{7\sqrt{2}i}{160}$ | 0 | $-\frac{3\sqrt{42}i}{160}$ |
| 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{14}i}{160}$ | 0 | $\frac{3\sqrt{6}i}{160}$ | 0 | $\frac{3\sqrt{10}i}{160}$ | 0 | $\frac{7\sqrt{2}i}{160}$ | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{7\sqrt{2}i}{160}$ | 0 | $-\frac{3\sqrt{10}i}{160}$ | 0 | $-\frac{3\sqrt{6}i}{160}$ | 0 | $-\frac{\sqrt{14}i}{160}$ |
| 0 | 0 | 0 | 0 | 0 | 0 | $\frac{3\sqrt{42}i}{160}$ | 0 | $\frac{7\sqrt{2}i}{160}$ | 0 | $\frac{\sqrt{30}i}{160}$ | 0 | $\frac{\sqrt{6}i}{160}$ | 0 |
| 0 | $\frac{i}{112}$ | 0 | $\frac{\sqrt{2}i}{48}$ | 0 | $\frac{3\sqrt{5}i}{80}$ | $\frac{\sqrt{210}i}{560}$ | 0 | $\frac{3\sqrt{10}i}{112}$ | 0 | $\frac{\sqrt{6}i}{16}$ | 0 | $\frac{3\sqrt{30}i}{80}$ | 0 |
| $-\frac{i}{112}$ | 0 | $-\frac{\sqrt{10}i}{112}$ | 0 | $-\frac{\sqrt{5}i}{48}$ | 0 | 0 | $-\frac{23\sqrt{6}i}{560}$ | 0 | $-\frac{13\sqrt{30}i}{560}$ | 0 | $-\frac{3\sqrt{2}i}{80}$ | 0 | $\frac{3\sqrt{42}i}{80}$ |
| 0 | $\frac{\sqrt{10}i}{112}$ | 0 | $\frac{\sqrt{5}i}{56}$ | 0 | $\frac{\sqrt{2}i}{48}$ | $\frac{\sqrt{21}i}{40}$ | 0 | $\frac{33i}{280}$ | 0 | $\frac{\sqrt{15}i}{280}$ | 0 | $-\frac{3\sqrt{3}i}{40}$ | 0 |
| $-\frac{\sqrt{2}i}{48}$ | 0 | $-\frac{\sqrt{5}i}{56}$ | 0 | $-\frac{\sqrt{10}i}{112}$ | 0 | 0 | $-\frac{3\sqrt{3}i}{40}$ | 0 | $\frac{\sqrt{15}i}{280}$ | 0 | $\frac{33i}{280}$ | 0 | $\frac{\sqrt{21}i}{40}$ |
| 0 | $\frac{\sqrt{5}i}{48}$ | 0 | $\frac{\sqrt{10}i}{112}$ | 0 | $\frac{i}{112}$ | $\frac{3\sqrt{42}i}{80}$ | 0 | $-\frac{3\sqrt{2}i}{80}$ | 0 | $-\frac{13\sqrt{30}i}{560}$ | 0 | $-\frac{23\sqrt{6}i}{560}$ | 0 |
| $-\frac{3\sqrt{5}i}{80}$ | 0 | $-\frac{\sqrt{2}i}{48}$ | 0 | $-\frac{i}{112}$ | 0 | 0 | $\frac{3\sqrt{30}i}{80}$ | 0 | $\frac{\sqrt{6}i}{16}$ | 0 | $\frac{3\sqrt{10}i}{112}$ | 0 | $\frac{\sqrt{210}i}{560}$ |

| No. | symmetry | |
|---|---|---|
| 584 | symmetry | $\dfrac{3\sqrt{35}x\left(y^2-2yz-z^2\right)\left(y^2+2yz-z^2\right)}{8}$ |

Table 9

| No. | multipole | matrix |
|-----|-----------|--------|
| | $\mathbb{Q}_{5,1}^{(1,-1;a)}(E_u,2)$ | $$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{800} & 0 & \frac{\sqrt{42}}{160} & 0 & \frac{9\sqrt{70}}{800} & 0 & \frac{\sqrt{30}}{160} \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{9\sqrt{10}}{800} & 0 & \frac{3\sqrt{210}}{800} & 0 & -\frac{3\sqrt{14}}{160} & 0 & -\frac{9\sqrt{70}}{800} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{9\sqrt{70}}{800} & 0 & -\frac{3\sqrt{14}}{160} & 0 & \frac{3\sqrt{210}}{800} & 0 & \frac{9\sqrt{10}}{800} \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{160} & 0 & \frac{9\sqrt{70}}{800} & 0 & \frac{\sqrt{42}}{160} & 0 & -\frac{\sqrt{210}}{800} & 0 \\ 0 & -\frac{\sqrt{35}}{560} & 0 & -\frac{3\sqrt{70}}{560} & 0 & -\frac{\sqrt{7}}{112} & \frac{\sqrt{6}}{80} & 0 & -\frac{3\sqrt{14}}{112} & 0 & -\frac{9\sqrt{210}}{560} & 0 & -\frac{\sqrt{42}}{112} & 0 \\ -\frac{\sqrt{35}}{560} & 0 & \frac{\sqrt{14}}{112} & 0 & \frac{3\sqrt{7}}{112} & 0 & 0 & -\frac{23\sqrt{210}}{2800} & 0 & \frac{13\sqrt{42}}{560} & 0 & \frac{27\sqrt{70}}{2800} & 0 & -\frac{\sqrt{30}}{80} \\ 0 & \frac{\sqrt{14}}{112} & 0 & -\frac{\sqrt{7}}{56} & 0 & -\frac{3\sqrt{70}}{560} & \frac{9\sqrt{15}}{200} & 0 & \frac{33\sqrt{35}}{1400} & 0 & -\frac{\sqrt{21}}{280} & 0 & \frac{27\sqrt{105}}{1400} & 0 \\ -\frac{3\sqrt{70}}{560} & 0 & -\frac{\sqrt{7}}{56} & 0 & \frac{\sqrt{14}}{112} & 0 & 0 & -\frac{27\sqrt{105}}{1400} & 0 & \frac{\sqrt{21}}{280} & 0 & -\frac{33\sqrt{35}}{1400} & 0 & -\frac{9\sqrt{15}}{200} \\ 0 & \frac{3\sqrt{7}}{112} & 0 & \frac{\sqrt{14}}{112} & 0 & -\frac{\sqrt{35}}{560} & \frac{\sqrt{30}}{80} & 0 & -\frac{27\sqrt{70}}{2800} & 0 & -\frac{13\sqrt{42}}{560} & 0 & \frac{23\sqrt{210}}{2800} & 0 \\ -\frac{\sqrt{7}}{112} & 0 & -\frac{3\sqrt{70}}{560} & 0 & -\frac{\sqrt{35}}{560} & 0 & 0 & \frac{\sqrt{42}}{112} & 0 & \frac{9\sqrt{210}}{560} & 0 & \frac{3\sqrt{14}}{112} & 0 & -\frac{\sqrt{6}}{80} \end{bmatrix}$$ |
| 585 | symmetry | $$\frac{3\sqrt{35}\,y\left(x^2-2xz-z^2\right)\left(x^2+2xz-z^2\right)}{8}$$ |
| | $\mathbb{Q}_{5,2}^{(1,-1;a)}(E_u,2)$ | $$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{800} & 0 & -\frac{\sqrt{42}i}{160} & 0 & \frac{9\sqrt{70}i}{800} & 0 & -\frac{\sqrt{30}i}{160} \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{9\sqrt{10}i}{800} & 0 & \frac{3\sqrt{210}i}{800} & 0 & \frac{3\sqrt{14}i}{160} & 0 & -\frac{9\sqrt{70}i}{800} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{9\sqrt{70}i}{800} & 0 & -\frac{3\sqrt{14}i}{160} & 0 & -\frac{3\sqrt{210}i}{800} & 0 & \frac{9\sqrt{10}i}{800} \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{160} & 0 & -\frac{9\sqrt{70}i}{800} & 0 & \frac{\sqrt{42}i}{160} & 0 & \frac{\sqrt{210}i}{800} & 0 \\ 0 & \frac{\sqrt{35}i}{560} & 0 & -\frac{3\sqrt{70}i}{560} & 0 & \frac{\sqrt{7}i}{112} & \frac{\sqrt{6}i}{80} & 0 & \frac{3\sqrt{14}i}{112} & 0 & -\frac{9\sqrt{210}i}{560} & 0 & \frac{\sqrt{42}i}{112} & 0 \\ -\frac{\sqrt{35}i}{560} & 0 & -\frac{\sqrt{14}i}{112} & 0 & \frac{3\sqrt{7}i}{112} & 0 & 0 & -\frac{23\sqrt{210}i}{2800} & 0 & -\frac{13\sqrt{42}i}{560} & 0 & \frac{27\sqrt{70}i}{2800} & 0 & \frac{\sqrt{30}i}{80} \\ 0 & \frac{\sqrt{14}i}{112} & 0 & \frac{\sqrt{7}i}{56} & 0 & -\frac{3\sqrt{70}i}{560} & -\frac{9\sqrt{15}i}{200} & 0 & \frac{33\sqrt{35}i}{1400} & 0 & \frac{\sqrt{21}i}{280} & 0 & \frac{27\sqrt{105}i}{1400} & 0 \\ \frac{3\sqrt{70}i}{560} & 0 & -\frac{\sqrt{7}i}{56} & 0 & -\frac{\sqrt{14}i}{112} & 0 & 0 & \frac{27\sqrt{105}i}{1400} & 0 & \frac{\sqrt{21}i}{280} & 0 & \frac{33\sqrt{35}i}{1400} & 0 & -\frac{9\sqrt{15}i}{200} \\ 0 & -\frac{3\sqrt{7}i}{112} & 0 & \frac{\sqrt{14}i}{112} & 0 & \frac{\sqrt{35}i}{560} & \frac{\sqrt{30}i}{80} & 0 & \frac{27\sqrt{70}i}{2800} & 0 & -\frac{13\sqrt{42}i}{560} & 0 & -\frac{23\sqrt{210}i}{2800} & 0 \\ -\frac{\sqrt{7}i}{112} & 0 & \frac{3\sqrt{70}i}{560} & 0 & -\frac{\sqrt{35}i}{560} & 0 & 0 & \frac{\sqrt{42}i}{112} & 0 & -\frac{9\sqrt{210}i}{560} & 0 & \frac{3\sqrt{14}i}{112} & 0 & \frac{\sqrt{6}i}{80} \end{bmatrix}$$ |
| 586 | symmetry | $$\frac{\sqrt{105}\,x(y-z)(y+z)\left(2x^2-y^2-z^2\right)}{4}$$ |

*continued ...*

Table 9

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{Q}_{5,1}^{(1,-1;a)}(E_u,3)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{400} & 0 & \frac{\sqrt{14}}{80} & 0 & -\frac{\sqrt{210}}{400} & 0 & -\frac{3\sqrt{10}}{80} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{400} & 0 & \frac{3\sqrt{70}}{400} & 0 & -\frac{\sqrt{42}}{80} & 0 & \frac{\sqrt{210}}{400} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{400} & 0 & -\frac{\sqrt{42}}{80} & 0 & \frac{3\sqrt{70}}{400} & 0 & -\frac{\sqrt{30}}{400} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}}{80} & 0 & -\frac{\sqrt{210}}{400} & 0 & \frac{\sqrt{14}}{80} & 0 & -\frac{\sqrt{70}}{400} & 0 \\
0 & -\frac{\sqrt{105}}{840} & 0 & \frac{\sqrt{210}}{840} & 0 & \frac{\sqrt{21}}{56} & \frac{\sqrt{2}}{40} & 0 & -\frac{\sqrt{42}}{56} & 0 & \frac{3\sqrt{70}}{280} & 0 & \frac{3\sqrt{14}}{56} & 0 \\
-\frac{\sqrt{105}}{840} & 0 & \frac{\sqrt{42}}{168} & 0 & -\frac{\sqrt{21}}{168} & 0 & 0 & -\frac{23\sqrt{70}}{1400} & 0 & \frac{13\sqrt{14}}{280} & 0 & -\frac{3\sqrt{210}}{1400} & 0 & \frac{3\sqrt{10}}{40} \\
0 & \frac{\sqrt{42}}{168} & 0 & -\frac{\sqrt{21}}{84} & 0 & \frac{\sqrt{210}}{840} & -\frac{3\sqrt{5}}{100} & 0 & \frac{11\sqrt{105}}{700} & 0 & -\frac{\sqrt{7}}{140} & 0 & -\frac{9\sqrt{35}}{700} & 0 \\
\frac{\sqrt{210}}{840} & 0 & -\frac{\sqrt{21}}{84} & 0 & \frac{\sqrt{42}}{168} & 0 & 0 & \frac{9\sqrt{35}}{700} & 0 & \frac{\sqrt{7}}{140} & 0 & -\frac{11\sqrt{105}}{700} & 0 & \frac{3\sqrt{5}}{100} \\
0 & -\frac{\sqrt{21}}{168} & 0 & \frac{\sqrt{42}}{168} & 0 & -\frac{\sqrt{105}}{840} & -\frac{3\sqrt{10}}{40} & 0 & \frac{3\sqrt{210}}{1400} & 0 & -\frac{13\sqrt{14}}{280} & 0 & \frac{23\sqrt{70}}{1400} & 0 \\
\frac{\sqrt{21}}{56} & 0 & \frac{\sqrt{210}}{840} & 0 & -\frac{\sqrt{105}}{840} & 0 & 0 & -\frac{3\sqrt{14}}{56} & 0 & -\frac{3\sqrt{70}}{280} & 0 & \frac{\sqrt{42}}{56} & 0 & -\frac{\sqrt{2}}{40}
\end{bmatrix}$$

| 587 | symmetry | $-\dfrac{\sqrt{105}\,y(x-z)(x+z)\left(x^2-2y^2+z^2\right)}{4}$ |
|-----|-----------|--------|

$\mathbb{Q}_{5,2}^{(1,-1;a)}(E_u,3)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{400} & 0 & -\frac{\sqrt{14}i}{80} & 0 & -\frac{\sqrt{210}i}{400} & 0 & \frac{3\sqrt{10}i}{80} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{400} & 0 & \frac{3\sqrt{70}i}{400} & 0 & \frac{\sqrt{42}i}{80} & 0 & \frac{\sqrt{210}i}{400} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{400} & 0 & -\frac{\sqrt{42}i}{80} & 0 & -\frac{3\sqrt{70}i}{400} & 0 & -\frac{\sqrt{30}i}{400} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}i}{80} & 0 & \frac{\sqrt{210}i}{400} & 0 & \frac{\sqrt{14}i}{80} & 0 & \frac{\sqrt{70}i}{400} & 0 \\
0 & \frac{\sqrt{105}i}{840} & 0 & \frac{\sqrt{210}i}{840} & 0 & -\frac{\sqrt{21}i}{56} & \frac{\sqrt{2}i}{40} & 0 & \frac{\sqrt{42}i}{56} & 0 & \frac{3\sqrt{70}i}{280} & 0 & -\frac{3\sqrt{14}i}{56} & 0 \\
-\frac{\sqrt{105}i}{840} & 0 & -\frac{\sqrt{42}i}{168} & 0 & -\frac{\sqrt{21}i}{168} & 0 & 0 & -\frac{23\sqrt{70}i}{1400} & 0 & -\frac{13\sqrt{14}i}{280} & 0 & -\frac{3\sqrt{210}i}{1400} & 0 & -\frac{3\sqrt{10}i}{40} \\
0 & \frac{\sqrt{42}i}{168} & 0 & \frac{\sqrt{21}i}{84} & 0 & \frac{\sqrt{210}i}{840} & \frac{3\sqrt{5}i}{100} & 0 & \frac{11\sqrt{105}i}{700} & 0 & \frac{\sqrt{7}i}{140} & 0 & -\frac{9\sqrt{35}i}{700} & 0 \\
-\frac{\sqrt{210}i}{840} & 0 & -\frac{\sqrt{21}i}{84} & 0 & -\frac{\sqrt{42}i}{168} & 0 & 0 & -\frac{9\sqrt{35}i}{700} & 0 & \frac{\sqrt{7}i}{140} & 0 & \frac{11\sqrt{105}i}{700} & 0 & \frac{3\sqrt{5}i}{100} \\
0 & \frac{\sqrt{21}i}{168} & 0 & \frac{\sqrt{42}i}{168} & 0 & \frac{\sqrt{105}i}{840} & -\frac{3\sqrt{10}i}{40} & 0 & -\frac{3\sqrt{210}i}{1400} & 0 & -\frac{13\sqrt{14}i}{280} & 0 & -\frac{23\sqrt{70}i}{1400} & 0 \\
\frac{\sqrt{21}i}{56} & 0 & -\frac{\sqrt{210}i}{840} & 0 & -\frac{\sqrt{105}i}{840} & 0 & 0 & -\frac{3\sqrt{14}i}{56} & 0 & \frac{3\sqrt{70}i}{280} & 0 & \frac{\sqrt{42}i}{56} & 0 & \frac{\sqrt{2}i}{40}
\end{bmatrix}$$

| 588 | symmetry | $z$ |
|-----|-----------|--------|

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_1^{(1,0;a)}(A_{2u})$

$$\begin{bmatrix}
0 & -\frac{\sqrt{2}}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{3}}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{3}}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{3\sqrt{2}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{9\sqrt{2}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{14} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{3\sqrt{2}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{14} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{3\sqrt{2}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{14} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{9\sqrt{2}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{14} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{2}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{14} & 0
\end{bmatrix}$$

| 589 | symmetry | $x$ |
|---|---|---|

$\mathbb{Q}_{1,1}^{(1,0;a)}(E_u)$

$$\begin{bmatrix}
\frac{\sqrt{10}}{20} & 0 & -\frac{1}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{6}}{20} & 0 & -\frac{\sqrt{3}}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{3}}{20} & 0 & -\frac{\sqrt{6}}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{1}{20} & 0 & -\frac{\sqrt{10}}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{3\sqrt{10}}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}}{28} & 0 & \frac{1}{28} & 0 & 0 & 0 & 0 & 0 \\
\frac{3\sqrt{10}}{70} & 0 & \frac{6}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{28} & 0 & \frac{\sqrt{3}}{28} & 0 & 0 & 0 & 0 \\
0 & \frac{6}{35} & 0 & \frac{9\sqrt{2}}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{28} & 0 & \frac{\sqrt{6}}{28} & 0 & 0 & 0 \\
0 & 0 & \frac{9\sqrt{2}}{70} & 0 & \frac{6}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{28} & 0 & \frac{\sqrt{10}}{28} & 0 & 0 \\
0 & 0 & 0 & \frac{6}{35} & 0 & \frac{3\sqrt{10}}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{28} & 0 & \frac{\sqrt{15}}{28} & 0 \\
0 & 0 & 0 & 0 & \frac{3\sqrt{10}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{28} & 0 & \frac{\sqrt{21}}{28}
\end{bmatrix}$$

| 590 | symmetry | $y$ |
|---|---|---|

167

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{1,2}^{(1,0;a)}(E_u)$

$$\begin{bmatrix}
\frac{\sqrt{10}i}{20} & 0 & \frac{i}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{6}i}{20} & 0 & \frac{\sqrt{3}i}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{3}i}{20} & 0 & \frac{\sqrt{6}i}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{i}{20} & 0 & \frac{\sqrt{10}i}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{3\sqrt{10}i}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{28} & 0 & -\frac{i}{28} & 0 & 0 & 0 & 0 & 0 \\
\frac{3\sqrt{10}i}{70} & 0 & -\frac{6i}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{28} & 0 & -\frac{\sqrt{3}i}{28} & 0 & 0 & 0 & 0 \\
0 & \frac{6i}{35} & 0 & -\frac{9\sqrt{2}i}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{28} & 0 & -\frac{\sqrt{6}i}{28} & 0 & 0 & 0 \\
0 & 0 & \frac{9\sqrt{2}i}{70} & 0 & -\frac{6i}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{28} & 0 & -\frac{\sqrt{10}i}{28} & 0 & 0 \\
0 & 0 & 0 & \frac{6i}{35} & 0 & -\frac{3\sqrt{10}i}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{28} & 0 & -\frac{\sqrt{15}i}{28} & 0 \\
0 & 0 & 0 & 0 & \frac{3\sqrt{10}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{i}{28} & 0 & -\frac{\sqrt{21}i}{28}
\end{bmatrix}$$

| 591 | symmetry | $-\frac{z\left(3x^2+3y^2-2z^2\right)}{2}$ |
|---|---|---|

$\mathbb{Q}_3^{(1,0;a)}(A_{2u})$

$$\begin{bmatrix}
0 & \frac{3\sqrt{7}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{28} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{42}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{28} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{42}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{28} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{3\sqrt{7}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{28} & 0 & 0 \\
-\frac{\sqrt{7}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}}{84} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{7}}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{2\sqrt{7}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}}{84} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{2\sqrt{7}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}}{84} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}}{84} & 0
\end{bmatrix}$$

| 592 | symmetry | $\sqrt{15}xyz$ |
|---|---|---|

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_3^{(1,0;a)}(B_{1u})$

$$\begin{pmatrix}
0 & 0 & 0 & -\frac{\sqrt{210}i}{280} & 0 & 0 & -\frac{\sqrt{2}i}{8} & 0 & 0 & 0 & \frac{\sqrt{70}i}{56} & 0 & 0 & 0 \\
-\frac{\sqrt{7}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{35}i}{280} & 0 & 0 & \frac{\sqrt{42}i}{56} & 0 & 0 & 0 & \frac{3\sqrt{14}i}{56} & 0 & 0 \\
0 & \frac{\sqrt{35}i}{280} & 0 & 0 & 0 & \frac{\sqrt{7}i}{56} & 0 & 0 & \frac{3\sqrt{14}i}{56} & 0 & 0 & 0 & \frac{\sqrt{42}i}{56} & 0 \\
0 & 0 & \frac{\sqrt{210}i}{280} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{2}i}{8} \\
0 & 0 & \frac{\sqrt{42}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}i}{84} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{210}i}{140} & 0 & 0 & \frac{\sqrt{2}i}{24} & 0 & 0 & 0 & \frac{\sqrt{70}i}{168} & 0 & 0 & 0 \\
-\frac{\sqrt{42}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{210}i}{140} & 0 & 0 & \frac{\sqrt{7}i}{168} & 0 & 0 & 0 & \frac{\sqrt{21}i}{168} & 0 & 0 \\
0 & -\frac{\sqrt{210}i}{140} & 0 & 0 & 0 & -\frac{\sqrt{42}i}{28} & 0 & 0 & -\frac{\sqrt{21}i}{168} & 0 & 0 & 0 & -\frac{\sqrt{7}i}{168} & 0 \\
0 & 0 & \frac{\sqrt{210}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{168} & 0 & 0 & 0 & -\frac{\sqrt{2}i}{24} \\
0 & 0 & 0 & \frac{\sqrt{42}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}i}{84} & 0 & 0 & 0
\end{pmatrix}$$

| 593 | symmetry | $\dfrac{\sqrt{15}z(x-y)(x+y)}{2}$ |
|---|---|---|

$\mathbb{Q}_3^{(1,0;a)}(B_{2u})$

$$\begin{pmatrix}
0 & 0 & 0 & \frac{\sqrt{210}}{280} & 0 & 0 & -\frac{\sqrt{2}}{8} & 0 & 0 & 0 & -\frac{\sqrt{70}}{56} & 0 & 0 & 0 \\
-\frac{\sqrt{7}}{56} & 0 & 0 & 0 & \frac{\sqrt{35}}{280} & 0 & 0 & \frac{\sqrt{42}}{56} & 0 & 0 & 0 & -\frac{3\sqrt{14}}{56} & 0 & 0 \\
0 & \frac{\sqrt{35}}{280} & 0 & 0 & 0 & -\frac{\sqrt{7}}{56} & 0 & 0 & \frac{3\sqrt{14}}{56} & 0 & 0 & 0 & -\frac{\sqrt{42}}{56} & 0 \\
0 & 0 & \frac{\sqrt{210}}{280} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{56} & 0 & 0 & 0 & \frac{\sqrt{2}}{8} \\
0 & 0 & -\frac{\sqrt{42}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{84} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{210}}{140} & 0 & 0 & \frac{\sqrt{2}}{24} & 0 & 0 & 0 & -\frac{\sqrt{70}}{168} & 0 & 0 & 0 \\
-\frac{\sqrt{42}}{28} & 0 & 0 & 0 & \frac{\sqrt{210}}{140} & 0 & 0 & \frac{\sqrt{7}}{168} & 0 & 0 & 0 & -\frac{\sqrt{21}}{168} & 0 & 0 \\
0 & -\frac{\sqrt{210}}{140} & 0 & 0 & 0 & \frac{\sqrt{42}}{28} & 0 & 0 & -\frac{\sqrt{21}}{168} & 0 & 0 & 0 & \frac{\sqrt{7}}{168} & 0 \\
0 & 0 & \frac{\sqrt{210}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{168} & 0 & 0 & 0 & \frac{\sqrt{2}}{24} \\
0 & 0 & 0 & \frac{\sqrt{42}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{84} & 0 & 0 & 0
\end{pmatrix}$$

| 594 | symmetry | $\dfrac{x\left(2x^2-3y^2-3z^2\right)}{2}$ |
|---|---|---|

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{3,1}^{(1,0;a)}(E_u,1)$

$$\begin{bmatrix}
\frac{3\sqrt{35}}{1120} & 0 & -\frac{9\sqrt{14}}{1120} & 0 & \frac{3\sqrt{7}}{224} & 0 & 0 & -\frac{\sqrt{210}}{112} & 0 & \frac{\sqrt{42}}{56} & 0 & -\frac{\sqrt{70}}{112} & 0 & 0 \\
0 & -\frac{\sqrt{21}}{160} & 0 & \frac{\sqrt{42}}{1120} & 0 & \frac{\sqrt{105}}{224} & -\frac{\sqrt{10}}{16} & 0 & 0 & 0 & \frac{3\sqrt{14}}{112} & 0 & -\frac{\sqrt{70}}{56} & 0 \\
-\frac{\sqrt{105}}{224} & 0 & -\frac{\sqrt{42}}{1120} & 0 & \frac{\sqrt{21}}{160} & 0 & 0 & -\frac{\sqrt{70}}{56} & 0 & \frac{3\sqrt{14}}{112} & 0 & 0 & 0 & -\frac{\sqrt{10}}{16} \\
0 & -\frac{3\sqrt{7}}{224} & 0 & \frac{9\sqrt{14}}{1120} & 0 & -\frac{3\sqrt{35}}{1120} & 0 & 0 & -\frac{\sqrt{70}}{112} & 0 & \frac{\sqrt{42}}{56} & 0 & -\frac{\sqrt{210}}{112} & 0 \\
0 & \frac{3\sqrt{35}}{140} & 0 & -\frac{\sqrt{70}}{56} & 0 & 0 & -\frac{\sqrt{6}}{96} & 0 & \frac{\sqrt{14}}{112} & 0 & -\frac{\sqrt{210}}{672} & 0 & 0 & 0 \\
\frac{3\sqrt{35}}{140} & 0 & -\frac{3\sqrt{14}}{280} & 0 & -\frac{\sqrt{7}}{14} & 0 & 0 & \frac{\sqrt{210}}{672} & 0 & \frac{\sqrt{42}}{336} & 0 & -\frac{\sqrt{70}}{224} & 0 & 0 \\
0 & -\frac{3\sqrt{14}}{280} & 0 & -\frac{3\sqrt{7}}{70} & 0 & -\frac{\sqrt{70}}{56} & \frac{\sqrt{15}}{96} & 0 & \frac{\sqrt{35}}{224} & 0 & -\frac{\sqrt{21}}{672} & 0 & -\frac{\sqrt{105}}{224} & 0 \\
-\frac{\sqrt{70}}{56} & 0 & -\frac{3\sqrt{7}}{70} & 0 & -\frac{3\sqrt{14}}{280} & 0 & 0 & \frac{\sqrt{105}}{224} & 0 & \frac{\sqrt{21}}{672} & 0 & -\frac{\sqrt{35}}{224} & 0 & -\frac{\sqrt{15}}{96} \\
0 & -\frac{\sqrt{7}}{14} & 0 & -\frac{3\sqrt{14}}{280} & 0 & \frac{3\sqrt{35}}{140} & 0 & 0 & \frac{\sqrt{70}}{224} & 0 & -\frac{\sqrt{42}}{336} & 0 & -\frac{\sqrt{210}}{672} & 0 \\
0 & 0 & -\frac{\sqrt{70}}{56} & 0 & \frac{3\sqrt{35}}{140} & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{672} & 0 & -\frac{\sqrt{14}}{112} & 0 & \frac{\sqrt{6}}{96}
\end{bmatrix}$$

| 595 | symmetry | $-\dfrac{y\left(3x^2-2y^2+3z^2\right)}{2}$ |
|---|---|---|

$\mathbb{Q}_{3,2}^{(1,0;a)}(E_u,1)$

$$\begin{bmatrix}
\frac{3\sqrt{35}i}{1120} & 0 & \frac{9\sqrt{14}i}{1120} & 0 & \frac{3\sqrt{7}i}{224} & 0 & 0 & -\frac{\sqrt{210}i}{112} & 0 & -\frac{\sqrt{42}i}{56} & 0 & -\frac{\sqrt{70}i}{112} & 0 & 0 \\
0 & -\frac{\sqrt{21}i}{160} & 0 & -\frac{\sqrt{42}i}{1120} & 0 & \frac{\sqrt{105}i}{224} & \frac{\sqrt{10}i}{16} & 0 & 0 & 0 & -\frac{3\sqrt{14}i}{112} & 0 & -\frac{\sqrt{70}i}{56} & 0 \\
\frac{\sqrt{105}i}{224} & 0 & -\frac{\sqrt{42}i}{1120} & 0 & -\frac{\sqrt{21}i}{160} & 0 & 0 & \frac{\sqrt{70}i}{56} & 0 & \frac{3\sqrt{14}i}{112} & 0 & 0 & 0 & -\frac{\sqrt{10}i}{16} \\
0 & \frac{3\sqrt{7}i}{224} & 0 & \frac{9\sqrt{14}i}{1120} & 0 & \frac{3\sqrt{35}i}{1120} & 0 & 0 & \frac{\sqrt{70}i}{112} & 0 & \frac{\sqrt{42}i}{56} & 0 & \frac{\sqrt{210}i}{112} & 0 \\
0 & -\frac{3\sqrt{35}i}{140} & 0 & -\frac{\sqrt{70}i}{56} & 0 & 0 & -\frac{\sqrt{6}i}{96} & 0 & -\frac{\sqrt{14}i}{112} & 0 & -\frac{\sqrt{210}i}{672} & 0 & 0 & 0 \\
\frac{3\sqrt{35}i}{140} & 0 & \frac{3\sqrt{14}i}{280} & 0 & -\frac{\sqrt{7}i}{14} & 0 & 0 & \frac{\sqrt{210}i}{672} & 0 & -\frac{\sqrt{42}i}{336} & 0 & -\frac{\sqrt{70}i}{224} & 0 & 0 \\
0 & -\frac{3\sqrt{14}i}{280} & 0 & \frac{3\sqrt{7}i}{70} & 0 & -\frac{\sqrt{70}i}{56} & -\frac{\sqrt{15}i}{96} & 0 & \frac{\sqrt{35}i}{224} & 0 & \frac{\sqrt{21}i}{672} & 0 & -\frac{\sqrt{105}i}{224} & 0 \\
\frac{\sqrt{70}i}{56} & 0 & -\frac{3\sqrt{7}i}{70} & 0 & \frac{3\sqrt{14}i}{280} & 0 & 0 & -\frac{\sqrt{105}i}{224} & 0 & \frac{\sqrt{21}i}{672} & 0 & \frac{\sqrt{35}i}{224} & 0 & -\frac{\sqrt{15}i}{96} \\
0 & \frac{\sqrt{7}i}{14} & 0 & -\frac{3\sqrt{14}i}{280} & 0 & -\frac{3\sqrt{35}i}{140} & 0 & 0 & -\frac{\sqrt{70}i}{224} & 0 & -\frac{\sqrt{42}i}{336} & 0 & \frac{\sqrt{210}i}{672} & 0 \\
0 & 0 & \frac{\sqrt{70}i}{56} & 0 & \frac{3\sqrt{35}i}{140} & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{672} & 0 & -\frac{\sqrt{14}i}{112} & 0 & -\frac{\sqrt{6}i}{96}
\end{bmatrix}$$

| 596 | symmetry | $\dfrac{\sqrt{15}x(y-z)(y+z)}{2}$ |
|---|---|---|

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{3,1}^{(1,0;a)}(E_u,2)$

$$\begin{bmatrix}
\frac{\sqrt{21}}{224} & 0 & -\frac{3\sqrt{210}}{1120} & 0 & -\frac{3\sqrt{105}}{1120} & 0 & 0 & -\frac{5\sqrt{14}}{112} & 0 & \frac{\sqrt{70}}{56} & 0 & \frac{\sqrt{42}}{112} & 0 & 0 \\[4pt]
0 & -\frac{\sqrt{35}}{160} & 0 & \frac{\sqrt{70}}{1120} & 0 & -\frac{3\sqrt{7}}{224} & \frac{\sqrt{6}}{16} & 0 & 0 & 0 & \frac{\sqrt{210}}{112} & 0 & \frac{\sqrt{42}}{56} & 0 \\[4pt]
\frac{3\sqrt{7}}{224} & 0 & -\frac{\sqrt{70}}{1120} & 0 & \frac{\sqrt{35}}{160} & 0 & 0 & \frac{\sqrt{42}}{56} & 0 & \frac{\sqrt{210}}{112} & 0 & 0 & 0 & \frac{\sqrt{6}}{16} \\[4pt]
0 & \frac{3\sqrt{105}}{1120} & 0 & \frac{3\sqrt{210}}{1120} & 0 & -\frac{\sqrt{21}}{224} & 0 & 0 & \frac{\sqrt{42}}{112} & 0 & \frac{\sqrt{70}}{56} & 0 & -\frac{5\sqrt{14}}{112} & 0 \\[4pt]
0 & \frac{\sqrt{21}}{28} & 0 & \frac{\sqrt{42}}{56} & 0 & 0 & -\frac{\sqrt{10}}{96} & 0 & \frac{\sqrt{210}}{336} & 0 & \frac{\sqrt{14}}{224} & 0 & 0 & 0 \\[4pt]
\frac{\sqrt{21}}{28} & 0 & -\frac{\sqrt{210}}{280} & 0 & \frac{\sqrt{105}}{70} & 0 & 0 & \frac{5\sqrt{14}}{672} & 0 & \frac{\sqrt{70}}{336} & 0 & \frac{\sqrt{42}}{224} & 0 & 0 \\[4pt]
0 & -\frac{\sqrt{210}}{280} & 0 & -\frac{\sqrt{105}}{70} & 0 & \frac{\sqrt{42}}{56} & -\frac{1}{32} & 0 & \frac{5\sqrt{21}}{672} & 0 & -\frac{\sqrt{35}}{672} & 0 & \frac{3\sqrt{7}}{224} & 0 \\[4pt]
\frac{\sqrt{42}}{56} & 0 & -\frac{\sqrt{105}}{70} & 0 & -\frac{\sqrt{210}}{280} & 0 & 0 & -\frac{3\sqrt{7}}{224} & 0 & \frac{\sqrt{35}}{672} & 0 & -\frac{5\sqrt{21}}{672} & 0 & \frac{1}{32} \\[4pt]
0 & \frac{\sqrt{105}}{70} & 0 & -\frac{\sqrt{210}}{280} & 0 & \frac{\sqrt{21}}{28} & 0 & 0 & -\frac{\sqrt{42}}{224} & 0 & -\frac{\sqrt{70}}{336} & 0 & -\frac{5\sqrt{14}}{672} & 0 \\[4pt]
0 & 0 & \frac{\sqrt{42}}{56} & 0 & \frac{\sqrt{21}}{28} & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{224} & 0 & -\frac{\sqrt{210}}{336} & 0 & \frac{\sqrt{10}}{96}
\end{bmatrix}$$

| 597 | symmetry | $\dfrac{\sqrt{15}\,y(x-z)(x+z)}{2}$ |

$\mathbb{Q}_{3,2}^{(1,0;a)}(E_u,2)$

$$\begin{bmatrix}
\frac{\sqrt{21}i}{224} & 0 & \frac{3\sqrt{210}i}{1120} & 0 & -\frac{3\sqrt{105}i}{1120} & 0 & 0 & -\frac{5\sqrt{14}i}{112} & 0 & -\frac{\sqrt{70}i}{56} & 0 & \frac{\sqrt{42}i}{112} & 0 & 0 \\[4pt]
0 & -\frac{\sqrt{35}i}{160} & 0 & -\frac{\sqrt{70}i}{1120} & 0 & -\frac{3\sqrt{7}i}{224} & -\frac{\sqrt{6}i}{16} & 0 & 0 & 0 & -\frac{\sqrt{210}i}{112} & 0 & \frac{\sqrt{42}i}{56} & 0 \\[4pt]
-\frac{3\sqrt{7}i}{224} & 0 & -\frac{\sqrt{70}i}{1120} & 0 & -\frac{\sqrt{35}i}{160} & 0 & 0 & -\frac{\sqrt{42}i}{56} & 0 & \frac{\sqrt{210}i}{112} & 0 & 0 & 0 & \frac{\sqrt{6}i}{16} \\[4pt]
0 & -\frac{3\sqrt{105}i}{1120} & 0 & \frac{3\sqrt{210}i}{1120} & 0 & \frac{\sqrt{21}i}{224} & 0 & 0 & -\frac{\sqrt{42}i}{112} & 0 & \frac{\sqrt{70}i}{56} & 0 & \frac{5\sqrt{14}i}{112} & 0 \\[4pt]
0 & -\frac{\sqrt{21}i}{28} & 0 & \frac{\sqrt{42}i}{56} & 0 & 0 & -\frac{\sqrt{10}i}{96} & 0 & -\frac{\sqrt{210}i}{336} & 0 & \frac{\sqrt{14}i}{224} & 0 & 0 & 0 \\[4pt]
\frac{\sqrt{21}i}{28} & 0 & \frac{\sqrt{210}i}{280} & 0 & \frac{\sqrt{105}i}{70} & 0 & 0 & \frac{5\sqrt{14}i}{672} & 0 & -\frac{\sqrt{70}i}{336} & 0 & \frac{\sqrt{42}i}{224} & 0 & 0 \\[4pt]
0 & -\frac{\sqrt{210}i}{280} & 0 & \frac{\sqrt{105}i}{70} & 0 & \frac{\sqrt{42}i}{56} & \frac{i}{32} & 0 & \frac{5\sqrt{21}i}{672} & 0 & \frac{\sqrt{35}i}{672} & 0 & \frac{3\sqrt{7}i}{224} & 0 \\[4pt]
-\frac{\sqrt{42}i}{56} & 0 & -\frac{\sqrt{105}i}{70} & 0 & \frac{\sqrt{210}i}{280} & 0 & 0 & \frac{3\sqrt{7}i}{224} & 0 & \frac{\sqrt{35}i}{672} & 0 & \frac{5\sqrt{21}i}{672} & 0 & \frac{i}{32} \\[4pt]
0 & -\frac{\sqrt{105}i}{70} & 0 & -\frac{\sqrt{210}i}{280} & 0 & -\frac{\sqrt{21}i}{28} & 0 & 0 & \frac{\sqrt{42}i}{224} & 0 & -\frac{\sqrt{70}i}{336} & 0 & \frac{5\sqrt{14}i}{672} & 0 \\[4pt]
0 & 0 & -\frac{\sqrt{42}i}{56} & 0 & \frac{\sqrt{21}i}{28} & 0 & 0 & 0 & 0 & \frac{\sqrt{14}i}{224} & 0 & -\frac{\sqrt{210}i}{336} & 0 & -\frac{\sqrt{10}i}{96}
\end{bmatrix}$$

| 598 | symmetry | $\dfrac{3\sqrt{35}\,xyz(x-y)(x+y)}{2}$ |

*continued ...*

Table 9

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{Q}_5^{(1,0;a)}(A_{1u})$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{50} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{10}i}{50} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{10}i}{50} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{50} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{3\sqrt{35}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}i}{140} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{35}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{2100} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{150} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{150} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{3\sqrt{35}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{2100} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{3\sqrt{35}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}i}{140} & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

| 599 | symmetry | $\frac{z\left(15x^4+30x^2y^2-40x^2z^2+15y^4-40y^2z^2+8z^4\right)}{8}$ |
|-----|----------|---------|

$\mathbb{Q}_5^{(1,0;a)}(A_{2u},1)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{10} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{10} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{10} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{10} & 0 & 0 \\
\frac{\sqrt{5}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{420} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{5}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{2}}{140} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{5}}{7} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{210} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{5}}{7} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{210} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{5}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{2}}{140} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{420} & 0
\end{pmatrix}$$

| 600 | symmetry | $\frac{3\sqrt{35}z\left(x^2-2xy-y^2\right)\left(x^2+2xy-y^2\right)}{8}$ |
|-----|----------|---------|

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_5^{(1,0;a)}(A_{2u}, 2)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{50} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}}{50} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{10}}{50} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{50} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{3\sqrt{35}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{140} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{35}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{2100} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{150} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{150} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{3\sqrt{35}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{2100} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{3\sqrt{35}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{140} & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

| 601 | symmetry | $\dfrac{\sqrt{105}\,xyz\left(x^2+y^2-2z^2\right)}{2}$ |
|---|---|---|

$\mathbb{Q}_5^{(1,0;a)}(B_{1u})$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{100} & 0 & 0 & 0 & \frac{\sqrt{14}i}{20} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{100} & 0 & 0 & 0 & -\frac{3\sqrt{70}i}{100} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{70}i}{100} & 0 & 0 & 0 & \frac{\sqrt{210}i}{100} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}i}{20} & 0 & 0 & 0 & -\frac{\sqrt{10}i}{100} \\
0 & 0 & \frac{\sqrt{210}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{420} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{42}i}{28} & 0 & 0 & \frac{\sqrt{10}i}{300} & 0 & 0 & 0 & -\frac{\sqrt{14}i}{210} & 0 & 0 & 0 \\
-\frac{\sqrt{210}i}{140} & 0 & 0 & 0 & \frac{\sqrt{42}i}{28} & 0 & 0 & -\frac{2\sqrt{35}i}{525} & 0 & 0 & 0 & -\frac{\sqrt{105}i}{1050} & 0 & 0 \\
0 & \frac{\sqrt{42}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{210}i}{140} & 0 & 0 & \frac{\sqrt{105}i}{1050} & 0 & 0 & 0 & \frac{2\sqrt{35}i}{525} & 0 \\
0 & 0 & -\frac{\sqrt{42}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}i}{210} & 0 & 0 & 0 & -\frac{\sqrt{10}i}{300} \\
0 & 0 & 0 & \frac{\sqrt{210}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{420} & 0 & 0 & 0
\end{pmatrix}$$

| 602 | symmetry | $-\dfrac{\sqrt{105}\,z(x-y)(x+y)\left(x^2+y^2-2z^2\right)}{4}$ |
|---|---|---|

*continued …*

173

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_5^{(1,0;a)}(B_{2u})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{100} & 0 & 0 & 0 & \frac{\sqrt{14}}{20} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{100} & 0 & 0 & 0 & -\frac{3\sqrt{70}}{100} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{70}}{100} & 0 & 0 & 0 & \frac{\sqrt{210}}{100} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{20} & 0 & 0 & 0 & -\frac{\sqrt{10}}{100} \\
0 & 0 & \frac{\sqrt{210}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{420} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{42}}{28} & 0 & 0 & -\frac{\sqrt{10}}{300} & 0 & 0 & 0 & -\frac{\sqrt{14}}{210} & 0 & 0 & 0 \\
\frac{\sqrt{210}}{140} & 0 & 0 & 0 & \frac{\sqrt{42}}{28} & 0 & 0 & \frac{2\sqrt{35}}{525} & 0 & 0 & 0 & -\frac{\sqrt{105}}{1050} & 0 & 0 \\
0 & -\frac{\sqrt{42}}{28} & 0 & 0 & 0 & -\frac{\sqrt{210}}{140} & 0 & 0 & -\frac{\sqrt{105}}{1050} & 0 & 0 & 0 & \frac{2\sqrt{35}}{525} & 0 \\
0 & 0 & \frac{\sqrt{42}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{210} & 0 & 0 & 0 & -\frac{\sqrt{10}}{300} \\
0 & 0 & 0 & -\frac{\sqrt{210}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{420} & 0 & 0 & 0
\end{bmatrix}$$

603  symmetry
$$\frac{x\left(8x^4-40x^2y^2-40x^2z^2+15y^4+30y^2z^2+15z^4\right)}{8}$$

$\mathbb{Q}_{5,1}^{(1,0;a)}(E_u,1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{80} & 0 & \frac{\sqrt{30}}{80} & 0 & -\frac{7\sqrt{2}}{80} & 0 & \frac{3\sqrt{42}}{80} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{80} & 0 & \frac{3\sqrt{6}}{80} & 0 & -\frac{3\sqrt{10}}{80} & 0 & \frac{7\sqrt{2}}{80} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{7\sqrt{2}}{80} & 0 & -\frac{3\sqrt{10}}{80} & 0 & \frac{3\sqrt{6}}{80} & 0 & -\frac{\sqrt{14}}{80} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{42}}{80} & 0 & -\frac{7\sqrt{2}}{80} & 0 & \frac{\sqrt{30}}{80} & 0 & -\frac{\sqrt{6}}{80} & 0 \\
0 & \frac{3}{112} & 0 & -\frac{\sqrt{2}}{16} & 0 & \frac{9\sqrt{5}}{80} & -\frac{\sqrt{210}}{6720} & 0 & \frac{\sqrt{10}}{448} & 0 & -\frac{\sqrt{6}}{192} & 0 & \frac{\sqrt{30}}{320} & 0 \\
\frac{3}{112} & 0 & -\frac{3\sqrt{10}}{112} & 0 & \frac{\sqrt{5}}{16} & 0 & 0 & \frac{23\sqrt{6}}{6720} & 0 & -\frac{13\sqrt{30}}{6720} & 0 & \frac{\sqrt{2}}{320} & 0 & \frac{\sqrt{42}}{320} \\
0 & -\frac{3\sqrt{10}}{112} & 0 & \frac{3\sqrt{5}}{56} & 0 & -\frac{\sqrt{2}}{16} & \frac{\sqrt{21}}{480} & 0 & -\frac{11}{1120} & 0 & \frac{\sqrt{15}}{3360} & 0 & \frac{\sqrt{3}}{160} & 0 \\
-\frac{\sqrt{2}}{16} & 0 & \frac{3\sqrt{5}}{56} & 0 & -\frac{3\sqrt{10}}{112} & 0 & 0 & -\frac{\sqrt{3}}{160} & 0 & -\frac{\sqrt{15}}{3360} & 0 & \frac{11}{1120} & 0 & -\frac{\sqrt{21}}{480} \\
0 & \frac{\sqrt{5}}{16} & 0 & -\frac{3\sqrt{10}}{112} & 0 & \frac{3}{112} & -\frac{\sqrt{42}}{320} & 0 & -\frac{\sqrt{2}}{320} & 0 & \frac{13\sqrt{30}}{6720} & 0 & -\frac{23\sqrt{6}}{6720} & 0 \\
\frac{9\sqrt{5}}{80} & 0 & -\frac{\sqrt{2}}{16} & 0 & \frac{3}{112} & 0 & 0 & -\frac{\sqrt{30}}{320} & 0 & \frac{\sqrt{6}}{192} & 0 & -\frac{\sqrt{10}}{448} & 0 & \frac{\sqrt{210}}{6720}
\end{bmatrix}$$

604  symmetry
$$\frac{y\left(15x^4-40x^2y^2+30x^2z^2+8y^4-40y^2z^2+15z^4\right)}{8}$$

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{5,2}^{(1,0;a)}(E_u,1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{80} & 0 & -\frac{\sqrt{30}i}{80} & 0 & -\frac{7\sqrt{2}i}{80} & 0 & -\frac{3\sqrt{42}i}{80} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}i}{80} & 0 & \frac{3\sqrt{6}i}{80} & 0 & \frac{3\sqrt{10}i}{80} & 0 & \frac{7\sqrt{2}i}{80} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{7\sqrt{2}i}{80} & 0 & -\frac{3\sqrt{10}i}{80} & 0 & -\frac{3\sqrt{6}i}{80} & 0 & -\frac{\sqrt{14}i}{80} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{42}i}{80} & 0 & \frac{7\sqrt{2}i}{80} & 0 & \frac{\sqrt{30}i}{80} & 0 & \frac{\sqrt{6}i}{80} & 0 \\
0 & -\frac{3i}{112} & 0 & -\frac{\sqrt{2}i}{16} & 0 & -\frac{9\sqrt{5}i}{80} & -\frac{\sqrt{210}i}{6720} & 0 & -\frac{\sqrt{10}i}{448} & 0 & -\frac{\sqrt{6}i}{192} & 0 & -\frac{\sqrt{30}i}{320} & 0 \\
\frac{3i}{112} & 0 & \frac{3\sqrt{10}i}{112} & 0 & \frac{\sqrt{5}i}{16} & 0 & 0 & \frac{23\sqrt{6}i}{6720} & 0 & \frac{13\sqrt{30}i}{6720} & 0 & \frac{\sqrt{2}i}{320} & 0 & -\frac{\sqrt{42}i}{320} \\
0 & -\frac{3\sqrt{10}i}{112} & 0 & -\frac{3\sqrt{5}i}{56} & 0 & -\frac{\sqrt{2}i}{16} & -\frac{\sqrt{21}i}{480} & 0 & -\frac{11i}{1120} & 0 & -\frac{\sqrt{15}i}{3360} & 0 & \frac{\sqrt{3}i}{160} & 0 \\
\frac{\sqrt{2}i}{16} & 0 & \frac{3\sqrt{5}i}{56} & 0 & \frac{3\sqrt{10}i}{112} & 0 & 0 & \frac{\sqrt{3}i}{160} & 0 & -\frac{\sqrt{15}i}{3360} & 0 & -\frac{11i}{1120} & 0 & -\frac{\sqrt{21}i}{480} \\
0 & -\frac{\sqrt{5}i}{16} & 0 & -\frac{3\sqrt{10}i}{112} & 0 & -\frac{3i}{112} & -\frac{\sqrt{42}i}{320} & 0 & \frac{\sqrt{2}i}{320} & 0 & \frac{13\sqrt{30}i}{6720} & 0 & \frac{23\sqrt{6}i}{6720} & 0 \\
\frac{9\sqrt{5}i}{80} & 0 & \frac{\sqrt{2}i}{16} & 0 & \frac{3i}{112} & 0 & 0 & -\frac{\sqrt{30}i}{320} & 0 & -\frac{\sqrt{6}i}{192} & 0 & -\frac{\sqrt{10}i}{448} & 0 & -\frac{\sqrt{210}i}{6720}
\end{bmatrix}$$

| 605 | symmetry | $\dfrac{3\sqrt{35}x\left(y^2-2yz-z^2\right)\left(y^2+2yz-z^2\right)}{8}$ |
|---|---|---|

$\mathbb{Q}_{5,1}^{(1,0;a)}(E_u,2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{400} & 0 & \frac{\sqrt{42}}{80} & 0 & \frac{9\sqrt{70}}{400} & 0 & \frac{\sqrt{30}}{80} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{9\sqrt{10}}{400} & 0 & \frac{3\sqrt{210}}{400} & 0 & -\frac{3\sqrt{14}}{80} & 0 & -\frac{9\sqrt{70}}{400} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{9\sqrt{70}}{400} & 0 & -\frac{3\sqrt{14}}{80} & 0 & \frac{3\sqrt{210}}{400} & 0 & \frac{9\sqrt{10}}{400} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{80} & 0 & \frac{9\sqrt{70}}{400} & 0 & \frac{\sqrt{42}}{80} & 0 & -\frac{\sqrt{210}}{400} & 0 \\
0 & \frac{3\sqrt{35}}{560} & 0 & \frac{9\sqrt{70}}{560} & 0 & \frac{3\sqrt{7}}{112} & -\frac{\sqrt{6}}{960} & 0 & \frac{\sqrt{14}}{448} & 0 & \frac{3\sqrt{210}}{2240} & 0 & \frac{\sqrt{42}}{1344} & 0 \\
\frac{3\sqrt{35}}{560} & 0 & -\frac{3\sqrt{14}}{112} & 0 & -\frac{9\sqrt{7}}{112} & 0 & 0 & \frac{23\sqrt{210}}{33600} & 0 & -\frac{13\sqrt{42}}{6720} & 0 & -\frac{9\sqrt{70}}{11200} & 0 & \frac{\sqrt{30}}{960} \\
0 & -\frac{3\sqrt{14}}{112} & 0 & \frac{3\sqrt{7}}{56} & 0 & \frac{9\sqrt{70}}{560} & -\frac{3\sqrt{15}}{800} & 0 & -\frac{11\sqrt{35}}{5600} & 0 & \frac{\sqrt{21}}{3360} & 0 & -\frac{9\sqrt{105}}{5600} & 0 \\
\frac{9\sqrt{70}}{560} & 0 & \frac{3\sqrt{7}}{56} & 0 & -\frac{3\sqrt{14}}{112} & 0 & 0 & \frac{9\sqrt{105}}{5600} & 0 & -\frac{\sqrt{21}}{3360} & 0 & \frac{11\sqrt{35}}{5600} & 0 & \frac{3\sqrt{15}}{800} \\
0 & -\frac{9\sqrt{7}}{112} & 0 & -\frac{3\sqrt{14}}{112} & 0 & \frac{3\sqrt{35}}{560} & -\frac{\sqrt{30}}{960} & 0 & \frac{9\sqrt{70}}{11200} & 0 & \frac{13\sqrt{42}}{6720} & 0 & -\frac{23\sqrt{210}}{33600} & 0 \\
\frac{3\sqrt{7}}{112} & 0 & \frac{9\sqrt{70}}{560} & 0 & \frac{3\sqrt{35}}{560} & 0 & 0 & -\frac{\sqrt{42}}{1344} & 0 & -\frac{3\sqrt{210}}{2240} & 0 & -\frac{\sqrt{14}}{448} & 0 & \frac{\sqrt{6}}{960}
\end{bmatrix}$$

| 606 | symmetry | $\dfrac{3\sqrt{35}y\left(x^2-2xz-z^2\right)\left(x^2+2xz-z^2\right)}{8}$ |
|---|---|---|

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{5,2}^{(1,0;a)}(E_u,2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{400} & 0 & -\frac{\sqrt{42}i}{80} & 0 & \frac{9\sqrt{70}i}{400} & 0 & -\frac{\sqrt{30}i}{80} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{9\sqrt{10}i}{400} & 0 & \frac{3\sqrt{210}i}{400} & 0 & \frac{3\sqrt{14}i}{80} & 0 & -\frac{9\sqrt{70}i}{400} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{9\sqrt{70}i}{400} & 0 & -\frac{3\sqrt{14}i}{80} & 0 & -\frac{3\sqrt{210}i}{400} & 0 & \frac{9\sqrt{10}i}{400} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{80} & 0 & -\frac{9\sqrt{70}i}{400} & 0 & \frac{\sqrt{42}i}{80} & 0 & \frac{\sqrt{210}i}{400} & 0 \\
0 & -\frac{3\sqrt{35}i}{560} & 0 & \frac{9\sqrt{70}i}{560} & 0 & -\frac{3\sqrt{7}i}{112} & -\frac{\sqrt{6}i}{960} & 0 & -\frac{\sqrt{14}i}{448} & 0 & \frac{3\sqrt{210}i}{2240} & 0 & -\frac{\sqrt{42}i}{1344} & 0 \\
\frac{3\sqrt{35}i}{560} & 0 & \frac{3\sqrt{14}i}{112} & 0 & -\frac{9\sqrt{7}i}{112} & 0 & 0 & \frac{23\sqrt{210}i}{33600} & 0 & \frac{13\sqrt{42}i}{6720} & 0 & -\frac{9\sqrt{70}i}{11200} & 0 & -\frac{\sqrt{30}i}{960} \\
0 & -\frac{3\sqrt{14}i}{112} & 0 & -\frac{3\sqrt{7}i}{56} & 0 & \frac{9\sqrt{70}i}{560} & \frac{3\sqrt{15}i}{800} & 0 & -\frac{11\sqrt{35}i}{5600} & 0 & -\frac{\sqrt{21}i}{3360} & 0 & -\frac{9\sqrt{105}i}{5600} & 0 \\
-\frac{9\sqrt{70}i}{560} & 0 & \frac{3\sqrt{7}i}{56} & 0 & \frac{3\sqrt{14}i}{112} & 0 & 0 & -\frac{9\sqrt{105}i}{5600} & 0 & -\frac{\sqrt{21}i}{3360} & 0 & -\frac{11\sqrt{35}i}{5600} & 0 & \frac{3\sqrt{15}i}{800} \\
0 & \frac{9\sqrt{7}i}{112} & 0 & -\frac{3\sqrt{14}i}{112} & 0 & -\frac{3\sqrt{35}i}{560} & -\frac{\sqrt{30}i}{960} & 0 & -\frac{9\sqrt{70}i}{11200} & 0 & \frac{13\sqrt{42}i}{6720} & 0 & \frac{23\sqrt{210}i}{33600} & 0 \\
\frac{3\sqrt{7}i}{112} & 0 & -\frac{9\sqrt{70}i}{560} & 0 & \frac{3\sqrt{35}i}{560} & 0 & 0 & -\frac{\sqrt{42}i}{1344} & 0 & \frac{3\sqrt{210}i}{2240} & 0 & -\frac{\sqrt{14}i}{448} & 0 & -\frac{\sqrt{6}i}{960}
\end{bmatrix}$$

| 607 | symmetry | $\dfrac{\sqrt{105}x(y-z)(y+z)\left(2x^2-y^2-z^2\right)}{4}$ |
|---|---|---|

$\mathbb{Q}_{5,1}^{(1,0;a)}(E_u,3)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{200} & 0 & \frac{\sqrt{14}}{40} & 0 & -\frac{\sqrt{210}}{200} & 0 & -\frac{3\sqrt{10}}{40} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{200} & 0 & \frac{3\sqrt{70}}{200} & 0 & -\frac{\sqrt{42}}{40} & 0 & \frac{\sqrt{210}}{200} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{200} & 0 & -\frac{\sqrt{42}}{40} & 0 & \frac{3\sqrt{70}}{200} & 0 & -\frac{\sqrt{30}}{200} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}}{40} & 0 & -\frac{\sqrt{210}}{200} & 0 & \frac{\sqrt{14}}{40} & 0 & -\frac{\sqrt{70}}{200} & 0 \\
0 & \frac{\sqrt{105}}{280} & 0 & -\frac{\sqrt{210}}{280} & 0 & -\frac{3\sqrt{21}}{56} & -\frac{\sqrt{2}}{480} & 0 & \frac{\sqrt{42}}{672} & 0 & -\frac{\sqrt{70}}{1120} & 0 & -\frac{\sqrt{14}}{224} & 0 \\
\frac{\sqrt{105}}{280} & 0 & -\frac{\sqrt{42}}{56} & 0 & \frac{\sqrt{21}}{56} & 0 & 0 & \frac{23\sqrt{70}}{16800} & 0 & -\frac{13\sqrt{14}}{3360} & 0 & \frac{\sqrt{210}}{5600} & 0 & -\frac{\sqrt{10}}{160} \\
0 & -\frac{\sqrt{42}}{56} & 0 & \frac{\sqrt{21}}{28} & 0 & -\frac{\sqrt{210}}{280} & \frac{\sqrt{5}}{400} & 0 & -\frac{11\sqrt{105}}{8400} & 0 & \frac{\sqrt{7}}{1680} & 0 & \frac{3\sqrt{35}}{2800} & 0 \\
-\frac{\sqrt{210}}{280} & 0 & \frac{\sqrt{21}}{28} & 0 & -\frac{\sqrt{42}}{56} & 0 & 0 & -\frac{3\sqrt{35}}{2800} & 0 & -\frac{\sqrt{7}}{1680} & 0 & \frac{11\sqrt{105}}{8400} & 0 & -\frac{\sqrt{5}}{400} \\
0 & \frac{\sqrt{21}}{56} & 0 & -\frac{\sqrt{42}}{56} & 0 & \frac{\sqrt{105}}{280} & \frac{\sqrt{10}}{160} & 0 & -\frac{\sqrt{210}}{5600} & 0 & \frac{13\sqrt{14}}{3360} & 0 & -\frac{23\sqrt{70}}{16800} & 0 \\
-\frac{3\sqrt{21}}{56} & 0 & -\frac{\sqrt{210}}{280} & 0 & \frac{\sqrt{105}}{280} & 0 & 0 & \frac{\sqrt{14}}{224} & 0 & \frac{\sqrt{70}}{1120} & 0 & -\frac{\sqrt{42}}{672} & 0 & \frac{\sqrt{2}}{480}
\end{bmatrix}$$

| 608 | symmetry | $-\dfrac{\sqrt{105}y(x-z)(x+z)\left(x^2-2y^2+z^2\right)}{4}$ |
|---|---|---|

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{5,2}^{(1,0;a)}(E_u,3)$

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{70}i}{200}$ | 0 | $-\frac{\sqrt{14}i}{40}$ | 0 | $-\frac{\sqrt{210}i}{200}$ | 0 | $\frac{3\sqrt{10}i}{40}$ |
| 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{30}i}{200}$ | 0 | $\frac{3\sqrt{70}i}{200}$ | 0 | $\frac{\sqrt{42}i}{40}$ | 0 | $\frac{\sqrt{210}i}{200}$ | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{210}i}{200}$ | 0 | $-\frac{\sqrt{42}i}{40}$ | 0 | $-\frac{3\sqrt{70}i}{200}$ | 0 | $-\frac{\sqrt{30}i}{200}$ |
| 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{3\sqrt{10}i}{40}$ | 0 | $\frac{\sqrt{210}i}{200}$ | 0 | $\frac{\sqrt{14}i}{40}$ | 0 | $\frac{\sqrt{70}i}{200}$ | 0 |
| 0 | $-\frac{\sqrt{105}i}{280}$ | 0 | $-\frac{\sqrt{210}i}{280}$ | 0 | $\frac{3\sqrt{21}i}{56}$ | $-\frac{\sqrt{2}i}{480}$ | 0 | $-\frac{\sqrt{42}i}{672}$ | 0 | $-\frac{\sqrt{70}i}{1120}$ | 0 | $\frac{\sqrt{14}i}{224}$ | 0 |
| $\frac{\sqrt{105}i}{280}$ | 0 | $\frac{\sqrt{42}i}{56}$ | 0 | $\frac{\sqrt{21}i}{56}$ | 0 | 0 | $\frac{23\sqrt{70}i}{16800}$ | 0 | $\frac{13\sqrt{14}i}{3360}$ | 0 | $\frac{\sqrt{210}i}{5600}$ | 0 | $\frac{\sqrt{10}i}{160}$ |
| 0 | $-\frac{\sqrt{42}i}{56}$ | 0 | $-\frac{\sqrt{21}i}{28}$ | 0 | $-\frac{\sqrt{210}i}{280}$ | $-\frac{\sqrt{5}i}{400}$ | 0 | $-\frac{11\sqrt{105}i}{8400}$ | 0 | $-\frac{\sqrt{7}i}{1680}$ | 0 | $\frac{3\sqrt{35}i}{2800}$ | 0 |
| $\frac{\sqrt{210}i}{280}$ | 0 | $\frac{\sqrt{21}i}{28}$ | 0 | $\frac{\sqrt{42}i}{56}$ | 0 | 0 | $\frac{3\sqrt{35}i}{2800}$ | 0 | $-\frac{\sqrt{7}i}{1680}$ | 0 | $-\frac{11\sqrt{105}i}{8400}$ | 0 | $-\frac{\sqrt{5}i}{400}$ |
| 0 | $-\frac{\sqrt{21}i}{56}$ | 0 | $-\frac{\sqrt{42}i}{56}$ | 0 | $-\frac{\sqrt{105}i}{280}$ | $\frac{\sqrt{10}i}{160}$ | 0 | $\frac{\sqrt{210}i}{5600}$ | 0 | $\frac{13\sqrt{14}i}{3360}$ | 0 | $\frac{23\sqrt{70}i}{16800}$ | 0 |
| $-\frac{3\sqrt{21}i}{56}$ | 0 | $\frac{\sqrt{210}i}{280}$ | 0 | $\frac{\sqrt{105}i}{280}$ | 0 | 0 | $\frac{\sqrt{14}i}{224}$ | 0 | $-\frac{\sqrt{70}i}{1120}$ | 0 | $-\frac{\sqrt{42}i}{672}$ | 0 | $-\frac{\sqrt{2}i}{480}$ |

| No. | symmetry | |
|---|---|---|
| 609 | symmetry | $z$ |

$\mathbb{Q}_1^{(1,1;a)}(A_{2u})$

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | $-\frac{1}{5}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | $-\frac{\sqrt{6}}{10}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | $-\frac{\sqrt{6}}{10}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | $-\frac{1}{5}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $-\frac{2}{7}$ | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{6}}{28}$ | 0 | 0 | 0 | 0 | 0 |
| 0 | $-\frac{6}{35}$ | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{10}}{28}$ | 0 | 0 | 0 | 0 |
| 0 | 0 | $-\frac{2}{35}$ | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{3}}{14}$ | 0 | 0 | 0 |
| 0 | 0 | 0 | $\frac{2}{35}$ | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{3}}{14}$ | 0 | 0 |
| 0 | 0 | 0 | 0 | $\frac{6}{35}$ | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{10}}{28}$ | 0 |
| 0 | 0 | 0 | 0 | 0 | $\frac{2}{7}$ | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{6}}{28}$ |

| No. | symmetry | |
|---|---|---|
| 610 | symmetry | $x$ |

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{Q}_{1,1}^{(1,1;a)}(E_u)$$

$$\begin{bmatrix}
\frac{\sqrt{5}}{10} & 0 & -\frac{\sqrt{2}}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{3}}{10} & 0 & -\frac{\sqrt{6}}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{6}}{20} & 0 & -\frac{\sqrt{3}}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{2}}{20} & 0 & -\frac{\sqrt{5}}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{2\sqrt{5}}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}}{56} & 0 & \frac{\sqrt{2}}{56} & 0 & 0 & 0 & 0 & 0 \\
-\frac{2\sqrt{5}}{35} & 0 & -\frac{4\sqrt{2}}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{56} & 0 & \frac{\sqrt{6}}{56} & 0 & 0 & 0 & 0 \\
0 & -\frac{4\sqrt{2}}{35} & 0 & -\frac{6}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}}{28} & 0 & \frac{\sqrt{3}}{28} & 0 & 0 & 0 \\
0 & 0 & -\frac{6}{35} & 0 & -\frac{4\sqrt{2}}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{28} & 0 & \frac{\sqrt{5}}{28} & 0 & 0 \\
0 & 0 & 0 & -\frac{4\sqrt{2}}{35} & 0 & -\frac{2\sqrt{5}}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{56} & 0 & \frac{\sqrt{30}}{56} & 0 \\
0 & 0 & 0 & 0 & -\frac{2\sqrt{5}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{56} & 0 & \frac{\sqrt{42}}{56}
\end{bmatrix}$$

| 611 | symmetry | $y$ |

$$\mathbb{Q}_{1,2}^{(1,1;a)}(E_u)$$

$$\begin{bmatrix}
\frac{\sqrt{5}i}{10} & 0 & \frac{\sqrt{2}i}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{3}i}{10} & 0 & \frac{\sqrt{6}i}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{6}i}{20} & 0 & \frac{\sqrt{3}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{2}i}{20} & 0 & \frac{\sqrt{5}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{2\sqrt{5}i}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}i}{56} & 0 & -\frac{\sqrt{2}i}{56} & 0 & 0 & 0 & 0 & 0 \\
-\frac{2\sqrt{5}i}{35} & 0 & \frac{4\sqrt{2}i}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{56} & 0 & -\frac{\sqrt{6}i}{56} & 0 & 0 & 0 & 0 \\
0 & -\frac{4\sqrt{2}i}{35} & 0 & \frac{6i}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}i}{28} & 0 & -\frac{\sqrt{3}i}{28} & 0 & 0 & 0 \\
0 & 0 & -\frac{6i}{35} & 0 & \frac{4\sqrt{2}i}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{28} & 0 & -\frac{\sqrt{5}i}{28} & 0 & 0 \\
0 & 0 & 0 & -\frac{4\sqrt{2}i}{35} & 0 & \frac{2\sqrt{5}i}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{56} & 0 & -\frac{\sqrt{30}i}{56} & 0 \\
0 & 0 & 0 & 0 & -\frac{2\sqrt{5}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{56} & 0 & -\frac{\sqrt{42}i}{56}
\end{bmatrix}$$

| 612 | symmetry | $-\frac{z\left(3x^2+3y^2-2z^2\right)}{2}$ |

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_3^{(1,1;a)}(A_{2u})$

$$\begin{bmatrix}
0 & \frac{9}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{28} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{3\sqrt{6}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{28} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{3\sqrt{6}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{28} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{9}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{28} & 0 & 0 \\
\frac{5}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{28} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{1}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{2}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{28} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{2}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{28} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{1}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{5}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{28} & 0
\end{bmatrix}$$

| 613 | symmetry | $\sqrt{15}xyz$ |
|---|---|---|

$\mathbb{Q}_3^{(1,1;a)}(B_{1u})$

$$\begin{bmatrix}
0 & 0 & 0 & -\frac{3\sqrt{30}i}{56} & 0 & 0 & -\frac{\sqrt{14}i}{56} & 0 & 0 & 0 & \frac{\sqrt{10}i}{56} & 0 & 0 & 0 \\
-\frac{15i}{56} & 0 & 0 & 0 & -\frac{3\sqrt{5}i}{56} & 0 & 0 & \frac{\sqrt{6}i}{56} & 0 & 0 & 0 & \frac{3\sqrt{2}i}{56} & 0 & 0 \\
0 & \frac{3\sqrt{5}i}{56} & 0 & 0 & 0 & \frac{15i}{56} & 0 & 0 & \frac{3\sqrt{2}i}{56} & 0 & 0 & 0 & \frac{\sqrt{6}i}{56} & 0 \\
0 & 0 & \frac{3\sqrt{30}i}{56} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{14}i}{56} \\
0 & 0 & -\frac{5\sqrt{6}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{28} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{30}i}{84} & 0 & 0 & \frac{\sqrt{14}i}{56} & 0 & 0 & 0 & \frac{\sqrt{10}i}{56} & 0 & 0 & 0 \\
\frac{5\sqrt{6}i}{84} & 0 & 0 & 0 & \frac{\sqrt{30}i}{84} & 0 & 0 & \frac{i}{56} & 0 & 0 & 0 & \frac{\sqrt{3}i}{56} & 0 & 0 \\
0 & \frac{\sqrt{30}i}{84} & 0 & 0 & 0 & \frac{5\sqrt{6}i}{84} & 0 & 0 & -\frac{\sqrt{3}i}{56} & 0 & 0 & 0 & -\frac{i}{56} & 0 \\
0 & 0 & -\frac{\sqrt{30}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{14}i}{56} \\
0 & 0 & 0 & -\frac{5\sqrt{6}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{28} & 0 & 0 & 0
\end{bmatrix}$$

| 614 | symmetry | $\frac{\sqrt{15}z(x-y)(x+y)}{2}$ |
|---|---|---|

Table 9

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{Q}_3^{(1,1;a)}(B_{2u})$$

$$
\begin{bmatrix}
0 & 0 & 0 & \frac{3\sqrt{30}}{56} & 0 & 0 & -\frac{\sqrt{14}}{56} & 0 & 0 & 0 & -\frac{\sqrt{10}}{56} & 0 & 0 & 0 \\
-\frac{15}{56} & 0 & 0 & 0 & \frac{3\sqrt{5}}{56} & 0 & 0 & \frac{\sqrt{6}}{56} & 0 & 0 & 0 & -\frac{3\sqrt{2}}{56} & 0 & 0 \\
0 & \frac{3\sqrt{5}}{56} & 0 & 0 & 0 & -\frac{15}{56} & 0 & 0 & \frac{3\sqrt{2}}{56} & 0 & 0 & 0 & -\frac{\sqrt{6}}{56} & 0 \\
0 & 0 & \frac{3\sqrt{30}}{56} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{56} & 0 & 0 & 0 & \frac{\sqrt{14}}{56} \\
0 & 0 & \frac{5\sqrt{6}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{28} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{30}}{84} & 0 & 0 & \frac{\sqrt{14}}{56} & 0 & 0 & 0 & -\frac{\sqrt{10}}{56} & 0 & 0 & 0 \\
\frac{5\sqrt{6}}{84} & 0 & 0 & 0 & -\frac{\sqrt{30}}{84} & 0 & 0 & \frac{1}{56} & 0 & 0 & 0 & -\frac{\sqrt{3}}{56} & 0 & 0 \\
0 & \frac{\sqrt{30}}{84} & 0 & 0 & 0 & -\frac{5\sqrt{6}}{84} & 0 & 0 & -\frac{\sqrt{3}}{56} & 0 & 0 & 0 & \frac{1}{56} & 0 \\
0 & 0 & -\frac{\sqrt{30}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{56} & 0 & 0 & 0 & \frac{\sqrt{14}}{56} \\
0 & 0 & 0 & -\frac{5\sqrt{6}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{28} & 0 & 0 & 0
\end{bmatrix}
$$

| 615 | symmetry | $\dfrac{x\left(2x^2-3y^2-3z^2\right)}{2}$ |
|---|---|---|

$$\mathbb{Q}_{3,1}^{(1,1;a)}(E_u,1)$$

$$
\begin{bmatrix}
\frac{9\sqrt{5}}{224} & 0 & -\frac{27\sqrt{2}}{224} & 0 & \frac{45}{224} & 0 & 0 & -\frac{\sqrt{30}}{112} & 0 & \frac{\sqrt{6}}{56} & 0 & -\frac{\sqrt{10}}{112} & 0 & 0 \\
0 & -\frac{3\sqrt{3}}{32} & 0 & \frac{3\sqrt{6}}{224} & 0 & \frac{15\sqrt{15}}{224} & -\frac{\sqrt{70}}{112} & 0 & 0 & 0 & \frac{3\sqrt{2}}{112} & 0 & -\frac{\sqrt{10}}{56} & 0 \\
-\frac{15\sqrt{15}}{224} & 0 & -\frac{3\sqrt{6}}{224} & 0 & \frac{3\sqrt{3}}{32} & 0 & 0 & -\frac{\sqrt{10}}{56} & 0 & \frac{3\sqrt{2}}{112} & 0 & 0 & 0 & -\frac{\sqrt{70}}{112} \\
0 & -\frac{45}{224} & 0 & \frac{27\sqrt{2}}{224} & 0 & -\frac{9\sqrt{5}}{224} & 0 & 0 & -\frac{\sqrt{10}}{112} & 0 & \frac{\sqrt{6}}{56} & 0 & -\frac{\sqrt{30}}{112} & 0 \\
0 & -\frac{\sqrt{5}}{28} & 0 & \frac{5\sqrt{10}}{168} & 0 & 0 & -\frac{\sqrt{42}}{224} & 0 & \frac{3\sqrt{2}}{112} & 0 & -\frac{\sqrt{30}}{224} & 0 & 0 & 0 \\
-\frac{\sqrt{5}}{28} & 0 & \frac{\sqrt{2}}{56} & 0 & \frac{5}{42} & 0 & 0 & \frac{\sqrt{30}}{224} & 0 & \frac{\sqrt{6}}{112} & 0 & -\frac{3\sqrt{10}}{224} & 0 & 0 \\
0 & \frac{\sqrt{2}}{56} & 0 & \frac{1}{14} & 0 & \frac{5\sqrt{10}}{168} & \frac{\sqrt{105}}{224} & 0 & \frac{3\sqrt{5}}{224} & 0 & -\frac{\sqrt{3}}{224} & 0 & -\frac{3\sqrt{15}}{224} & 0 \\
\frac{5\sqrt{10}}{168} & 0 & \frac{1}{14} & 0 & \frac{\sqrt{2}}{56} & 0 & 0 & \frac{3\sqrt{15}}{224} & 0 & \frac{\sqrt{3}}{224} & 0 & -\frac{3\sqrt{5}}{224} & 0 & -\frac{\sqrt{105}}{224} \\
0 & \frac{5}{42} & 0 & \frac{\sqrt{2}}{56} & 0 & -\frac{\sqrt{5}}{28} & 0 & 0 & \frac{3\sqrt{10}}{224} & 0 & -\frac{\sqrt{6}}{112} & 0 & -\frac{\sqrt{30}}{224} & 0 \\
0 & 0 & \frac{5\sqrt{10}}{168} & 0 & -\frac{\sqrt{5}}{28} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{224} & 0 & -\frac{3\sqrt{2}}{112} & 0 & \frac{\sqrt{42}}{224}
\end{bmatrix}
$$

| 616 | symmetry | $-\dfrac{y\left(3x^2-2y^2+3z^2\right)}{2}$ |
|---|---|---|

Table 9

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{Q}_{3,2}^{(1,1;a)}(E_u,1)$ | (matrix below) |

$$\begin{bmatrix}
\frac{9\sqrt{5}i}{224} & 0 & \frac{27\sqrt{2}i}{224} & 0 & \frac{45i}{224} & 0 & 0 & -\frac{\sqrt{30}i}{112} & 0 & -\frac{\sqrt{6}i}{56} & 0 & -\frac{\sqrt{10}i}{112} & 0 & 0 \\
0 & -\frac{3\sqrt{3}i}{32} & 0 & -\frac{3\sqrt{6}i}{224} & 0 & \frac{15\sqrt{15}i}{224} & \frac{\sqrt{70}i}{112} & 0 & 0 & 0 & -\frac{3\sqrt{2}i}{112} & 0 & -\frac{\sqrt{10}i}{56} & 0 \\
\frac{15\sqrt{15}i}{224} & 0 & -\frac{3\sqrt{6}i}{224} & 0 & -\frac{3\sqrt{3}i}{32} & 0 & 0 & \frac{\sqrt{10}i}{56} & 0 & \frac{3\sqrt{2}i}{112} & 0 & 0 & 0 & -\frac{\sqrt{70}i}{112} \\
0 & \frac{45i}{224} & 0 & \frac{27\sqrt{2}i}{224} & 0 & \frac{9\sqrt{5}i}{224} & 0 & 0 & \frac{\sqrt{10}i}{112} & 0 & \frac{\sqrt{6}i}{56} & 0 & \frac{\sqrt{30}i}{112} & 0 \\
0 & \frac{\sqrt{5}i}{28} & 0 & \frac{5\sqrt{10}i}{168} & 0 & 0 & -\frac{\sqrt{42}i}{224} & 0 & -\frac{3\sqrt{2}i}{112} & 0 & -\frac{\sqrt{30}i}{224} & 0 & 0 & 0 \\
-\frac{\sqrt{5}i}{28} & 0 & -\frac{\sqrt{2}i}{56} & 0 & \frac{5i}{42} & 0 & 0 & \frac{\sqrt{30}i}{224} & 0 & -\frac{\sqrt{6}i}{112} & 0 & -\frac{3\sqrt{10}i}{224} & 0 & 0 \\
0 & \frac{\sqrt{2}i}{56} & 0 & -\frac{i}{14} & 0 & \frac{5\sqrt{10}i}{168} & -\frac{\sqrt{105}i}{224} & 0 & \frac{3\sqrt{5}i}{224} & 0 & \frac{\sqrt{3}i}{224} & 0 & -\frac{3\sqrt{15}i}{224} & 0 \\
-\frac{5\sqrt{10}i}{168} & 0 & \frac{i}{14} & 0 & -\frac{\sqrt{2}i}{56} & 0 & 0 & -\frac{3\sqrt{15}i}{224} & 0 & \frac{\sqrt{3}i}{224} & 0 & \frac{3\sqrt{5}i}{224} & 0 & -\frac{\sqrt{105}i}{224} \\
0 & -\frac{5i}{42} & 0 & \frac{\sqrt{2}i}{56} & 0 & \frac{\sqrt{5}i}{28} & 0 & 0 & -\frac{3\sqrt{10}i}{224} & 0 & -\frac{\sqrt{6}i}{112} & 0 & \frac{\sqrt{30}i}{224} & 0 \\
0 & 0 & -\frac{5\sqrt{10}i}{168} & 0 & -\frac{\sqrt{5}i}{28} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{224} & 0 & -\frac{3\sqrt{2}i}{112} & 0 & -\frac{\sqrt{42}i}{224}
\end{bmatrix}$$

| No. | multipole | matrix |
|---|---|---|
| 617 | symmetry | $\frac{\sqrt{15}x(y-z)(y+z)}{2}$ |
| | $\mathbb{Q}_{3,1}^{(1,1;a)}(E_u,2)$ | (matrix below) |

$$\begin{bmatrix}
\frac{15\sqrt{3}}{224} & 0 & -\frac{9\sqrt{30}}{224} & 0 & -\frac{9\sqrt{15}}{224} & 0 & 0 & -\frac{5\sqrt{2}}{112} & 0 & \frac{\sqrt{10}}{56} & 0 & \frac{\sqrt{6}}{112} & 0 & 0 \\
0 & -\frac{3\sqrt{5}}{32} & 0 & \frac{3\sqrt{10}}{224} & 0 & -\frac{45}{224} & \frac{\sqrt{42}}{112} & 0 & 0 & 0 & \frac{\sqrt{30}}{112} & 0 & \frac{\sqrt{6}}{56} & 0 \\
\frac{45}{224} & 0 & -\frac{3\sqrt{10}}{224} & 0 & \frac{3\sqrt{5}}{32} & 0 & 0 & \frac{\sqrt{6}}{56} & 0 & \frac{\sqrt{30}}{112} & 0 & 0 & 0 & \frac{\sqrt{42}}{112} \\
0 & \frac{9\sqrt{15}}{224} & 0 & \frac{9\sqrt{30}}{224} & 0 & -\frac{15\sqrt{3}}{224} & 0 & 0 & \frac{\sqrt{6}}{112} & 0 & \frac{\sqrt{10}}{56} & 0 & -\frac{5\sqrt{2}}{112} & 0 \\
0 & -\frac{5\sqrt{3}}{84} & 0 & -\frac{5\sqrt{6}}{168} & 0 & 0 & -\frac{\sqrt{70}}{224} & 0 & \frac{\sqrt{30}}{112} & 0 & \frac{3\sqrt{2}}{224} & 0 & 0 & 0 \\
-\frac{5\sqrt{3}}{84} & 0 & \frac{\sqrt{30}}{168} & 0 & -\frac{\sqrt{15}}{42} & 0 & 0 & \frac{5\sqrt{2}}{224} & 0 & \frac{\sqrt{10}}{112} & 0 & \frac{3\sqrt{6}}{224} & 0 & 0 \\
0 & \frac{\sqrt{30}}{168} & 0 & \frac{\sqrt{15}}{42} & 0 & -\frac{5\sqrt{6}}{168} & -\frac{3\sqrt{7}}{224} & 0 & \frac{5\sqrt{3}}{224} & 0 & -\frac{\sqrt{5}}{224} & 0 & \frac{9}{224} & 0 \\
-\frac{5\sqrt{6}}{168} & 0 & \frac{\sqrt{15}}{42} & 0 & \frac{\sqrt{30}}{168} & 0 & 0 & -\frac{9}{224} & 0 & \frac{\sqrt{5}}{224} & 0 & -\frac{5\sqrt{3}}{224} & 0 & \frac{3\sqrt{7}}{224} \\
0 & -\frac{\sqrt{15}}{42} & 0 & \frac{\sqrt{30}}{168} & 0 & -\frac{5\sqrt{3}}{84} & 0 & 0 & -\frac{3\sqrt{6}}{224} & 0 & -\frac{\sqrt{10}}{112} & 0 & -\frac{5\sqrt{2}}{224} & 0 \\
0 & 0 & -\frac{5\sqrt{6}}{168} & 0 & -\frac{5\sqrt{3}}{84} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{2}}{224} & 0 & -\frac{\sqrt{30}}{112} & 0 & \frac{\sqrt{70}}{224}
\end{bmatrix}$$

| No. | symmetry | matrix |
|---|---|---|
| 618 | symmetry | $\frac{\sqrt{15}y(x-z)(x+z)}{2}$ |

*continued …*

Table 9

| No. | multipole | matrix |
|-----|-----------|--------|
|  | $\mathbb{Q}_{3,2}^{(1,1;a)}(E_u,2)$ | (matrix below) |

$$\begin{pmatrix}
\frac{15\sqrt{3}i}{224} & 0 & \frac{9\sqrt{30}i}{224} & 0 & -\frac{9\sqrt{15}i}{224} & 0 & 0 & -\frac{5\sqrt{2}i}{112} & 0 & -\frac{\sqrt{10}i}{56} & 0 & \frac{\sqrt{6}i}{112} & 0 & 0 \\
0 & -\frac{3\sqrt{5}i}{32} & 0 & -\frac{3\sqrt{10}i}{224} & 0 & -\frac{45i}{224} & -\frac{\sqrt{42}i}{112} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{112} & 0 & \frac{\sqrt{6}i}{56} & 0 \\
-\frac{45i}{224} & 0 & -\frac{3\sqrt{10}i}{224} & 0 & -\frac{3\sqrt{5}i}{32} & 0 & 0 & -\frac{\sqrt{6}i}{56} & 0 & \frac{\sqrt{30}i}{112} & 0 & 0 & 0 & \frac{\sqrt{42}i}{112} \\
0 & -\frac{9\sqrt{15}i}{224} & 0 & \frac{9\sqrt{30}i}{224} & 0 & \frac{15\sqrt{3}i}{224} & 0 & 0 & -\frac{\sqrt{6}i}{112} & 0 & \frac{\sqrt{10}i}{56} & 0 & \frac{5\sqrt{2}i}{112} & 0 \\
0 & \frac{5\sqrt{3}i}{84} & 0 & -\frac{5\sqrt{6}i}{168} & 0 & 0 & -\frac{\sqrt{70}i}{224} & 0 & -\frac{\sqrt{30}i}{112} & 0 & \frac{3\sqrt{2}i}{224} & 0 & 0 & 0 \\
-\frac{5\sqrt{3}i}{84} & 0 & -\frac{\sqrt{30}i}{168} & 0 & -\frac{\sqrt{15}i}{42} & 0 & 0 & \frac{5\sqrt{2}i}{224} & 0 & -\frac{\sqrt{10}i}{112} & 0 & \frac{3\sqrt{6}i}{224} & 0 & 0 \\
0 & \frac{\sqrt{30}i}{168} & 0 & -\frac{\sqrt{15}i}{42} & 0 & -\frac{5\sqrt{6}i}{168} & \frac{3\sqrt{7}i}{224} & 0 & \frac{5\sqrt{3}i}{224} & 0 & \frac{\sqrt{5}i}{224} & 0 & \frac{9i}{224} & 0 \\
\frac{5\sqrt{6}i}{168} & 0 & \frac{\sqrt{15}i}{42} & 0 & -\frac{\sqrt{30}i}{168} & 0 & 0 & \frac{9i}{224} & 0 & \frac{\sqrt{5}i}{224} & 0 & \frac{5\sqrt{3}i}{224} & 0 & \frac{3\sqrt{7}i}{224} \\
0 & \frac{\sqrt{15}i}{42} & 0 & \frac{\sqrt{30}i}{168} & 0 & \frac{5\sqrt{3}i}{84} & 0 & 0 & \frac{3\sqrt{6}i}{224} & 0 & -\frac{\sqrt{10}i}{112} & 0 & \frac{5\sqrt{2}i}{224} & 0 \\
0 & 0 & \frac{5\sqrt{6}i}{168} & 0 & -\frac{5\sqrt{3}i}{84} & 0 & 0 & 0 & \frac{3\sqrt{2}i}{224} & 0 & -\frac{\sqrt{30}i}{112} & 0 & -\frac{\sqrt{70}i}{224}
\end{pmatrix}$$

| No. | | |
|-----|---|---|
| 619 | symmetry | $-\frac{x^2}{2} - \frac{y^2}{2} + z^2$ |

|  | multipole | matrix |
|--|-----------|--------|
|  | $\mathbb{G}_2^{(a)}(A_{1u})$ | (matrix below) |

$$\begin{pmatrix}
0 & \frac{3\sqrt{10}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{i}{14} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{15}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{5}i}{70} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{15}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{5}i}{70} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{3\sqrt{10}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{i}{14} & 0 & 0 \\
-\frac{\sqrt{10}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{10}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3i}{14} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{10}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{70} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{10}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{70} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3i}{14} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{14} & 0
\end{pmatrix}$$

| No. | | |
|-----|---|---|
| 620 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |

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Table  9

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

$\mathbb{G}_2^{(a)}(B_{1u})$

$$\begin{pmatrix}
0 & 0 & 0 & \frac{\sqrt{15}i}{35} & 0 & 0 & \frac{\sqrt{7}i}{28} & 0 & 0 & 0 & \frac{\sqrt{5}i}{140} & 0 & 0 & 0 \\
-\frac{\sqrt{2}i}{7} & 0 & 0 & 0 & \frac{2\sqrt{10}i}{35} & 0 & 0 & \frac{\sqrt{3}i}{28} & 0 & 0 & 0 & \frac{i}{28} & 0 & 0 \\
0 & -\frac{2\sqrt{10}i}{35} & 0 & 0 & 0 & \frac{\sqrt{2}i}{7} & 0 & 0 & \frac{i}{28} & 0 & 0 & 0 & \frac{\sqrt{3}i}{28} & 0 \\
0 & 0 & -\frac{\sqrt{15}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}i}{140} & 0 & 0 & 0 & \frac{\sqrt{7}i}{28} \\
0 & 0 & -\frac{\sqrt{3}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{i}{14} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{3\sqrt{15}i}{140} & 0 & 0 & -\frac{\sqrt{7}i}{14} & 0 & 0 & 0 & \frac{2\sqrt{5}i}{35} & 0 & 0 & 0 \\
-\frac{\sqrt{3}i}{28} & 0 & 0 & 0 & -\frac{3\sqrt{15}i}{140} & 0 & 0 & -\frac{\sqrt{2}i}{7} & 0 & 0 & 0 & \frac{\sqrt{6}i}{14} & 0 & 0 \\
0 & -\frac{3\sqrt{15}i}{140} & 0 & 0 & 0 & -\frac{\sqrt{3}i}{28} & 0 & 0 & -\frac{\sqrt{6}i}{14} & 0 & 0 & 0 & \frac{\sqrt{2}i}{7} & 0 \\
0 & 0 & -\frac{3\sqrt{15}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{5}i}{35} & 0 & 0 & 0 & \frac{\sqrt{7}i}{14} \\
0 & 0 & 0 & -\frac{\sqrt{3}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{i}{14} & 0 & 0 & 0
\end{pmatrix}$$

| 621 | symmetry | $\sqrt{3}xy$ |

$\mathbb{G}_2^{(a)}(B_{2u})$

$$\begin{pmatrix}
0 & 0 & 0 & \frac{\sqrt{15}}{35} & 0 & 0 & -\frac{\sqrt{7}}{28} & 0 & 0 & 0 & \frac{\sqrt{5}}{140} & 0 & 0 & 0 \\
\frac{\sqrt{2}}{7} & 0 & 0 & 0 & \frac{2\sqrt{10}}{35} & 0 & 0 & -\frac{\sqrt{3}}{28} & 0 & 0 & 0 & \frac{1}{28} & 0 & 0 \\
0 & \frac{2\sqrt{10}}{35} & 0 & 0 & 0 & \frac{\sqrt{2}}{7} & 0 & 0 & -\frac{1}{28} & 0 & 0 & 0 & \frac{\sqrt{3}}{28} & 0 \\
0 & 0 & \frac{\sqrt{15}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}}{140} & 0 & 0 & 0 & \frac{\sqrt{7}}{28} \\
0 & 0 & -\frac{\sqrt{3}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{14} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{3\sqrt{15}}{140} & 0 & 0 & \frac{\sqrt{7}}{14} & 0 & 0 & 0 & \frac{2\sqrt{5}}{35} & 0 & 0 & 0 \\
\frac{\sqrt{3}}{28} & 0 & 0 & 0 & -\frac{3\sqrt{15}}{140} & 0 & 0 & \frac{\sqrt{2}}{7} & 0 & 0 & 0 & \frac{\sqrt{6}}{14} & 0 & 0 \\
0 & \frac{3\sqrt{15}}{140} & 0 & 0 & 0 & -\frac{\sqrt{3}}{28} & 0 & 0 & \frac{\sqrt{6}}{14} & 0 & 0 & 0 & \frac{\sqrt{2}}{7} & 0 \\
0 & 0 & \frac{3\sqrt{15}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt{5}}{35} & 0 & 0 & 0 & \frac{\sqrt{7}}{14} \\
0 & 0 & 0 & \frac{\sqrt{3}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{14} & 0 & 0 & 0
\end{pmatrix}$$

| 622 | symmetry | $\sqrt{3}yz$ |

*continued ...*

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Table 9

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{G}_{2,1}^{(a)}(E_u) =
\begin{bmatrix}
\frac{\sqrt6}{14} & 0 & \frac{3\sqrt{15}}{70} & 0 & 0 & 0 & 0 & \frac{1}{14} & 0 & \frac{\sqrt5}{70} & 0 & 0 & 0 & 0 \\[4pt]
0 & -\frac{\sqrt{10}}{70} & 0 & \frac{\sqrt5}{14} & 0 & 0 & 0 & 0 & \frac{1}{14} & 0 & \frac{\sqrt{15}}{70} & 0 & 0 & 0 \\[4pt]
0 & 0 & -\frac{\sqrt5}{14} & 0 & \frac{\sqrt{10}}{70} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{70} & 0 & \frac{1}{14} & 0 & 0 \\[4pt]
0 & 0 & 0 & -\frac{3\sqrt{15}}{70} & 0 & -\frac{\sqrt6}{14} & 0 & 0 & 0 & 0 & \frac{\sqrt5}{70} & 0 & \frac{1}{14} & 0 \\[4pt]
0 & -\frac{\sqrt6}{28} & 0 & 0 & 0 & 0 & \frac{\sqrt{35}}{28} & 0 & \frac{\sqrt{15}}{28} & 0 & 0 & 0 & 0 & 0 \\[4pt]
\frac{\sqrt6}{28} & 0 & -\frac{\sqrt{15}}{70} & 0 & 0 & 0 & 0 & \frac{1}{28} & 0 & \frac{11\sqrt5}{140} & 0 & 0 & 0 & 0 \\[4pt]
0 & \frac{\sqrt{15}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt6}{28} & 0 & \frac{\sqrt{10}}{20} & 0 & 0 & 0 \\[4pt]
0 & 0 & 0 & 0 & \frac{\sqrt{15}}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{20} & 0 & \frac{\sqrt6}{28} & 0 & 0 \\[4pt]
0 & 0 & 0 & -\frac{\sqrt{15}}{70} & 0 & \frac{\sqrt6}{28} & 0 & 0 & 0 & 0 & -\frac{11\sqrt5}{140} & 0 & -\frac{1}{28} & 0 \\[4pt]
0 & 0 & 0 & 0 & -\frac{\sqrt6}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{28} & 0 & -\frac{\sqrt{35}}{28}
\end{bmatrix}$$

| 623 | symmetry | $-\sqrt3\,xz$ |
|---|---|---|

$$\mathbb{G}_{2,2}^{(a)}(E_u) =
\begin{bmatrix}
\frac{\sqrt6 i}{14} & 0 & -\frac{3\sqrt{15}i}{70} & 0 & 0 & 0 & 0 & \frac{i}{14} & 0 & -\frac{\sqrt5 i}{70} & 0 & 0 & 0 & 0 \\[4pt]
0 & -\frac{\sqrt{10}i}{70} & 0 & -\frac{\sqrt5 i}{14} & 0 & 0 & 0 & 0 & \frac{i}{14} & 0 & -\frac{\sqrt{15}i}{70} & 0 & 0 & 0 \\[4pt]
0 & 0 & -\frac{\sqrt5 i}{14} & 0 & -\frac{\sqrt{10}i}{70} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{70} & 0 & -\frac{i}{14} & 0 & 0 \\[4pt]
0 & 0 & 0 & -\frac{3\sqrt{15}i}{70} & 0 & \frac{\sqrt6 i}{14} & 0 & 0 & 0 & 0 & \frac{\sqrt5 i}{70} & 0 & -\frac{i}{14} & 0 \\[4pt]
0 & \frac{\sqrt6 i}{28} & 0 & 0 & 0 & 0 & \frac{\sqrt{35}i}{28} & 0 & -\frac{\sqrt{15}i}{28} & 0 & 0 & 0 & 0 & 0 \\[4pt]
\frac{\sqrt6 i}{28} & 0 & \frac{\sqrt{15}i}{70} & 0 & 0 & 0 & 0 & \frac{i}{28} & 0 & -\frac{11\sqrt5 i}{140} & 0 & 0 & 0 & 0 \\[4pt]
0 & \frac{\sqrt{15}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt6 i}{28} & 0 & -\frac{\sqrt{10}i}{20} & 0 & 0 & 0 \\[4pt]
0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{20} & 0 & -\frac{\sqrt6 i}{28} & 0 & 0 \\[4pt]
0 & 0 & 0 & -\frac{\sqrt{15}i}{70} & 0 & -\frac{\sqrt6 i}{28} & 0 & 0 & 0 & 0 & -\frac{11\sqrt5 i}{140} & 0 & \frac{i}{28} & 0 \\[4pt]
0 & 0 & 0 & 0 & -\frac{\sqrt6 i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{28} & 0 & \frac{\sqrt{35}i}{28}
\end{bmatrix}$$

| 624 | symmetry | $\dfrac{\sqrt{21}\left(x^4-3x^2y^2-3x^2z^2+y^4-3y^2z^2+z^4\right)}{6}$ |
|---|---|---|

Table 9

| No. | multipole | matrix |
|-----|-----------|--------|

$$\mathbb{G}_4^{(a)}(A_{1u},1)=\begin{pmatrix}
0 & -\frac{\sqrt{21}i}{84} & 0 & 0 & 0 & -\frac{\sqrt{105}i}{84} & 0 & 0 & -\frac{3\sqrt{210}i}{280} & 0 & 0 & 0 & -\frac{3\sqrt{70}i}{280} & 0 \\
0 & 0 & \frac{\sqrt{14}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{40} \\
0 & 0 & 0 & -\frac{\sqrt{14}i}{28} & 0 & 0 & -\frac{\sqrt{30}i}{40} & 0 & 0 & 0 & \frac{\sqrt{42}i}{56} & 0 & 0 & 0 \\
\frac{\sqrt{105}i}{84} & 0 & 0 & 0 & \frac{\sqrt{21}i}{84} & 0 & 0 & -\frac{3\sqrt{70}i}{280} & 0 & 0 & 0 & -\frac{3\sqrt{210}i}{280} & 0 & 0 \\
\frac{\sqrt{21}i}{84} & 0 & 0 & 0 & \frac{\sqrt{105}i}{84} & 0 & 0 & -\frac{\sqrt{14}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{42}i}{84} & 0 & 0 \\
0 & -\frac{\sqrt{21}i}{28} & 0 & 0 & 0 & \frac{\sqrt{105}i}{84} & 0 & 0 & \frac{\sqrt{210}i}{105} & 0 & 0 & 0 & -\frac{\sqrt{70}i}{70} & 0 \\
0 & 0 & \frac{\sqrt{21}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{5}i}{20} \\
0 & 0 & 0 & \frac{\sqrt{21}i}{42} & 0 & 0 & \frac{\sqrt{5}i}{20} & 0 & 0 & 0 & -\frac{\sqrt{7}i}{28} & 0 & 0 & 0 \\
\frac{\sqrt{105}i}{84} & 0 & 0 & 0 & -\frac{\sqrt{21}i}{28} & 0 & 0 & \frac{\sqrt{70}i}{70} & 0 & 0 & 0 & -\frac{\sqrt{210}i}{105} & 0 & 0 \\
0 & \frac{\sqrt{105}i}{84} & 0 & 0 & 0 & \frac{\sqrt{21}i}{84} & 0 & 0 & \frac{\sqrt{42}i}{84} & 0 & 0 & 0 & \frac{\sqrt{14}i}{28} & 0
\end{pmatrix}$$

**625**  symmetry

$$-\frac{\sqrt{15}\left(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4\right)}{12}$$

$$\mathbb{G}_4^{(a)}(A_{1u},2)=\begin{bmatrix}
0 & -\frac{\sqrt{15}i}{84} & 0 & 0 & 0 & \frac{\sqrt{3}i}{12} & 0 & 0 & -\frac{3\sqrt{6}i}{56} & 0 & 0 & 0 & \frac{3\sqrt{2}i}{40} & 0 \\
0 & 0 & \frac{\sqrt{10}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{56} & 0 & 0 & 0 & \frac{\sqrt{42}i}{40} \\
0 & 0 & 0 & -\frac{\sqrt{10}i}{28} & 0 & 0 & \frac{\sqrt{42}i}{40} & 0 & 0 & 0 & \frac{\sqrt{30}i}{56} & 0 & 0 & 0 \\
-\frac{\sqrt{3}i}{12} & 0 & 0 & 0 & \frac{\sqrt{15}i}{84} & 0 & 0 & \frac{3\sqrt{2}i}{40} & 0 & 0 & 0 & -\frac{3\sqrt{6}i}{56} & 0 & 0 \\
\frac{\sqrt{15}i}{84} & 0 & 0 & 0 & -\frac{\sqrt{3}i}{12} & 0 & 0 & -\frac{\sqrt{10}i}{28} & 0 & 0 & 0 & \frac{\sqrt{30}i}{60} & 0 & 0 \\
0 & -\frac{\sqrt{15}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{3}i}{12} & 0 & 0 & \frac{\sqrt{6}i}{21} & 0 & 0 & 0 & \frac{\sqrt{2}i}{10} & 0 \\
0 & 0 & \frac{\sqrt{15}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}i}{28} & 0 & 0 & 0 & \frac{\sqrt{7}i}{20} \\
0 & 0 & 0 & \frac{\sqrt{15}i}{42} & 0 & 0 & -\frac{\sqrt{7}i}{20} & 0 & 0 & 0 & -\frac{\sqrt{5}i}{28} & 0 & 0 & 0 \\
-\frac{\sqrt{3}i}{12} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{28} & 0 & 0 & -\frac{\sqrt{2}i}{10} & 0 & 0 & 0 & -\frac{\sqrt{6}i}{21} & 0 & 0 \\
0 & -\frac{\sqrt{3}i}{12} & 0 & 0 & 0 & \frac{\sqrt{15}i}{84} & 0 & 0 & -\frac{\sqrt{30}i}{60} & 0 & 0 & 0 & \frac{\sqrt{10}i}{28} & 0
\end{bmatrix}$$

**626**  symmetry

$$\frac{\sqrt{35}xy(x-y)(x+y)}{2}$$

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_4^{(a)}(A_{2u})$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{42}}{140} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{2}}{20} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{2}}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{7}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{42}}{140} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{7}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{70} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}}{35} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{10} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{7}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}}{35} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{7}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{70} & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

| 627 | symmetry | $\dfrac{\sqrt{5}(x-y)(x+y)\left(x^2+y^2-6z^2\right)}{4}$ |

$\mathbb{G}_4^{(a)}(B_{1u})$

$$\begin{pmatrix}
0 & 0 & 0 & \frac{\sqrt{10}i}{28} & 0 & 0 & \frac{3\sqrt{42}i}{280} & 0 & 0 & 0 & \frac{9\sqrt{30}i}{280} & 0 & 0 & 0 \\
-\frac{\sqrt{3}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{28} & 0 & 0 & -\frac{33\sqrt{2}i}{280} & 0 & 0 & 0 & \frac{3\sqrt{6}i}{280} & 0 & 0 \\
0 & \frac{\sqrt{15}i}{28} & 0 & 0 & 0 & \frac{\sqrt{3}i}{28} & 0 & 0 & \frac{3\sqrt{6}i}{280} & 0 & 0 & 0 & -\frac{33\sqrt{2}i}{280} & 0 \\
0 & 0 & -\frac{\sqrt{10}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{9\sqrt{30}i}{280} & 0 & 0 & 0 & \frac{3\sqrt{42}i}{280} \\
0 & 0 & -\frac{3\sqrt{2}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{14} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{10}i}{28} & 0 & 0 & -\frac{3\sqrt{42}i}{140} & 0 & 0 & 0 & \frac{\sqrt{30}i}{140} & 0 & 0 & 0 \\
-\frac{3\sqrt{2}i}{28} & 0 & 0 & 0 & \frac{\sqrt{10}i}{28} & 0 & 0 & \frac{9\sqrt{3}i}{140} & 0 & 0 & 0 & -\frac{17i}{140} & 0 & 0 \\
0 & \frac{\sqrt{10}i}{28} & 0 & 0 & 0 & -\frac{3\sqrt{2}i}{28} & 0 & 0 & \frac{17i}{140} & 0 & 0 & 0 & -\frac{9\sqrt{3}i}{140} & 0 \\
0 & 0 & \frac{\sqrt{10}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{140} & 0 & 0 & 0 & \frac{3\sqrt{42}i}{140} \\
0 & 0 & 0 & -\frac{3\sqrt{2}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{14} & 0 & 0 & 0
\end{pmatrix}$$

| 628 | symmetry | $-\dfrac{\sqrt{5}xy\left(x^2+y^2-6z^2\right)}{2}$ |

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_4^{(a)}(B_{2u})$

$$\begin{bmatrix}
0 & 0 & 0 & -\frac{\sqrt{10}}{28} & 0 & 0 & \frac{3\sqrt{42}}{280} & 0 & 0 & 0 & -\frac{9\sqrt{30}}{280} & 0 & 0 & 0 \\
-\frac{\sqrt{3}}{28} & 0 & 0 & 0 & \frac{\sqrt{15}}{28} & 0 & 0 & -\frac{33\sqrt{2}}{280} & 0 & 0 & 0 & -\frac{3\sqrt{6}}{280} & 0 & 0 \\
0 & \frac{\sqrt{15}}{28} & 0 & 0 & 0 & -\frac{\sqrt{3}}{28} & 0 & 0 & \frac{3\sqrt{6}}{280} & 0 & 0 & 0 & \frac{33\sqrt{2}}{280} & 0 \\
0 & 0 & -\frac{\sqrt{10}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{9\sqrt{30}}{280} & 0 & 0 & 0 & -\frac{3\sqrt{42}}{280} \\
0 & 0 & \frac{3\sqrt{2}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{14} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{10}}{28} & 0 & 0 & -\frac{3\sqrt{42}}{140} & 0 & 0 & 0 & -\frac{\sqrt{30}}{140} & 0 & 0 & 0 \\
-\frac{3\sqrt{2}}{28} & 0 & 0 & 0 & -\frac{\sqrt{10}}{28} & 0 & 0 & \frac{9\sqrt{3}}{140} & 0 & 0 & 0 & \frac{17}{140} & 0 & 0 \\
0 & \frac{\sqrt{10}}{28} & 0 & 0 & 0 & \frac{3\sqrt{2}}{28} & 0 & 0 & \frac{17}{140} & 0 & 0 & 0 & \frac{9\sqrt{3}}{140} & 0 \\
0 & 0 & \frac{\sqrt{10}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{140} & 0 & 0 & 0 & -\frac{3\sqrt{42}}{140} \\
0 & 0 & 0 & -\frac{3\sqrt{2}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{14} & 0 & 0 & 0
\end{bmatrix}$$

| 629 | symmetry | $\dfrac{\sqrt{35}yz(y-z)(y+z)}{2}$ |

$\mathbb{G}_{4,1}^{(a)}(E_u,1)$

$$\begin{bmatrix}
\frac{\sqrt{7}}{112} & 0 & \frac{\sqrt{70}}{112} & 0 & \frac{\sqrt{35}}{112} & 0 & 0 & \frac{9\sqrt{42}}{560} & 0 & \frac{3\sqrt{210}}{280} & 0 & \frac{9\sqrt{14}}{560} & 0 & 0 \\
0 & -\frac{\sqrt{105}}{112} & 0 & -\frac{\sqrt{210}}{112} & 0 & -\frac{\sqrt{21}}{112} & -\frac{3\sqrt{2}}{80} & 0 & -\frac{3\sqrt{42}}{140} & 0 & -\frac{3\sqrt{70}}{560} & 0 & \frac{3\sqrt{14}}{280} & 0 \\
\frac{\sqrt{21}}{112} & 0 & \frac{\sqrt{210}}{112} & 0 & \frac{\sqrt{105}}{112} & 0 & 0 & \frac{3\sqrt{14}}{280} & 0 & -\frac{3\sqrt{70}}{560} & 0 & -\frac{3\sqrt{42}}{140} & 0 & -\frac{3\sqrt{2}}{80} \\
0 & -\frac{\sqrt{35}}{112} & 0 & -\frac{\sqrt{70}}{112} & 0 & -\frac{\sqrt{7}}{112} & 0 & 0 & \frac{9\sqrt{14}}{560} & 0 & \frac{3\sqrt{210}}{280} & 0 & \frac{9\sqrt{42}}{560} & 0 \\
0 & -\frac{\sqrt{7}}{28} & 0 & -\frac{\sqrt{14}}{56} & 0 & 0 & \frac{\sqrt{30}}{80} & 0 & \frac{\sqrt{70}}{56} & 0 & \frac{\sqrt{42}}{112} & 0 & 0 & 0 \\
\frac{\sqrt{7}}{28} & 0 & \frac{\sqrt{70}}{56} & 0 & 0 & 0 & 0 & -\frac{13\sqrt{42}}{560} & 0 & -\frac{\sqrt{210}}{280} & 0 & \frac{\sqrt{14}}{80} & 0 & 0 \\
0 & -\frac{\sqrt{70}}{56} & 0 & 0 & 0 & \frac{\sqrt{14}}{56} & \frac{3\sqrt{3}}{80} & 0 & \frac{\sqrt{7}}{560} & 0 & -\frac{\sqrt{105}}{80} & 0 & -\frac{\sqrt{21}}{560} & 0 \\
\frac{\sqrt{14}}{56} & 0 & 0 & 0 & -\frac{\sqrt{70}}{56} & 0 & 0 & \frac{\sqrt{21}}{560} & 0 & \frac{\sqrt{105}}{80} & 0 & -\frac{\sqrt{7}}{560} & 0 & -\frac{3\sqrt{3}}{80} \\
0 & 0 & 0 & \frac{\sqrt{70}}{56} & 0 & \frac{\sqrt{7}}{28} & 0 & 0 & -\frac{\sqrt{14}}{80} & 0 & \frac{\sqrt{210}}{280} & 0 & \frac{13\sqrt{42}}{560} & 0 \\
0 & 0 & -\frac{\sqrt{14}}{56} & 0 & -\frac{\sqrt{7}}{28} & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}}{112} & 0 & -\frac{\sqrt{70}}{56} & 0 & -\frac{\sqrt{30}}{80}
\end{bmatrix}$$

| 630 | symmetry | $-\dfrac{\sqrt{35}xz(x-z)(x+z)}{2}$ |

*continued ...*

**Table 9**

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_{4,2}^{(a)}(E_u, 1)$

$$\begin{bmatrix}
\frac{\sqrt{7}i}{112} & 0 & -\frac{\sqrt{70}i}{112} & 0 & \frac{\sqrt{35}i}{112} & 0 & 0 & \frac{9\sqrt{42}i}{560} & 0 & -\frac{3\sqrt{210}i}{280} & 0 & \frac{9\sqrt{14}i}{560} & 0 & 0 \\
0 & -\frac{\sqrt{105}i}{112} & 0 & \frac{\sqrt{210}i}{112} & 0 & -\frac{\sqrt{21}i}{112} & \frac{3\sqrt{2}i}{80} & 0 & -\frac{3\sqrt{42}i}{140} & 0 & \frac{3\sqrt{70}i}{560} & 0 & \frac{3\sqrt{14}i}{280} & 0 \\
-\frac{\sqrt{21}i}{112} & 0 & \frac{\sqrt{210}i}{112} & 0 & -\frac{\sqrt{105}i}{112} & 0 & 0 & -\frac{3\sqrt{14}i}{280} & 0 & -\frac{3\sqrt{70}i}{560} & 0 & \frac{3\sqrt{42}i}{140} & 0 & -\frac{3\sqrt{2}i}{80} \\
0 & \frac{\sqrt{35}i}{112} & 0 & -\frac{\sqrt{70}i}{112} & 0 & \frac{\sqrt{7}i}{112} & 0 & 0 & -\frac{9\sqrt{14}i}{560} & 0 & \frac{3\sqrt{210}i}{280} & 0 & -\frac{9\sqrt{42}i}{560} & 0 \\
0 & \frac{\sqrt{7}i}{28} & 0 & -\frac{\sqrt{14}i}{56} & 0 & 0 & \frac{\sqrt{30}i}{80} & 0 & -\frac{\sqrt{70}i}{56} & 0 & \frac{\sqrt{42}i}{112} & 0 & 0 & 0 \\
\frac{\sqrt{7}i}{28} & 0 & -\frac{\sqrt{70}i}{56} & 0 & 0 & 0 & 0 & -\frac{13\sqrt{42}i}{560} & 0 & \frac{\sqrt{210}i}{280} & 0 & \frac{\sqrt{14}i}{80} & 0 & 0 \\
0 & -\frac{\sqrt{70}i}{56} & 0 & 0 & 0 & \frac{\sqrt{14}i}{56} & -\frac{3\sqrt{3}i}{80} & 0 & \frac{\sqrt{7}i}{560} & 0 & \frac{\sqrt{105}i}{80} & 0 & -\frac{\sqrt{21}i}{560} & 0 \\
-\frac{\sqrt{14}i}{56} & 0 & 0 & 0 & \frac{\sqrt{70}i}{56} & 0 & 0 & -\frac{\sqrt{21}i}{560} & 0 & \frac{\sqrt{105}i}{80} & 0 & \frac{\sqrt{7}i}{560} & 0 & -\frac{3\sqrt{3}i}{80} \\
0 & 0 & 0 & \frac{\sqrt{70}i}{56} & 0 & -\frac{\sqrt{7}i}{28} & 0 & 0 & \frac{\sqrt{14}i}{80} & 0 & \frac{\sqrt{210}i}{280} & 0 & -\frac{13\sqrt{42}i}{560} & 0 \\
0 & 0 & \frac{\sqrt{14}i}{56} & 0 & -\frac{\sqrt{7}i}{28} & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{112} & 0 & -\frac{\sqrt{70}i}{56} & 0 & \frac{\sqrt{30}i}{80}
\end{bmatrix}$$

**631** symmetry $\dfrac{\sqrt{5}yz\left(6x^2-y^2-z^2\right)}{2}$

$\mathbb{G}_{4,1}^{(a)}(E_u, 2)$

$$\begin{bmatrix}
\frac{1}{112} & 0 & \frac{\sqrt{10}}{112} & 0 & -\frac{\sqrt{5}}{16} & 0 & 0 & \frac{9\sqrt{6}}{560} & 0 & \frac{3\sqrt{30}}{280} & 0 & -\frac{9\sqrt{2}}{80} & 0 & 0 \\
0 & -\frac{\sqrt{15}}{112} & 0 & -\frac{\sqrt{30}}{112} & 0 & \frac{\sqrt{3}}{16} & \frac{3\sqrt{14}}{80} & 0 & -\frac{3\sqrt{6}}{140} & 0 & -\frac{3\sqrt{10}}{560} & 0 & -\frac{3\sqrt{2}}{40} & 0 \\
-\frac{\sqrt{3}}{16} & 0 & \frac{\sqrt{30}}{112} & 0 & \frac{\sqrt{15}}{112} & 0 & 0 & -\frac{3\sqrt{2}}{40} & 0 & -\frac{3\sqrt{10}}{560} & 0 & -\frac{3\sqrt{6}}{140} & 0 & \frac{3\sqrt{14}}{80} \\
0 & \frac{\sqrt{5}}{16} & 0 & -\frac{\sqrt{10}}{112} & 0 & -\frac{1}{112} & 0 & 0 & -\frac{9\sqrt{2}}{80} & 0 & \frac{3\sqrt{30}}{280} & 0 & \frac{9\sqrt{6}}{560} & 0 \\
0 & -\frac{1}{28} & 0 & \frac{\sqrt{2}}{8} & 0 & 0 & \frac{\sqrt{210}}{560} & 0 & \frac{\sqrt{10}}{56} & 0 & -\frac{\sqrt{6}}{16} & 0 & 0 & 0 \\
\frac{1}{28} & 0 & \frac{\sqrt{10}}{56} & 0 & 0 & 0 & 0 & -\frac{13\sqrt{6}}{560} & 0 & -\frac{\sqrt{30}}{280} & 0 & -\frac{7\sqrt{2}}{80} & 0 & 0 \\
0 & -\frac{\sqrt{10}}{56} & 0 & 0 & 0 & -\frac{\sqrt{2}}{8} & -\frac{3\sqrt{21}}{80} & 0 & \frac{1}{560} & 0 & -\frac{\sqrt{15}}{80} & 0 & \frac{\sqrt{3}}{80} & 0 \\
-\frac{\sqrt{2}}{8} & 0 & 0 & 0 & -\frac{\sqrt{10}}{56} & 0 & 0 & -\frac{\sqrt{3}}{80} & 0 & \frac{\sqrt{15}}{80} & 0 & -\frac{1}{560} & 0 & \frac{3\sqrt{21}}{80} \\
0 & 0 & 0 & \frac{\sqrt{10}}{56} & 0 & \frac{1}{28} & 0 & 0 & \frac{7\sqrt{2}}{80} & 0 & \frac{\sqrt{30}}{280} & 0 & \frac{13\sqrt{6}}{560} & 0 \\
0 & 0 & \frac{\sqrt{2}}{8} & 0 & -\frac{1}{28} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{16} & 0 & -\frac{\sqrt{10}}{56} & 0 & -\frac{\sqrt{210}}{560}
\end{bmatrix}$$

**632** symmetry $\dfrac{\sqrt{5}xz\left(x^2-6y^2+z^2\right)}{2}$

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_{4,2}^{(a)}(E_u, 2)$

$$\begin{pmatrix}
\frac{i}{112} & 0 & -\frac{\sqrt{10}i}{112} & 0 & -\frac{\sqrt{5}i}{16} & 0 & 0 & \frac{9\sqrt{6}i}{560} & 0 & -\frac{3\sqrt{30}i}{280} & 0 & -\frac{9\sqrt{2}i}{80} & 0 & 0 \\
0 & -\frac{\sqrt{15}i}{112} & 0 & \frac{\sqrt{30}i}{112} & 0 & \frac{\sqrt{3}i}{16} & -\frac{3\sqrt{14}i}{80} & 0 & -\frac{3\sqrt{6}i}{140} & 0 & \frac{3\sqrt{10}i}{560} & 0 & -\frac{3\sqrt{2}i}{40} & 0 \\
\frac{\sqrt{3}i}{16} & 0 & \frac{\sqrt{30}i}{112} & 0 & -\frac{\sqrt{15}i}{112} & 0 & 0 & \frac{3\sqrt{2}i}{40} & 0 & -\frac{3\sqrt{10}i}{560} & 0 & \frac{3\sqrt{6}i}{140} & 0 & \frac{3\sqrt{14}i}{80} \\
0 & -\frac{\sqrt{5}i}{16} & 0 & -\frac{\sqrt{10}i}{112} & 0 & \frac{i}{112} & 0 & 0 & \frac{9\sqrt{2}i}{80} & 0 & \frac{3\sqrt{30}i}{280} & 0 & -\frac{9\sqrt{6}i}{560} & 0 \\
0 & \frac{i}{28} & 0 & \frac{\sqrt{2}i}{8} & 0 & 0 & \frac{\sqrt{210}i}{560} & 0 & -\frac{\sqrt{10}i}{56} & 0 & -\frac{\sqrt{6}i}{16} & 0 & 0 & 0 \\
\frac{i}{28} & 0 & -\frac{\sqrt{10}i}{56} & 0 & 0 & 0 & 0 & -\frac{13\sqrt{6}i}{560} & 0 & \frac{\sqrt{30}i}{280} & 0 & -\frac{7\sqrt{2}i}{80} & 0 & 0 \\
0 & -\frac{\sqrt{10}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{2}i}{8} & \frac{3\sqrt{21}i}{80} & 0 & \frac{i}{560} & 0 & \frac{\sqrt{15}i}{80} & 0 & \frac{\sqrt{3}i}{80} & 0 \\
\frac{\sqrt{2}i}{8} & 0 & 0 & 0 & \frac{\sqrt{10}i}{56} & 0 & 0 & \frac{\sqrt{3}i}{80} & 0 & \frac{\sqrt{15}i}{80} & 0 & \frac{i}{560} & 0 & \frac{3\sqrt{21}i}{80} \\
0 & 0 & 0 & \frac{\sqrt{10}i}{56} & 0 & -\frac{i}{28} & 0 & 0 & -\frac{7\sqrt{2}i}{80} & 0 & \frac{\sqrt{30}i}{280} & 0 & -\frac{13\sqrt{6}i}{560} & 0 \\
0 & 0 & -\frac{\sqrt{2}i}{8} & 0 & -\frac{i}{28} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{16} & 0 & -\frac{\sqrt{10}i}{56} & 0 & \frac{\sqrt{210}i}{560}
\end{pmatrix}$$

| 633 | symmetry | $-\frac{x^2}{2} - \frac{y^2}{2} + z^2$ |
|---|---|---|

$\mathbb{G}_2^{(1,-1;a)}(A_{1u})$

$$\begin{pmatrix}
0 & -\frac{3\sqrt{6}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{15}i}{35} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{3i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{6\sqrt{3}i}{35} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{3i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{6\sqrt{3}i}{35} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{3\sqrt{6}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{15}i}{35} & 0 & 0 \\
\frac{\sqrt{6}i}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3i}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{6}i}{105} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{15}i}{70} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{4\sqrt{6}i}{105} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{2}i}{70} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{4\sqrt{6}i}{105} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{2}i}{70} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{105} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{15}i}{70} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{21} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3i}{14} & 0
\end{pmatrix}$$

| 634 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |
|---|---|---|

189

Table 9

| No. | multipole | matrix |
|-----|-----------|--------|

$$\mathbb{G}_2^{(1,-1;a)}(B_{1u}) = \begin{pmatrix}
0 & 0 & 0 & -\frac{3i}{70} & 0 & 0 & -\frac{\sqrt{105}i}{35} & 0 & 0 & 0 & -\frac{\sqrt{3}i}{35} & 0 & 0 & 0 \\
\frac{\sqrt{30}i}{70} & 0 & 0 & 0 & -\frac{\sqrt{6}i}{35} & 0 & 0 & -\frac{3\sqrt{5}i}{35} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{35} & 0 & 0 \\
0 & \frac{\sqrt{6}i}{35} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{70} & 0 & 0 & -\frac{\sqrt{15}i}{35} & 0 & 0 & 0 & -\frac{3\sqrt{5}i}{35} & 0 \\
0 & 0 & \frac{3i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{35} & 0 & 0 & 0 & -\frac{\sqrt{105}i}{35} \\
0 & 0 & \frac{\sqrt{5}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{70} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{3i}{35} & 0 & 0 & -\frac{\sqrt{105}i}{70} & 0 & 0 & 0 & \frac{2\sqrt{3}i}{35} & 0 & 0 & 0 \\
\frac{\sqrt{5}i}{35} & 0 & 0 & 0 & \frac{3i}{35} & 0 & 0 & -\frac{\sqrt{30}i}{35} & 0 & 0 & 0 & \frac{3\sqrt{10}i}{70} & 0 & 0 \\
0 & \frac{3i}{35} & 0 & 0 & 0 & \frac{\sqrt{5}i}{35} & 0 & 0 & -\frac{3\sqrt{10}i}{70} & 0 & 0 & 0 & \frac{\sqrt{30}i}{35} & 0 \\
0 & 0 & \frac{3i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{3}i}{35} & 0 & 0 & 0 & \frac{\sqrt{105}i}{70} \\
0 & 0 & 0 & \frac{\sqrt{5}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{70} & 0 & 0 & 0
\end{pmatrix}$$

| 635 | symmetry | $\sqrt{3}xy$ |
|-----|----------|--------------|

$$\mathbb{G}_2^{(1,-1;a)}(B_{2u}) = \begin{pmatrix}
0 & 0 & 0 & -\frac{3}{70} & 0 & 0 & \frac{\sqrt{105}}{35} & 0 & 0 & 0 & -\frac{\sqrt{3}}{35} & 0 & 0 & 0 \\
-\frac{\sqrt{30}}{70} & 0 & 0 & 0 & -\frac{\sqrt{6}}{35} & 0 & 0 & \frac{3\sqrt{5}}{35} & 0 & 0 & 0 & -\frac{\sqrt{15}}{35} & 0 & 0 \\
0 & -\frac{\sqrt{6}}{35} & 0 & 0 & 0 & -\frac{\sqrt{30}}{70} & 0 & 0 & \frac{\sqrt{15}}{35} & 0 & 0 & 0 & -\frac{3\sqrt{5}}{35} & 0 \\
0 & 0 & -\frac{3}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{35} & 0 & 0 & 0 & -\frac{\sqrt{105}}{35} \\
0 & 0 & \frac{\sqrt{5}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{70} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{3}{35} & 0 & 0 & \frac{\sqrt{105}}{70} & 0 & 0 & 0 & \frac{2\sqrt{3}}{35} & 0 & 0 & 0 \\
-\frac{\sqrt{5}}{35} & 0 & 0 & 0 & \frac{3}{35} & 0 & 0 & \frac{\sqrt{30}}{35} & 0 & 0 & 0 & \frac{3\sqrt{10}}{70} & 0 & 0 \\
0 & -\frac{3}{35} & 0 & 0 & 0 & \frac{\sqrt{5}}{35} & 0 & 0 & \frac{3\sqrt{10}}{70} & 0 & 0 & 0 & \frac{\sqrt{30}}{35} & 0 \\
0 & 0 & -\frac{3}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt{3}}{35} & 0 & 0 & 0 & \frac{\sqrt{105}}{70} \\
0 & 0 & 0 & -\frac{\sqrt{5}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{70} & 0 & 0 & 0
\end{pmatrix}$$

| 636 | symmetry | $\sqrt{3}yz$ |
|-----|----------|--------------|

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_{2,1}^{(1,-1;a)}(E_u)$

$$\begin{pmatrix}
-\frac{3\sqrt{10}}{140} & 0 & -\frac{9}{140} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{15}}{35} & 0 & -\frac{2\sqrt{3}}{35} & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{6}}{140} & 0 & -\frac{\sqrt{3}}{28} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{15}}{35} & 0 & -\frac{6}{35} & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{3}}{28} & 0 & -\frac{\sqrt{6}}{140} & 0 & 0 & 0 & 0 & -\frac{6}{35} & 0 & -\frac{2\sqrt{15}}{35} & 0 & 0 \\
0 & 0 & 0 & \frac{9}{140} & 0 & \frac{3\sqrt{10}}{140} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{3}}{35} & 0 & -\frac{2\sqrt{15}}{35} & 0 \\
0 & \frac{\sqrt{10}}{35} & 0 & 0 & 0 & 0 & \frac{\sqrt{21}}{28} & 0 & \frac{3}{28} & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{10}}{35} & 0 & \frac{2}{35} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{140} & 0 & \frac{11\sqrt{3}}{140} & 0 & 0 & 0 & 0 \\
0 & -\frac{2}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}}{140} & 0 & \frac{\sqrt{6}}{20} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{2}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{20} & 0 & \frac{3\sqrt{10}}{140} & 0 & 0 \\
0 & 0 & 0 & \frac{2}{35} & 0 & -\frac{\sqrt{10}}{35} & 0 & 0 & 0 & 0 & -\frac{11\sqrt{3}}{140} & 0 & -\frac{\sqrt{15}}{140} & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{10}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3}{28} & 0 & -\frac{\sqrt{21}}{28}
\end{pmatrix}$$

| 637 | symmetry | $-\sqrt{3}xz$ |
|---|---|---|

$\mathbb{G}_{2,2}^{(1,-1;a)}(E_u)$

$$\begin{pmatrix}
-\frac{3\sqrt{10}i}{140} & 0 & \frac{9i}{140} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{15}i}{35} & 0 & \frac{2\sqrt{3}i}{35} & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{6}i}{140} & 0 & \frac{\sqrt{3}i}{28} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{15}i}{35} & 0 & \frac{6i}{35} & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{3}i}{28} & 0 & \frac{\sqrt{6}i}{140} & 0 & 0 & 0 & 0 & -\frac{6i}{35} & 0 & \frac{2\sqrt{15}i}{35} & 0 & 0 \\
0 & 0 & 0 & \frac{9i}{140} & 0 & -\frac{3\sqrt{10}i}{140} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{3}i}{35} & 0 & \frac{2\sqrt{15}i}{35} & 0 \\
0 & -\frac{\sqrt{10}i}{35} & 0 & 0 & 0 & 0 & \frac{\sqrt{21}i}{28} & 0 & -\frac{3i}{28} & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{10}i}{35} & 0 & -\frac{2i}{35} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{140} & 0 & -\frac{11\sqrt{3}i}{140} & 0 & 0 & 0 & 0 \\
0 & -\frac{2i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}i}{140} & 0 & -\frac{\sqrt{6}i}{20} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{2i}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{20} & 0 & -\frac{3\sqrt{10}i}{140} & 0 & 0 \\
0 & 0 & 0 & \frac{2i}{35} & 0 & \frac{\sqrt{10}i}{35} & 0 & 0 & 0 & 0 & -\frac{11\sqrt{3}i}{140} & 0 & \frac{\sqrt{15}i}{140} & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3i}{28} & 0 & \frac{\sqrt{21}i}{28}
\end{pmatrix}$$

| 638 | symmetry | $\frac{\sqrt{21}\left(x^4-3x^2y^2-3x^2z^2+y^4-3y^2z^2+z^4\right)}{6}$ |
|---|---|---|

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_4^{(1,-1;a)}(A_{1u},1)$

$$\begin{bmatrix}
0 & \frac{\sqrt{7}i}{168} & 0 & 0 & 0 & \frac{\sqrt{35}i}{168} & 0 & 0 & \frac{\sqrt{70}i}{56} & 0 & 0 & 0 & \frac{\sqrt{210}i}{168} & 0 \\
0 & 0 & -\frac{\sqrt{42}i}{168} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{14}i}{168} & 0 & 0 & 0 & \frac{\sqrt{10}i}{24} \\
0 & 0 & 0 & \frac{\sqrt{42}i}{168} & 0 & 0 & \frac{\sqrt{10}i}{24} & 0 & 0 & 0 & -\frac{5\sqrt{14}i}{168} & 0 & 0 & 0 \\
-\frac{\sqrt{35}i}{168} & 0 & 0 & 0 & -\frac{\sqrt{7}i}{168} & 0 & 0 & \frac{\sqrt{210}i}{168} & 0 & 0 & 0 & \frac{\sqrt{70}i}{56} & 0 & 0 \\
-\frac{\sqrt{7}i}{84} & 0 & 0 & 0 & -\frac{\sqrt{35}i}{84} & 0 & 0 & -\frac{5\sqrt{42}i}{168} & 0 & 0 & 0 & -\frac{5\sqrt{14}i}{168} & 0 & 0 \\
0 & \frac{\sqrt{7}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{35}i}{84} & 0 & 0 & \frac{\sqrt{70}i}{42} & 0 & 0 & 0 & -\frac{\sqrt{210}i}{84} & 0 \\
0 & 0 & -\frac{\sqrt{7}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{21}i}{168} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{24} \\
0 & 0 & 0 & -\frac{\sqrt{7}i}{42} & 0 & 0 & \frac{\sqrt{15}i}{24} & 0 & 0 & 0 & -\frac{5\sqrt{21}i}{168} & 0 & 0 & 0 \\
-\frac{\sqrt{35}i}{84} & 0 & 0 & 0 & \frac{\sqrt{7}i}{28} & 0 & 0 & \frac{\sqrt{210}i}{84} & 0 & 0 & 0 & -\frac{\sqrt{70}i}{42} & 0 & 0 \\
0 & -\frac{\sqrt{35}i}{84} & 0 & 0 & 0 & -\frac{\sqrt{7}i}{84} & 0 & 0 & \frac{5\sqrt{14}i}{168} & 0 & 0 & 0 & \frac{5\sqrt{42}i}{168} & 0
\end{bmatrix}$$

639  symmetry

$$-\frac{\sqrt{15}\left(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4\right)}{12}$$

$\mathbb{G}_4^{(1,-1;a)}(A_{1u},2)$

$$\begin{bmatrix}
0 & \frac{\sqrt{5}i}{168} & 0 & 0 & 0 & -\frac{i}{24} & 0 & 0 & \frac{5\sqrt{2}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{6}i}{24} & 0 \\
0 & 0 & -\frac{\sqrt{30}i}{168} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{10}i}{168} & 0 & 0 & 0 & -\frac{\sqrt{14}i}{24} \\
0 & 0 & 0 & \frac{\sqrt{30}i}{168} & 0 & 0 & -\frac{\sqrt{14}i}{24} & 0 & 0 & 0 & -\frac{5\sqrt{10}i}{168} & 0 & 0 & 0 \\
\frac{i}{24} & 0 & 0 & 0 & -\frac{\sqrt{5}i}{168} & 0 & 0 & -\frac{\sqrt{6}i}{24} & 0 & 0 & 0 & \frac{5\sqrt{2}i}{56} & 0 & 0 \\
-\frac{\sqrt{5}i}{84} & 0 & 0 & 0 & \frac{i}{12} & 0 & 0 & -\frac{5\sqrt{30}i}{168} & 0 & 0 & 0 & \frac{\sqrt{10}i}{24} & 0 & 0 \\
0 & \frac{\sqrt{5}i}{28} & 0 & 0 & 0 & \frac{i}{12} & 0 & 0 & \frac{5\sqrt{2}i}{42} & 0 & 0 & 0 & \frac{\sqrt{6}i}{12} & 0 \\
0 & 0 & -\frac{\sqrt{5}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{15}i}{168} & 0 & 0 & 0 & \frac{\sqrt{21}i}{24} \\
0 & 0 & 0 & -\frac{\sqrt{5}i}{42} & 0 & 0 & -\frac{\sqrt{21}i}{24} & 0 & 0 & 0 & -\frac{5\sqrt{15}i}{168} & 0 & 0 & 0 \\
\frac{i}{12} & 0 & 0 & 0 & \frac{\sqrt{5}i}{28} & 0 & 0 & -\frac{\sqrt{6}i}{12} & 0 & 0 & 0 & -\frac{5\sqrt{2}i}{42} & 0 & 0 \\
0 & \frac{i}{12} & 0 & 0 & 0 & -\frac{\sqrt{5}i}{84} & 0 & 0 & -\frac{\sqrt{10}i}{24} & 0 & 0 & 0 & \frac{5\sqrt{30}i}{168} & 0
\end{bmatrix}$$

640  symmetry

$$\frac{\sqrt{35}xy(x-y)(x+y)}{2}$$

Table 9

| No. | multipole | matrix |
|---|---|---|
|  | $\mathbb{G}_4^{(1,-1;a)}(A_{2u})$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{28} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{12} \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \frac{\sqrt{21}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{28} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{21}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{84} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{14} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{4} \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \frac{\sqrt{21}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{21}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{84} & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$ |
| 641 | symmetry | $\dfrac{\sqrt{5}(x-y)(x+y)\left(x^2+y^2-6z^2\right)}{4}$ |
|  | $\mathbb{G}_4^{(1,-1;a)}(B_{1u})$ | $\begin{bmatrix} 0 & 0 & 0 & -\frac{\sqrt{30}i}{168} & 0 & 0 & -\frac{\sqrt{14}i}{56} & 0 & 0 & 0 & -\frac{3\sqrt{10}i}{56} & 0 & 0 & 0 \\ \frac{i}{56} & 0 & 0 & 0 & \frac{\sqrt{5}i}{56} & 0 & 0 & \frac{11\sqrt{6}i}{168} & 0 & 0 & 0 & -\frac{\sqrt{2}i}{56} & 0 & 0 \\ 0 & -\frac{\sqrt{5}i}{56} & 0 & 0 & 0 & -\frac{i}{56} & 0 & 0 & -\frac{\sqrt{2}i}{56} & 0 & 0 & 0 & \frac{11\sqrt{6}i}{168} & 0 \\ 0 & 0 & \frac{\sqrt{30}i}{168} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{14}i}{56} \\ 0 & 0 & \frac{\sqrt{6}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{2}i}{28} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{30}i}{84} & 0 & 0 & -\frac{3\sqrt{14}i}{56} & 0 & 0 & 0 & \frac{\sqrt{10}i}{56} & 0 & 0 & 0 \\ \frac{\sqrt{6}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{84} & 0 & 0 & \frac{9i}{56} & 0 & 0 & 0 & -\frac{17\sqrt{3}i}{168} & 0 & 0 \\ 0 & -\frac{\sqrt{30}i}{84} & 0 & 0 & 0 & \frac{\sqrt{6}i}{28} & 0 & 0 & \frac{17\sqrt{3}i}{168} & 0 & 0 & 0 & -\frac{9i}{56} & 0 \\ 0 & 0 & -\frac{\sqrt{30}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{56} & 0 & 0 & 0 & \frac{3\sqrt{14}i}{56} \\ 0 & 0 & 0 & \frac{\sqrt{6}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{2}i}{28} & 0 & 0 & 0 \end{bmatrix}$ |
| 642 | symmetry | $-\dfrac{\sqrt{5}xy\left(x^2+y^2-6z^2\right)}{2}$ |

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_4^{(1,-1;a)}(B_{2u})$

$$\begin{bmatrix}
0 & 0 & 0 & \frac{\sqrt{30}}{168} & 0 & 0 & -\frac{\sqrt{14}}{56} & 0 & 0 & 0 & \frac{3\sqrt{10}}{56} & 0 & 0 & 0 \\
\frac{1}{56} & 0 & 0 & 0 & -\frac{\sqrt{5}}{56} & 0 & 0 & \frac{11\sqrt{6}}{168} & 0 & 0 & 0 & \frac{\sqrt{2}}{56} & 0 & 0 \\
0 & -\frac{\sqrt{5}}{56} & 0 & 0 & 0 & \frac{1}{56} & 0 & 0 & -\frac{\sqrt{2}}{56} & 0 & 0 & 0 & -\frac{11\sqrt{6}}{168} & 0 \\
0 & 0 & \frac{\sqrt{30}}{168} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}}{56} & 0 & 0 & 0 & \frac{\sqrt{14}}{56} \\
0 & 0 & -\frac{\sqrt{6}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{2}}{28} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{30}}{84} & 0 & 0 & -\frac{3\sqrt{14}}{56} & 0 & 0 & 0 & -\frac{\sqrt{10}}{56} & 0 & 0 & 0 \\
\frac{\sqrt{6}}{28} & 0 & 0 & 0 & \frac{\sqrt{30}}{84} & 0 & 0 & \frac{9}{56} & 0 & 0 & 0 & \frac{17\sqrt{3}}{168} & 0 & 0 \\
0 & -\frac{\sqrt{30}}{84} & 0 & 0 & 0 & -\frac{\sqrt{6}}{28} & 0 & 0 & \frac{17\sqrt{3}}{168} & 0 & 0 & 0 & \frac{9}{56} & 0 \\
0 & 0 & -\frac{\sqrt{30}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{56} & 0 & 0 & 0 & -\frac{3\sqrt{14}}{56} \\
0 & 0 & 0 & \frac{\sqrt{6}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{2}}{28} & 0 & 0 & 0
\end{bmatrix}$$

643   symmetry

$$\frac{\sqrt{35}\,yz(y-z)(y+z)}{2}$$

$\mathbb{G}_{4,1}^{(1,-1;a)}(E_u,1)$

$$\begin{bmatrix}
-\frac{\sqrt{21}}{672} & 0 & -\frac{\sqrt{210}}{672} & 0 & -\frac{\sqrt{105}}{672} & 0 & 0 & -\frac{3\sqrt{14}}{112} & 0 & -\frac{\sqrt{70}}{56} & 0 & -\frac{\sqrt{42}}{112} & 0 & 0 \\
0 & \frac{\sqrt{35}}{224} & 0 & \frac{\sqrt{70}}{224} & 0 & \frac{\sqrt{7}}{224} & \frac{\sqrt{6}}{48} & 0 & \frac{\sqrt{14}}{28} & 0 & \frac{\sqrt{210}}{336} & 0 & -\frac{\sqrt{42}}{168} & 0 \\
-\frac{\sqrt{7}}{224} & 0 & -\frac{\sqrt{70}}{224} & 0 & -\frac{\sqrt{35}}{224} & 0 & 0 & -\frac{\sqrt{42}}{168} & 0 & \frac{\sqrt{210}}{336} & 0 & \frac{\sqrt{14}}{28} & 0 & \frac{\sqrt{6}}{48} \\
0 & \frac{\sqrt{105}}{672} & 0 & \frac{\sqrt{210}}{672} & 0 & \frac{\sqrt{21}}{672} & 0 & 0 & -\frac{\sqrt{42}}{112} & 0 & -\frac{\sqrt{70}}{56} & 0 & -\frac{3\sqrt{14}}{112} & 0 \\
0 & \frac{\sqrt{21}}{84} & 0 & \frac{\sqrt{42}}{168} & 0 & 0 & \frac{\sqrt{10}}{32} & 0 & \frac{5\sqrt{210}}{336} & 0 & \frac{5\sqrt{14}}{224} & 0 & 0 & 0 \\
-\frac{\sqrt{21}}{84} & 0 & -\frac{\sqrt{210}}{168} & 0 & 0 & 0 & 0 & -\frac{13\sqrt{14}}{224} & 0 & -\frac{\sqrt{70}}{112} & 0 & \frac{\sqrt{42}}{96} & 0 & 0 \\
0 & \frac{\sqrt{210}}{168} & 0 & 0 & 0 & -\frac{\sqrt{42}}{168} & \frac{3}{32} & 0 & \frac{\sqrt{21}}{672} & 0 & -\frac{\sqrt{35}}{32} & 0 & -\frac{\sqrt{7}}{224} & 0 \\
-\frac{\sqrt{42}}{168} & 0 & 0 & 0 & \frac{\sqrt{210}}{168} & 0 & 0 & \frac{\sqrt{7}}{224} & 0 & \frac{\sqrt{35}}{32} & 0 & -\frac{\sqrt{21}}{672} & 0 & -\frac{3}{32} \\
0 & 0 & 0 & -\frac{\sqrt{210}}{168} & 0 & -\frac{\sqrt{21}}{84} & 0 & 0 & -\frac{\sqrt{42}}{96} & 0 & \frac{\sqrt{70}}{112} & 0 & \frac{13\sqrt{14}}{224} & 0 \\
0 & 0 & \frac{\sqrt{42}}{168} & 0 & \frac{\sqrt{21}}{84} & 0 & 0 & 0 & 0 & -\frac{5\sqrt{14}}{224} & 0 & -\frac{5\sqrt{210}}{336} & 0 & -\frac{\sqrt{10}}{32}
\end{bmatrix}$$

644   symmetry

$$-\frac{\sqrt{35}\,xz(x-z)(x+z)}{2}$$

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{G}_{4,2}^{(1,-1;a)}(E_u,1)$ | $$\begin{pmatrix} -\frac{\sqrt{21}i}{672} & 0 & \frac{\sqrt{210}i}{672} & 0 & -\frac{\sqrt{105}i}{672} & 0 & 0 & -\frac{3\sqrt{14}i}{112} & 0 & \frac{\sqrt{70}i}{56} & 0 & -\frac{\sqrt{42}i}{112} & 0 & 0 \\ 0 & \frac{\sqrt{35}i}{224} & 0 & -\frac{\sqrt{70}i}{224} & 0 & \frac{\sqrt{7}i}{224} & -\frac{\sqrt{6}i}{48} & 0 & \frac{\sqrt{14}i}{28} & 0 & -\frac{\sqrt{210}i}{336} & 0 & -\frac{\sqrt{42}i}{168} & 0 \\ \frac{\sqrt{7}i}{224} & 0 & -\frac{\sqrt{70}i}{224} & 0 & \frac{\sqrt{35}i}{224} & 0 & 0 & \frac{\sqrt{42}i}{168} & 0 & \frac{\sqrt{210}i}{336} & 0 & -\frac{\sqrt{14}i}{28} & 0 & \frac{\sqrt{6}i}{48} \\ 0 & -\frac{\sqrt{105}i}{672} & 0 & \frac{\sqrt{210}i}{672} & 0 & -\frac{\sqrt{21}i}{672} & 0 & 0 & \frac{\sqrt{42}i}{112} & 0 & -\frac{\sqrt{70}i}{56} & 0 & \frac{3\sqrt{14}i}{112} & 0 \\ 0 & -\frac{\sqrt{21}i}{84} & 0 & \frac{\sqrt{42}i}{168} & 0 & 0 & \frac{\sqrt{10}i}{32} & 0 & -\frac{5\sqrt{210}i}{336} & 0 & \frac{5\sqrt{14}i}{224} & 0 & 0 & 0 \\ -\frac{\sqrt{21}i}{84} & 0 & \frac{\sqrt{210}i}{168} & 0 & 0 & 0 & 0 & -\frac{13\sqrt{14}i}{224} & 0 & \frac{\sqrt{70}i}{112} & 0 & \frac{\sqrt{42}i}{96} & 0 & 0 \\ 0 & \frac{\sqrt{210}i}{168} & 0 & 0 & 0 & -\frac{\sqrt{42}i}{168} & -\frac{3i}{32} & 0 & \frac{\sqrt{21}i}{672} & 0 & \frac{\sqrt{35}i}{32} & 0 & -\frac{\sqrt{7}i}{224} & 0 \\ \frac{\sqrt{42}i}{168} & 0 & 0 & 0 & -\frac{\sqrt{210}i}{168} & 0 & 0 & -\frac{\sqrt{7}i}{224} & 0 & \frac{\sqrt{35}i}{32} & 0 & \frac{\sqrt{21}i}{672} & 0 & -\frac{3i}{32} \\ 0 & 0 & 0 & -\frac{\sqrt{210}i}{168} & 0 & \frac{\sqrt{21}i}{84} & 0 & 0 & \frac{\sqrt{42}i}{96} & 0 & \frac{\sqrt{70}i}{112} & 0 & -\frac{13\sqrt{14}i}{224} & 0 \\ 0 & 0 & -\frac{\sqrt{42}i}{168} & 0 & \frac{\sqrt{21}i}{84} & 0 & 0 & 0 & 0 & \frac{5\sqrt{14}i}{224} & 0 & -\frac{5\sqrt{210}i}{336} & 0 & \frac{\sqrt{10}i}{32} \end{pmatrix}$$ |
| 645 | symmetry | $\dfrac{\sqrt{5}yz\left(6x^2-y^2-z^2\right)}{2}$ |
| | $\mathbb{G}_{4,1}^{(1,-1;a)}(E_u,2)$ | $$\begin{bmatrix} -\frac{\sqrt{3}}{672} & 0 & -\frac{\sqrt{30}}{672} & 0 & \frac{\sqrt{15}}{96} & 0 & 0 & -\frac{3\sqrt{2}}{112} & 0 & -\frac{\sqrt{10}}{56} & 0 & \frac{\sqrt{6}}{16} & 0 & 0 \\ 0 & \frac{\sqrt{5}}{224} & 0 & \frac{\sqrt{10}}{224} & 0 & -\frac{1}{32} & -\frac{\sqrt{42}}{48} & 0 & \frac{\sqrt{2}}{28} & 0 & \frac{\sqrt{30}}{336} & 0 & \frac{\sqrt{6}}{24} & 0 \\ \frac{1}{32} & 0 & -\frac{\sqrt{10}}{224} & 0 & -\frac{\sqrt{5}}{224} & 0 & 0 & \frac{\sqrt{6}}{24} & 0 & \frac{\sqrt{30}}{336} & 0 & \frac{\sqrt{2}}{28} & 0 & -\frac{\sqrt{42}}{48} \\ 0 & -\frac{\sqrt{15}}{96} & 0 & \frac{\sqrt{30}}{672} & 0 & \frac{\sqrt{3}}{672} & 0 & 0 & \frac{\sqrt{6}}{16} & 0 & -\frac{\sqrt{10}}{56} & 0 & -\frac{3\sqrt{2}}{112} & 0 \\ 0 & \frac{\sqrt{3}}{84} & 0 & -\frac{\sqrt{6}}{24} & 0 & 0 & \frac{\sqrt{70}}{224} & 0 & \frac{5\sqrt{30}}{336} & 0 & -\frac{5\sqrt{2}}{32} & 0 & 0 & 0 \\ -\frac{\sqrt{3}}{84} & 0 & -\frac{\sqrt{30}}{168} & 0 & 0 & 0 & 0 & -\frac{13\sqrt{2}}{224} & 0 & -\frac{\sqrt{10}}{112} & 0 & -\frac{7\sqrt{6}}{96} & 0 & 0 \\ 0 & \frac{\sqrt{30}}{168} & 0 & 0 & 0 & \frac{\sqrt{6}}{24} & -\frac{3\sqrt{7}}{32} & 0 & \frac{\sqrt{3}}{672} & 0 & -\frac{\sqrt{5}}{32} & 0 & \frac{1}{32} & 0 \\ \frac{\sqrt{6}}{24} & 0 & 0 & 0 & \frac{\sqrt{30}}{168} & 0 & 0 & -\frac{1}{32} & 0 & \frac{\sqrt{5}}{32} & 0 & -\frac{\sqrt{3}}{672} & 0 & \frac{3\sqrt{7}}{32} \\ 0 & 0 & 0 & -\frac{\sqrt{30}}{168} & 0 & -\frac{\sqrt{3}}{84} & 0 & 0 & \frac{7\sqrt{6}}{96} & 0 & \frac{\sqrt{10}}{112} & 0 & \frac{13\sqrt{2}}{224} & 0 \\ 0 & 0 & -\frac{\sqrt{6}}{24} & 0 & \frac{\sqrt{3}}{84} & 0 & 0 & 0 & 0 & \frac{5\sqrt{2}}{32} & 0 & -\frac{5\sqrt{30}}{336} & 0 & -\frac{\sqrt{70}}{224} \end{bmatrix}$$ |
| 646 | symmetry | $\dfrac{\sqrt{5}xz\left(x^2-6y^2+z^2\right)}{2}$ |

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_{4,2}^{(1,-1;a)}(E_u,2)$

$$\begin{bmatrix}
-\frac{\sqrt{3}i}{672} & 0 & \frac{\sqrt{30}i}{672} & 0 & \frac{\sqrt{15}i}{96} & 0 & 0 & -\frac{3\sqrt{2}i}{112} & 0 & \frac{\sqrt{10}i}{56} & 0 & \frac{\sqrt{6}i}{16} & 0 & 0 \\
0 & \frac{\sqrt{5}i}{224} & 0 & -\frac{\sqrt{10}i}{224} & 0 & -\frac{i}{32} & \frac{\sqrt{42}i}{48} & 0 & \frac{\sqrt{2}i}{28} & 0 & -\frac{\sqrt{30}i}{336} & 0 & \frac{\sqrt{6}i}{24} & 0 \\
-\frac{i}{32} & 0 & -\frac{\sqrt{10}i}{224} & 0 & \frac{\sqrt{5}i}{224} & 0 & 0 & -\frac{\sqrt{6}i}{24} & 0 & \frac{\sqrt{30}i}{336} & 0 & -\frac{\sqrt{2}i}{28} & 0 & -\frac{\sqrt{42}i}{48} \\
0 & \frac{\sqrt{15}i}{96} & 0 & \frac{\sqrt{30}i}{672} & 0 & -\frac{\sqrt{3}i}{672} & 0 & 0 & -\frac{\sqrt{6}i}{16} & 0 & -\frac{\sqrt{10}i}{56} & 0 & \frac{3\sqrt{2}i}{112} & 0 \\
0 & -\frac{\sqrt{3}i}{84} & 0 & -\frac{\sqrt{6}i}{24} & 0 & 0 & \frac{\sqrt{70}i}{224} & 0 & -\frac{5\sqrt{30}i}{336} & 0 & -\frac{5\sqrt{2}i}{32} & 0 & 0 & 0 \\
-\frac{\sqrt{3}i}{84} & 0 & \frac{\sqrt{30}i}{168} & 0 & 0 & 0 & 0 & -\frac{13\sqrt{2}i}{224} & 0 & \frac{\sqrt{10}i}{112} & 0 & -\frac{7\sqrt{6}i}{96} & 0 & 0 \\
0 & \frac{\sqrt{30}i}{168} & 0 & 0 & 0 & \frac{\sqrt{6}i}{24} & \frac{3\sqrt{7}i}{32} & 0 & \frac{\sqrt{3}i}{672} & 0 & \frac{\sqrt{5}i}{32} & 0 & \frac{i}{32} & 0 \\
-\frac{\sqrt{6}i}{24} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{168} & 0 & 0 & \frac{i}{32} & 0 & \frac{\sqrt{5}i}{32} & 0 & \frac{\sqrt{3}i}{672} & 0 & \frac{3\sqrt{7}i}{32} \\
0 & 0 & 0 & -\frac{\sqrt{30}i}{168} & 0 & \frac{\sqrt{3}i}{84} & 0 & 0 & -\frac{7\sqrt{6}i}{96} & 0 & \frac{\sqrt{10}i}{112} & 0 & -\frac{13\sqrt{2}i}{224} & 0 \\
0 & 0 & \frac{\sqrt{6}i}{24} & 0 & \frac{\sqrt{3}i}{84} & 0 & 0 & 0 & 0 & -\frac{5\sqrt{2}i}{32} & 0 & -\frac{5\sqrt{30}i}{336} & 0 & \frac{\sqrt{70}i}{224}
\end{bmatrix}$$

**647  symmetry**

$$\frac{\sqrt{2}\left(2x^6-15x^4y^2-15x^4z^2-15x^2y^4+180x^2y^2z^2-15x^2z^4+2y^6-15y^4z^2-15y^2z^4+2z^6\right)}{8}$$

$\mathbb{G}_{6}^{(1,-1;a)}(A_{1u},1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{33}i}{264} & 0 & 0 & 0 & -\frac{7\sqrt{11}i}{88} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{55}i}{88} & 0 & 0 & 0 & \frac{7\sqrt{165}i}{264} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{66}i}{264} & 0 & 0 & 0 & -\frac{\sqrt{2310}i}{264} \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2310}i}{264} & 0 & 0 & 0 & -\frac{5\sqrt{66}i}{264} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{7\sqrt{165}i}{264} & 0 & 0 & 0 & \frac{\sqrt{55}i}{88} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{7\sqrt{11}i}{88} & 0 & 0 & 0 & -\frac{\sqrt{33}i}{264}
\end{bmatrix}$$

**648  symmetry**

$$-\frac{\sqrt{14}\left(x^6-15x^4z^2+15x^2z^4+y^6-15y^4z^2+15y^2z^4-2z^6\right)}{8}$$

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_6^{(1,-1;a)}(A_{1u},2)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{231}i}{264} & 0 & 0 & 0 & \frac{\sqrt{77}i}{88} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{385}i}{88} & 0 & 0 & 0 & -\frac{\sqrt{1155}i}{264} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{462}i}{264} & 0 & 0 & 0 & \frac{\sqrt{330}i}{264} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{330}i}{264} & 0 & 0 & 0 & -\frac{5\sqrt{462}i}{264} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{1155}i}{264} & 0 & 0 & 0 & \frac{\sqrt{385}i}{88} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{77}i}{88} & 0 & 0 & 0 & -\frac{\sqrt{231}i}{264} & 0
\end{pmatrix}$$

| 649 | symmetry | $-\dfrac{3\sqrt{7}xy(x-y)(x+y)\left(x^2+y^2-10z^2\right)}{4}$ |

$\mathbb{G}_6^{(1,-1;a)}(A_{2u})$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{154}}{44} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2310}}{132} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{165}}{66} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{165}}{66} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2310}}{132} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{154}}{44} & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

| 650 | symmetry | $-\dfrac{\sqrt{2310}(x-y)(x+y)(x-z)(x+z)(y-z)(y+z)}{8}$ |

Table 9

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{G}_6^{(1,-1;a)}(B_{1u},1)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{24} & 0 & 0 & 0 & \frac{\sqrt{5}i}{8} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{i}{24} & 0 & 0 & 0 & \frac{\sqrt{35}i}{24} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}i}{24} & 0 & 0 & 0 & -\frac{\sqrt{42}i}{24} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{24} & 0 & 0 & 0 & \frac{\sqrt{14}i}{24} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{35}i}{24} & 0 & 0 & 0 & -\frac{i}{24} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}i}{8} & 0 & 0 & 0 & \frac{\sqrt{7}i}{24} & 0 & 0 & 0
\end{pmatrix}$$

| 651 | symmetry | $\dfrac{\sqrt{42}(x-y)(x+y)\left(x^4-9x^2y^2-5x^2z^2+y^4-5y^2z^2+5z^4\right)}{8}$ |

$\mathbb{G}_6^{(1,-1;a)}(B_{1u},2)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{385}i}{264} & 0 & 0 & 0 & \frac{\sqrt{11}i}{8} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{55}i}{264} & 0 & 0 & 0 & -\frac{5\sqrt{77}i}{264} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{770}i}{264} & 0 & 0 & 0 & \frac{\sqrt{2310}i}{264} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2310}i}{264} & 0 & 0 & 0 & -\frac{\sqrt{770}i}{264} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{77}i}{264} & 0 & 0 & 0 & \frac{\sqrt{55}i}{264} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{11}i}{8} & 0 & 0 & 0 & -\frac{\sqrt{385}i}{264} & 0 & 0 & 0
\end{pmatrix}$$

| 652 | symmetry | $\dfrac{\sqrt{462}xy\left(x^2-3y^2\right)\left(3x^2-y^2\right)}{16}$ |

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{G}_6^{(1,-1;a)}(B_{2u},1)$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{2} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{2} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$ |
| 653 | symmetry | $\dfrac{\sqrt{210}\,xy\left(x^4+2x^2y^2-16x^2z^2+y^4-16y^2z^2+16z^4\right)}{16}$ |
| | $\mathbb{G}_6^{(1,-1;a)}(B_{2u},2)$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{77}}{66} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{11}}{66} & 0 & 0 & 0 & -\frac{\sqrt{385}}{66} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{154}}{66} & 0 & 0 & 0 & \frac{\sqrt{462}}{66} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{462}}{66} & 0 & 0 & 0 & -\frac{\sqrt{154}}{66} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{385}}{66} & 0 & 0 & 0 & \frac{\sqrt{11}}{66} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{77}}{66} & 0 & 0 & 0 \end{bmatrix}$ |
| 654 | symmetry | $\dfrac{3\sqrt{7}\,yz(y-z)(y+z)\left(10x^2-y^2-z^2\right)}{4}$ |

*continued ...*

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# Table 9

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{G}_{6,1}^{(1,-1;a)}(E_u,1)$$

$$
\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{66}}{1056} & 0 & \frac{\sqrt{154}}{352} & 0 & -\frac{\sqrt{2310}}{352} & 0 & -\frac{\sqrt{462}}{96} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2310}}{1056} & 0 & -\frac{5\sqrt{462}}{1056} & 0 & \frac{3\sqrt{770}}{352} & 0 & \frac{\sqrt{330}}{96} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{165}}{176} & 0 & \frac{\sqrt{385}}{176} & 0 & \frac{5\sqrt{231}}{528} & 0 & -\frac{\sqrt{1155}}{176} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{1155}}{176} & 0 & -\frac{5\sqrt{231}}{528} & 0 & -\frac{\sqrt{385}}{176} & 0 & \frac{\sqrt{165}}{176} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{330}}{96} & 0 & -\frac{3\sqrt{770}}{352} & 0 & \frac{5\sqrt{462}}{1056} & 0 & \frac{\sqrt{2310}}{1056} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{462}}{96} & 0 & \frac{\sqrt{2310}}{352} & 0 & -\frac{\sqrt{154}}{352} & 0 & -\frac{\sqrt{66}}{1056}
\end{bmatrix}
$$

| 655 | symmetry | $\dfrac{3\sqrt{7}xz(x-z)(x+z)\left(x^2-10y^2+z^2\right)}{4}$ |
|---|---|---|

$$\mathbb{G}_{6,2}^{(1,-1;a)}(E_u,1)$$

$$
\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{66}i}{1056} & 0 & -\frac{\sqrt{154}i}{352} & 0 & -\frac{\sqrt{2310}i}{352} & 0 & \frac{\sqrt{462}i}{96} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2310}i}{1056} & 0 & \frac{5\sqrt{462}i}{1056} & 0 & \frac{3\sqrt{770}i}{352} & 0 & -\frac{\sqrt{330}i}{96} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{165}i}{176} & 0 & \frac{\sqrt{385}i}{176} & 0 & -\frac{5\sqrt{231}i}{528} & 0 & -\frac{\sqrt{1155}i}{176} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{1155}i}{176} & 0 & -\frac{5\sqrt{231}i}{528} & 0 & \frac{\sqrt{385}i}{176} & 0 & \frac{\sqrt{165}i}{176} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{330}i}{96} & 0 & \frac{3\sqrt{770}i}{352} & 0 & \frac{5\sqrt{462}i}{1056} & 0 & -\frac{\sqrt{2310}i}{1056} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{462}i}{96} & 0 & -\frac{\sqrt{2310}i}{352} & 0 & -\frac{\sqrt{154}i}{352} & 0 & \frac{\sqrt{66}i}{1056}
\end{bmatrix}
$$

| 656 | symmetry | $\dfrac{\sqrt{462}yz\left(y^2-3z^2\right)\left(3y^2-z^2\right)}{16}$ |
|---|---|---|

Table 9

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{G}_{6,1}^{(1,-1;a)}(E_u,2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{64} & 0 & \frac{\sqrt{21}}{64} & 0 & \frac{\sqrt{35}}{64} & 0 & \frac{\sqrt{7}}{64} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{35}}{64} & 0 & -\frac{5\sqrt{7}}{64} & 0 & -\frac{\sqrt{105}}{64} & 0 & -\frac{\sqrt{5}}{64} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{64} & 0 & \frac{\sqrt{210}}{64} & 0 & \frac{5\sqrt{14}}{64} & 0 & \frac{\sqrt{70}}{64} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{64} & 0 & -\frac{5\sqrt{14}}{64} & 0 & -\frac{\sqrt{210}}{64} & 0 & -\frac{\sqrt{10}}{64} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{64} & 0 & \frac{\sqrt{105}}{64} & 0 & \frac{5\sqrt{7}}{64} & 0 & \frac{\sqrt{35}}{64} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{64} & 0 & -\frac{\sqrt{35}}{64} & 0 & -\frac{\sqrt{21}}{64} & 0 & -\frac{1}{64}
\end{bmatrix}$$

| 657 | symmetry | $-\dfrac{\sqrt{462}\,xz\left(x^2-3z^2\right)\left(3x^2-z^2\right)}{16}$ |

$\mathbb{G}_{6,2}^{(1,-1;a)}(E_u,2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{i}{64} & 0 & -\frac{\sqrt{21}i}{64} & 0 & \frac{\sqrt{35}i}{64} & 0 & -\frac{\sqrt{7}i}{64} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{35}i}{64} & 0 & \frac{5\sqrt{7}i}{64} & 0 & -\frac{\sqrt{105}i}{64} & 0 & \frac{\sqrt{5}i}{64} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{64} & 0 & \frac{\sqrt{210}i}{64} & 0 & -\frac{5\sqrt{14}i}{64} & 0 & \frac{\sqrt{70}i}{64} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{64} & 0 & -\frac{5\sqrt{14}i}{64} & 0 & \frac{\sqrt{210}i}{64} & 0 & -\frac{\sqrt{10}i}{64} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}i}{64} & 0 & -\frac{\sqrt{105}i}{64} & 0 & \frac{5\sqrt{7}i}{64} & 0 & -\frac{\sqrt{35}i}{64} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{64} & 0 & \frac{\sqrt{35}i}{64} & 0 & -\frac{\sqrt{21}i}{64} & 0 & \frac{i}{64}
\end{bmatrix}$$

| 658 | symmetry | $\dfrac{\sqrt{210}\,yz\left(16x^4-16x^2y^2-16x^2z^2+y^4+2y^2z^2+z^4\right)}{16}$ |

*continued ...*

Table 9

| No. | multipole | matrix | | | | | | | | | | | | | | |
|-----|-----------|--------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

$\mathbb{G}_{6,1}^{(1,-1;a)}(E_u,3)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{55}}{2112} & 0 & \frac{\sqrt{1155}}{2112} & 0 & -\frac{9\sqrt{77}}{704} & 0 & \frac{\sqrt{385}}{64} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{77}}{2112} & 0 & -\frac{5\sqrt{385}}{2112} & 0 & \frac{9\sqrt{231}}{704} & 0 & -\frac{5\sqrt{11}}{64} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{9\sqrt{22}}{704} & 0 & \frac{5\sqrt{462}}{2112} & 0 & \frac{5\sqrt{770}}{2112} & 0 & -\frac{9\sqrt{154}}{704} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{9\sqrt{154}}{704} & 0 & -\frac{5\sqrt{770}}{2112} & 0 & -\frac{5\sqrt{462}}{2112} & 0 & \frac{9\sqrt{22}}{704} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{11}}{64} & 0 & -\frac{9\sqrt{231}}{704} & 0 & \frac{5\sqrt{385}}{2112} & 0 & \frac{5\sqrt{77}}{2112} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{385}}{64} & 0 & \frac{9\sqrt{77}}{704} & 0 & -\frac{\sqrt{1155}}{2112} & 0 & -\frac{\sqrt{55}}{2112}
\end{pmatrix}$$

| 659 | symmetry | $-\frac{\sqrt{210}xz\left(x^4-16x^2y^2+2x^2z^2+16y^4-16y^2z^2+z^4\right)}{16}$ |

$\mathbb{G}_{6,2}^{(1,-1;a)}(E_u,3)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{55}i}{2112} & 0 & -\frac{\sqrt{1155}i}{2112} & 0 & -\frac{9\sqrt{77}i}{704} & 0 & -\frac{\sqrt{385}i}{64} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{77}i}{2112} & 0 & \frac{5\sqrt{385}i}{2112} & 0 & \frac{9\sqrt{231}i}{704} & 0 & \frac{5\sqrt{11}i}{64} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{9\sqrt{22}i}{704} & 0 & \frac{5\sqrt{462}i}{2112} & 0 & -\frac{5\sqrt{770}i}{2112} & 0 & -\frac{9\sqrt{154}i}{704} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{9\sqrt{154}i}{704} & 0 & -\frac{5\sqrt{770}i}{2112} & 0 & \frac{5\sqrt{462}i}{2112} & 0 & \frac{9\sqrt{22}i}{704} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{11}i}{64} & 0 & \frac{9\sqrt{231}i}{704} & 0 & \frac{5\sqrt{385}i}{2112} & 0 & -\frac{5\sqrt{77}i}{2112} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{385}i}{64} & 0 & -\frac{9\sqrt{77}i}{704} & 0 & -\frac{\sqrt{1155}i}{2112} & 0 & \frac{\sqrt{55}i}{2112}
\end{pmatrix}$$

| 660 | symmetry | $-\frac{x^2}{2}-\frac{y^2}{2}+z^2$ |

Table 9

| No. | multipole | matrix |
|-----|-----------|--------|

$$\mathbb{G}_2^{(1,0;a)}(A_{1u})$$

$$\begin{bmatrix}
0 & \frac{\sqrt{15}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{14} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{10}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{30}i}{70} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{10}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{30}i}{70} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{14} & 0 & 0 \\
-\frac{\sqrt{15}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{15}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{28} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{2\sqrt{15}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}i}{70} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{2\sqrt{15}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}i}{70} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{28} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{28} & 0 \\
\end{bmatrix}$$

| 661 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |
|-----|----------|--------------------------------|

$$\mathbb{G}_2^{(1,0;a)}(B_{1u})$$

$$\begin{bmatrix}
0 & 0 & 0 & \frac{\sqrt{10}i}{70} & 0 & 0 & -\frac{\sqrt{42}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{140} & 0 & 0 & 0 \\
-\frac{\sqrt{3}i}{21} & 0 & 0 & 0 & \frac{2\sqrt{15}i}{105} & 0 & 0 & -\frac{3\sqrt{2}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{6}i}{28} & 0 & 0 \\
0 & -\frac{2\sqrt{15}i}{105} & 0 & 0 & 0 & \frac{\sqrt{3}i}{21} & 0 & 0 & -\frac{\sqrt{6}i}{28} & 0 & 0 & 0 & -\frac{3\sqrt{2}i}{28} & 0 \\
0 & 0 & -\frac{\sqrt{10}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{140} & 0 & 0 & 0 & -\frac{\sqrt{42}i}{28} \\
0 & 0 & -\frac{3\sqrt{2}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{84} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{9\sqrt{10}i}{140} & 0 & 0 & \frac{\sqrt{42}i}{84} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{105} & 0 & 0 & 0 \\
-\frac{3\sqrt{2}i}{28} & 0 & 0 & 0 & -\frac{9\sqrt{10}i}{140} & 0 & 0 & \frac{\sqrt{3}i}{21} & 0 & 0 & 0 & -\frac{i}{14} & 0 & 0 \\
0 & -\frac{9\sqrt{10}i}{140} & 0 & 0 & 0 & -\frac{3\sqrt{2}i}{28} & 0 & 0 & \frac{i}{14} & 0 & 0 & 0 & -\frac{\sqrt{3}i}{21} & 0 \\
0 & 0 & -\frac{9\sqrt{10}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{105} & 0 & 0 & 0 & -\frac{\sqrt{42}i}{84} \\
0 & 0 & 0 & -\frac{3\sqrt{2}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{84} & 0 & 0 & 0 \\
\end{bmatrix}$$

| 662 | symmetry | $\sqrt{3}xy$ |
|-----|----------|--------------|

203

Table 9

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

$\mathbb{G}_2^{(1,0;a)}(B_{2u})$

$$\begin{pmatrix}
0 & 0 & 0 & \frac{\sqrt{10}}{70} & 0 & 0 & \frac{\sqrt{42}}{28} & 0 & 0 & 0 & -\frac{\sqrt{30}}{140} & 0 & 0 & 0 \\
\frac{\sqrt{3}}{21} & 0 & 0 & 0 & \frac{2\sqrt{15}}{105} & 0 & 0 & \frac{3\sqrt{2}}{28} & 0 & 0 & 0 & -\frac{\sqrt{6}}{28} & 0 & 0 \\
0 & \frac{2\sqrt{15}}{105} & 0 & 0 & 0 & \frac{\sqrt{3}}{21} & 0 & 0 & \frac{\sqrt{6}}{28} & 0 & 0 & 0 & -\frac{3\sqrt{2}}{28} & 0 \\
0 & 0 & \frac{\sqrt{10}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{140} & 0 & 0 & 0 & -\frac{\sqrt{42}}{28} \\
0 & 0 & -\frac{3\sqrt{2}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{84} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{9\sqrt{10}}{140} & 0 & 0 & -\frac{\sqrt{42}}{84} & 0 & 0 & 0 & -\frac{\sqrt{30}}{105} & 0 & 0 & 0 \\
\frac{3\sqrt{2}}{28} & 0 & 0 & 0 & -\frac{9\sqrt{10}}{140} & 0 & 0 & -\frac{\sqrt{3}}{21} & 0 & 0 & 0 & -\frac{1}{14} & 0 & 0 \\
0 & \frac{9\sqrt{10}}{140} & 0 & 0 & 0 & -\frac{3\sqrt{2}}{28} & 0 & 0 & -\frac{1}{14} & 0 & 0 & 0 & -\frac{\sqrt{3}}{21} & 0 \\
0 & 0 & \frac{9\sqrt{10}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{105} & 0 & 0 & 0 & -\frac{\sqrt{42}}{84} \\
0 & 0 & 0 & \frac{3\sqrt{2}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{84} & 0 & 0 & 0
\end{pmatrix}$$

| 663 | symmetry | $\sqrt{3}yz$ |
|---|---|---|

$\mathbb{G}_{2,1}^{(1,0;a)}(E_u)$

$$\begin{pmatrix}
\frac{1}{14} & 0 & \frac{3\sqrt{10}}{140} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{14} & 0 & -\frac{\sqrt{30}}{70} & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{15}}{210} & 0 & \frac{\sqrt{30}}{84} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{14} & 0 & -\frac{3\sqrt{10}}{70} & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{30}}{84} & 0 & \frac{\sqrt{15}}{210} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}}{70} & 0 & -\frac{\sqrt{6}}{14} & 0 & 0 \\
0 & 0 & 0 & -\frac{3\sqrt{10}}{140} & 0 & -\frac{1}{14} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{70} & 0 & -\frac{\sqrt{6}}{14} & 0 \\
0 & -\frac{3}{14} & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{168} & 0 & -\frac{\sqrt{10}}{56} & 0 & 0 & 0 & 0 & 0 \\
\frac{3}{14} & 0 & -\frac{3\sqrt{10}}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{168} & 0 & -\frac{11\sqrt{30}}{840} & 0 & 0 & 0 & 0 \\
0 & \frac{3\sqrt{10}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{28} & 0 & -\frac{\sqrt{15}}{60} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{3\sqrt{10}}{70} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{60} & 0 & -\frac{1}{28} & 0 & 0 \\
0 & 0 & 0 & -\frac{3\sqrt{10}}{70} & 0 & \frac{3}{14} & 0 & 0 & 0 & 0 & \frac{11\sqrt{30}}{840} & 0 & \frac{\sqrt{6}}{168} & 0 \\
0 & 0 & 0 & 0 & -\frac{3}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{56} & 0 & \frac{\sqrt{210}}{168}
\end{pmatrix}$$

| 664 | symmetry | $-\sqrt{3}xz$ |
|---|---|---|

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{G}_{2,2}^{(1,0;a)}(E_u)$$

$$\begin{bmatrix}
\frac{i}{14} & 0 & -\frac{3\sqrt{10}i}{140} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{14} & 0 & \frac{\sqrt{30}i}{70} & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{15}i}{210} & 0 & -\frac{\sqrt{30}i}{84} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{14} & 0 & \frac{3\sqrt{10}i}{70} & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{30}i}{84} & 0 & -\frac{\sqrt{15}i}{210} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}i}{70} & 0 & \frac{\sqrt{6}i}{14} & 0 & 0 \\
0 & 0 & 0 & -\frac{3\sqrt{10}i}{140} & 0 & \frac{i}{14} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{70} & 0 & \frac{\sqrt{6}i}{14} & 0 \\
0 & \frac{3i}{14} & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{168} & 0 & \frac{\sqrt{10}i}{56} & 0 & 0 & 0 & 0 & 0 \\
\frac{3i}{14} & 0 & \frac{3\sqrt{10}i}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{168} & 0 & \frac{11\sqrt{30}i}{840} & 0 & 0 & 0 & 0 \\
0 & \frac{3\sqrt{10}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{i}{28} & 0 & \frac{\sqrt{15}i}{60} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{3\sqrt{10}i}{70} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{60} & 0 & \frac{i}{28} & 0 & 0 \\
0 & 0 & 0 & -\frac{3\sqrt{10}i}{70} & 0 & -\frac{3i}{14} & 0 & 0 & 0 & 0 & \frac{11\sqrt{30}i}{840} & 0 & -\frac{\sqrt{6}i}{168} & 0 \\
0 & 0 & 0 & 0 & -\frac{3i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{56} & 0 & -\frac{\sqrt{210}i}{168}
\end{bmatrix}$$

| 665 | symmetry | $\dfrac{\sqrt{21}\left(x^4-3x^2y^2-3x^2z^2+y^4-3y^2z^2+z^4\right)}{6}$ |
|---|---|---|

$$\mathbb{G}_{4}^{(1,0;a)}(A_{1u},1)$$

$$\begin{bmatrix}
0 & -\frac{\sqrt{105}i}{840} & 0 & 0 & 0 & -\frac{\sqrt{21}i}{168} & 0 & 0 & \frac{9\sqrt{42}i}{280} & 0 & 0 & 0 & \frac{9\sqrt{14}i}{280} & 0 \\
0 & 0 & \frac{\sqrt{70}i}{280} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{210}i}{280} & 0 & 0 & 0 & \frac{3\sqrt{6}i}{40} \\
0 & 0 & 0 & -\frac{\sqrt{70}i}{280} & 0 & 0 & \frac{3\sqrt{6}i}{40} & 0 & 0 & 0 & -\frac{3\sqrt{210}i}{280} & 0 & 0 & 0 \\
\frac{\sqrt{21}i}{168} & 0 & 0 & 0 & \frac{\sqrt{105}i}{840} & 0 & 0 & \frac{9\sqrt{14}i}{280} & 0 & 0 & 0 & \frac{9\sqrt{42}i}{280} & 0 & 0 \\
\frac{\sqrt{105}i}{140} & 0 & 0 & 0 & \frac{\sqrt{21}i}{28} & 0 & 0 & \frac{\sqrt{70}i}{280} & 0 & 0 & 0 & \frac{\sqrt{210}i}{840} & 0 & 0 \\
0 & -\frac{3\sqrt{105}i}{140} & 0 & 0 & 0 & \frac{\sqrt{21}i}{28} & 0 & 0 & -\frac{\sqrt{42}i}{210} & 0 & 0 & 0 & \frac{\sqrt{14}i}{140} & 0 \\
0 & 0 & \frac{\sqrt{105}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{35}i}{280} & 0 & 0 & 0 & \frac{i}{40} \\
0 & 0 & 0 & \frac{\sqrt{105}i}{70} & 0 & 0 & -\frac{i}{40} & 0 & 0 & 0 & \frac{\sqrt{35}i}{280} & 0 & 0 & 0 \\
\frac{\sqrt{21}i}{28} & 0 & 0 & 0 & -\frac{3\sqrt{105}i}{140} & 0 & 0 & -\frac{\sqrt{14}i}{140} & 0 & 0 & 0 & \frac{\sqrt{42}i}{210} & 0 & 0 \\
0 & \frac{\sqrt{21}i}{28} & 0 & 0 & 0 & \frac{\sqrt{105}i}{140} & 0 & 0 & -\frac{\sqrt{210}i}{840} & 0 & 0 & 0 & -\frac{\sqrt{70}i}{280} & 0
\end{bmatrix}$$

| 666 | symmetry | $-\dfrac{\sqrt{15}\left(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4\right)}{12}$ |
|---|---|---|

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_4^{(1,0;a)}(A_{1u},2)$

$$\begin{pmatrix}
0 & -\frac{\sqrt{3}i}{168} & 0 & 0 & 0 & \frac{\sqrt{15}i}{120} & 0 & 0 & \frac{9\sqrt{30}i}{280} & 0 & 0 & 0 & -\frac{9\sqrt{10}i}{200} & 0 \\
0 & 0 & \frac{\sqrt{2}i}{56} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{6}i}{56} & 0 & 0 & 0 & -\frac{3\sqrt{210}i}{200} \\
0 & 0 & 0 & -\frac{\sqrt{2}i}{56} & 0 & 0 & -\frac{3\sqrt{210}i}{200} & 0 & 0 & 0 & -\frac{3\sqrt{6}i}{56} & 0 & 0 & 0 \\
-\frac{\sqrt{15}i}{120} & 0 & 0 & 0 & \frac{\sqrt{3}i}{168} & 0 & 0 & -\frac{9\sqrt{10}i}{200} & 0 & 0 & 0 & \frac{9\sqrt{30}i}{280} & 0 & 0 \\
\frac{\sqrt{3}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{20} & 0 & 0 & \frac{\sqrt{2}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{6}i}{120} & 0 & 0 \\
0 & -\frac{3\sqrt{3}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{20} & 0 & 0 & -\frac{\sqrt{30}i}{210} & 0 & 0 & 0 & -\frac{\sqrt{10}i}{100} & 0 \\
0 & 0 & \frac{\sqrt{3}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{i}{56} & 0 & 0 & 0 & -\frac{\sqrt{35}i}{200} \\
0 & 0 & 0 & \frac{\sqrt{3}i}{14} & 0 & 0 & \frac{\sqrt{35}i}{200} & 0 & 0 & 0 & \frac{i}{56} & 0 & 0 & 0 \\
-\frac{\sqrt{15}i}{20} & 0 & 0 & 0 & -\frac{3\sqrt{3}i}{28} & 0 & 0 & \frac{\sqrt{10}i}{100} & 0 & 0 & 0 & \frac{\sqrt{30}i}{210} & 0 & 0 \\
0 & -\frac{\sqrt{15}i}{20} & 0 & 0 & 0 & \frac{\sqrt{3}i}{28} & 0 & 0 & \frac{\sqrt{6}i}{120} & 0 & 0 & 0 & -\frac{\sqrt{2}i}{56} & 0
\end{pmatrix}$$

| 667 | symmetry | $\frac{\sqrt{35}xy(x-y)(x+y)}{2}$ |

$\mathbb{G}_4^{(1,0;a)}(A_{2u})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{35}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{9\sqrt{210}}{700} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{9\sqrt{10}}{100} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{9\sqrt{10}}{100} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{35}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{9\sqrt{210}}{700} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{3\sqrt{35}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{140} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{35}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{350} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{100} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{100} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{3\sqrt{35}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{350} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{3\sqrt{35}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{140} & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

| 668 | symmetry | $\frac{\sqrt{5}(x-y)(x+y)\left(x^2+y^2-6z^2\right)}{4}$ |

Table 9

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{G}_4^{(1,0;a)}(B_{1u}) = \begin{pmatrix}
0 & 0 & 0 & \frac{\sqrt{2}i}{56} & 0 & 0 & -\frac{9\sqrt{210}i}{1400} & 0 & 0 & 0 & -\frac{27\sqrt{6}i}{280} & 0 & 0 & 0 \\
-\frac{\sqrt{15}i}{280} & 0 & 0 & 0 & -\frac{\sqrt{3}i}{56} & 0 & 0 & \frac{99\sqrt{10}i}{1400} & 0 & 0 & 0 & -\frac{9\sqrt{30}i}{1400} & 0 & 0 \\
0 & \frac{\sqrt{3}i}{56} & 0 & 0 & 0 & \frac{\sqrt{15}i}{280} & 0 & 0 & -\frac{9\sqrt{30}i}{1400} & 0 & 0 & 0 & \frac{99\sqrt{10}i}{1400} & 0 \\
0 & 0 & -\frac{\sqrt{2}i}{56} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{27\sqrt{6}i}{280} & 0 & 0 & 0 & -\frac{9\sqrt{210}i}{1400} \\
0 & 0 & -\frac{9\sqrt{10}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{140} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{3\sqrt{2}i}{28} & 0 & 0 & \frac{3\sqrt{210}i}{1400} & 0 & 0 & 0 & -\frac{\sqrt{6}i}{280} & 0 & 0 & 0 \\
-\frac{9\sqrt{10}i}{140} & 0 & 0 & 0 & \frac{3\sqrt{2}i}{28} & 0 & 0 & -\frac{9\sqrt{15}i}{1400} & 0 & 0 & 0 & \frac{17\sqrt{5}i}{1400} & 0 & 0 \\
0 & \frac{3\sqrt{2}i}{28} & 0 & 0 & 0 & -\frac{9\sqrt{10}i}{140} & 0 & 0 & -\frac{17\sqrt{5}i}{1400} & 0 & 0 & 0 & \frac{9\sqrt{15}i}{1400} & 0 \\
0 & 0 & \frac{3\sqrt{2}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{280} & 0 & 0 & 0 & -\frac{3\sqrt{210}i}{1400} \\
0 & 0 & 0 & -\frac{9\sqrt{10}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{140} & 0 & 0 & 0
\end{pmatrix}$$

| 669 | symmetry | $-\dfrac{\sqrt{5}xy\left(x^2+y^2-6z^2\right)}{2}$ |
|---|---|---|

$$\mathbb{G}_4^{(1,0;a)}(B_{2u}) = \begin{bmatrix}
0 & 0 & 0 & -\frac{\sqrt{2}}{56} & 0 & 0 & -\frac{9\sqrt{210}}{1400} & 0 & 0 & 0 & \frac{27\sqrt{6}}{280} & 0 & 0 & 0 \\
-\frac{\sqrt{15}}{280} & 0 & 0 & 0 & \frac{\sqrt{3}}{56} & 0 & 0 & \frac{99\sqrt{10}}{1400} & 0 & 0 & 0 & \frac{9\sqrt{30}}{1400} & 0 & 0 \\
0 & \frac{\sqrt{3}}{56} & 0 & 0 & 0 & -\frac{\sqrt{15}}{280} & 0 & 0 & -\frac{9\sqrt{30}}{1400} & 0 & 0 & 0 & -\frac{99\sqrt{10}}{1400} & 0 \\
0 & 0 & -\frac{\sqrt{2}}{56} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{27\sqrt{6}}{280} & 0 & 0 & 0 & \frac{9\sqrt{210}}{1400} \\
0 & 0 & \frac{9\sqrt{10}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{140} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{3\sqrt{2}}{28} & 0 & 0 & \frac{3\sqrt{210}}{1400} & 0 & 0 & 0 & \frac{\sqrt{6}}{280} & 0 & 0 & 0 \\
-\frac{9\sqrt{10}}{140} & 0 & 0 & 0 & -\frac{3\sqrt{2}}{28} & 0 & 0 & -\frac{9\sqrt{15}}{1400} & 0 & 0 & 0 & -\frac{17\sqrt{5}}{1400} & 0 & 0 \\
0 & \frac{3\sqrt{2}}{28} & 0 & 0 & 0 & \frac{9\sqrt{10}}{140} & 0 & 0 & -\frac{17\sqrt{5}}{1400} & 0 & 0 & 0 & -\frac{9\sqrt{15}}{1400} & 0 \\
0 & 0 & \frac{3\sqrt{2}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{280} & 0 & 0 & 0 & \frac{3\sqrt{210}}{1400} \\
0 & 0 & 0 & -\frac{9\sqrt{10}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{140} & 0 & 0 & 0
\end{bmatrix}$$

| 670 | symmetry | $\dfrac{\sqrt{35}yz(y-z)(y+z)}{2}$ |
|---|---|---|

*continued ...*

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Table 9

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{G}_{4,1}^{(1,0;a)}(E_u,1)$

$$\begin{pmatrix}
\frac{\sqrt{35}}{1120} & 0 & \frac{\sqrt{14}}{224} & 0 & \frac{\sqrt{7}}{224} & 0 & 0 & -\frac{27\sqrt{210}}{2800} & 0 & -\frac{9\sqrt{42}}{280} & 0 & -\frac{27\sqrt{70}}{2800} & 0 & 0 \\
0 & -\frac{\sqrt{21}}{224} & 0 & -\frac{\sqrt{42}}{224} & 0 & -\frac{\sqrt{105}}{1120} & \frac{9\sqrt{10}}{400} & 0 & \frac{9\sqrt{210}}{700} & 0 & \frac{9\sqrt{14}}{560} & 0 & -\frac{9\sqrt{70}}{1400} & 0 \\
\frac{\sqrt{105}}{1120} & 0 & \frac{\sqrt{42}}{224} & 0 & \frac{\sqrt{21}}{224} & 0 & 0 & -\frac{9\sqrt{70}}{1400} & 0 & \frac{9\sqrt{14}}{560} & 0 & \frac{9\sqrt{210}}{700} & 0 & \frac{9\sqrt{10}}{400} \\
0 & -\frac{\sqrt{7}}{224} & 0 & -\frac{\sqrt{14}}{224} & 0 & -\frac{\sqrt{35}}{1120} & 0 & 0 & -\frac{27\sqrt{70}}{2800} & 0 & -\frac{9\sqrt{42}}{280} & 0 & -\frac{27\sqrt{210}}{2800} & 0 \\
0 & -\frac{3\sqrt{35}}{140} & 0 & -\frac{3\sqrt{70}}{280} & 0 & 0 & -\frac{\sqrt{6}}{160} & 0 & -\frac{\sqrt{14}}{112} & 0 & -\frac{\sqrt{210}}{1120} & 0 & 0 & 0 \\
\frac{3\sqrt{35}}{140} & 0 & \frac{3\sqrt{14}}{56} & 0 & 0 & 0 & 0 & \frac{13\sqrt{210}}{5600} & 0 & \frac{\sqrt{42}}{560} & 0 & -\frac{\sqrt{70}}{800} & 0 & 0 \\
0 & -\frac{3\sqrt{14}}{56} & 0 & 0 & 0 & \frac{3\sqrt{70}}{280} & -\frac{3\sqrt{15}}{800} & 0 & -\frac{\sqrt{35}}{5600} & 0 & \frac{\sqrt{21}}{160} & 0 & \frac{\sqrt{105}}{5600} & 0 \\
\frac{3\sqrt{70}}{280} & 0 & 0 & 0 & -\frac{3\sqrt{14}}{56} & 0 & 0 & -\frac{\sqrt{105}}{5600} & 0 & -\frac{\sqrt{21}}{160} & 0 & \frac{\sqrt{35}}{5600} & 0 & \frac{3\sqrt{15}}{800} \\
0 & 0 & 0 & \frac{3\sqrt{14}}{56} & 0 & \frac{3\sqrt{35}}{140} & 0 & 0 & \frac{\sqrt{70}}{800} & 0 & -\frac{\sqrt{42}}{560} & 0 & -\frac{13\sqrt{210}}{5600} & 0 \\
0 & 0 & -\frac{3\sqrt{70}}{280} & 0 & -\frac{3\sqrt{35}}{140} & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{1120} & 0 & \frac{\sqrt{14}}{112} & 0 & \frac{\sqrt{6}}{160}
\end{pmatrix}$$

| 671 | symmetry | $-\frac{\sqrt{35}xz(x-z)(x+z)}{2}$ |

$\mathbb{G}_{4,2}^{(1,0;a)}(E_u,1)$

$$\begin{pmatrix}
\frac{\sqrt{35}i}{1120} & 0 & -\frac{\sqrt{14}i}{224} & 0 & \frac{\sqrt{7}i}{224} & 0 & 0 & -\frac{27\sqrt{210}i}{2800} & 0 & \frac{9\sqrt{42}i}{280} & 0 & -\frac{27\sqrt{70}i}{2800} & 0 & 0 \\
0 & -\frac{\sqrt{21}i}{224} & 0 & \frac{\sqrt{42}i}{224} & 0 & -\frac{\sqrt{105}i}{1120} & -\frac{9\sqrt{10}i}{400} & 0 & \frac{9\sqrt{210}i}{700} & 0 & -\frac{9\sqrt{14}i}{560} & 0 & -\frac{9\sqrt{70}i}{1400} & 0 \\
-\frac{\sqrt{105}i}{1120} & 0 & \frac{\sqrt{42}i}{224} & 0 & -\frac{\sqrt{21}i}{224} & 0 & 0 & \frac{9\sqrt{70}i}{1400} & 0 & \frac{9\sqrt{14}i}{560} & 0 & -\frac{9\sqrt{210}i}{700} & 0 & \frac{9\sqrt{10}i}{400} \\
0 & \frac{\sqrt{7}i}{224} & 0 & -\frac{\sqrt{14}i}{224} & 0 & \frac{\sqrt{35}i}{1120} & 0 & 0 & \frac{27\sqrt{70}i}{2800} & 0 & -\frac{9\sqrt{42}i}{280} & 0 & \frac{27\sqrt{210}i}{2800} & 0 \\
0 & \frac{3\sqrt{35}i}{140} & 0 & -\frac{3\sqrt{70}i}{280} & 0 & 0 & -\frac{\sqrt{6}i}{160} & 0 & \frac{\sqrt{14}i}{112} & 0 & -\frac{\sqrt{210}i}{1120} & 0 & 0 & 0 \\
\frac{3\sqrt{35}i}{140} & 0 & -\frac{3\sqrt{14}i}{56} & 0 & 0 & 0 & 0 & \frac{13\sqrt{210}i}{5600} & 0 & -\frac{\sqrt{42}i}{560} & 0 & -\frac{\sqrt{70}i}{800} & 0 & 0 \\
0 & -\frac{3\sqrt{14}i}{56} & 0 & 0 & 0 & \frac{3\sqrt{70}i}{280} & \frac{3\sqrt{15}i}{800} & 0 & -\frac{\sqrt{35}i}{5600} & 0 & -\frac{\sqrt{21}i}{160} & 0 & \frac{\sqrt{105}i}{5600} & 0 \\
-\frac{3\sqrt{70}i}{280} & 0 & 0 & 0 & \frac{3\sqrt{14}i}{56} & 0 & 0 & \frac{\sqrt{105}i}{5600} & 0 & -\frac{\sqrt{21}i}{160} & 0 & -\frac{\sqrt{35}i}{5600} & 0 & \frac{3\sqrt{15}i}{800} \\
0 & 0 & 0 & \frac{3\sqrt{14}i}{56} & 0 & -\frac{3\sqrt{35}i}{140} & 0 & 0 & -\frac{\sqrt{70}i}{800} & 0 & -\frac{\sqrt{42}i}{560} & 0 & \frac{13\sqrt{210}i}{5600} & 0 \\
0 & 0 & \frac{3\sqrt{70}i}{280} & 0 & -\frac{3\sqrt{35}i}{140} & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{1120} & 0 & \frac{\sqrt{14}i}{112} & 0 & -\frac{\sqrt{6}i}{160}
\end{pmatrix}$$

| 672 | symmetry | $\frac{\sqrt{5}yz\left(6x^2-y^2-z^2\right)}{2}$ |

Table 9

| No. | multipole | matrix |
|---|---|---|
|  | $\mathbb{G}_{4,1}^{(1,0;a)}(E_u,2)$ | (matrix below) |

$$\begin{bmatrix}
\frac{\sqrt5}{1120} & 0 & \frac{\sqrt2}{224} & 0 & -\frac{1}{32} & 0 & 0 & -\frac{27\sqrt{30}}{2800} & 0 & -\frac{9\sqrt6}{280} & 0 & \frac{27\sqrt{10}}{400} & 0 & 0 \\
0 & -\frac{\sqrt3}{224} & 0 & -\frac{\sqrt6}{224} & 0 & \frac{\sqrt{15}}{160} & -\frac{9\sqrt{70}}{400} & 0 & \frac{9\sqrt{30}}{700} & 0 & \frac{9\sqrt2}{560} & 0 & \frac{9\sqrt{10}}{200} & 0 \\
-\frac{\sqrt{15}}{160} & 0 & \frac{\sqrt6}{224} & 0 & \frac{\sqrt3}{224} & 0 & 0 & \frac{9\sqrt{10}}{200} & 0 & \frac{9\sqrt2}{560} & 0 & \frac{9\sqrt{30}}{700} & 0 & -\frac{9\sqrt{70}}{400} \\
0 & \frac{1}{32} & 0 & -\frac{\sqrt2}{224} & 0 & -\frac{\sqrt5}{1120} & 0 & 0 & \frac{27\sqrt{10}}{400} & 0 & -\frac{9\sqrt6}{280} & 0 & -\frac{27\sqrt{30}}{2800} & 0 \\
0 & -\frac{3\sqrt5}{140} & 0 & \frac{3\sqrt{10}}{40} & 0 & 0 & -\frac{\sqrt{42}}{1120} & 0 & -\frac{\sqrt2}{112} & 0 & \frac{\sqrt{30}}{160} & 0 & 0 & 0 \\
\frac{3\sqrt5}{140} & 0 & \frac{3\sqrt2}{56} & 0 & 0 & 0 & 0 & \frac{13\sqrt{30}}{5600} & 0 & \frac{\sqrt6}{560} & 0 & \frac{7\sqrt{10}}{800} & 0 & 0 \\
0 & -\frac{3\sqrt2}{56} & 0 & 0 & 0 & -\frac{3\sqrt{10}}{40} & \frac{3\sqrt{105}}{800} & 0 & -\frac{\sqrt5}{5600} & 0 & \frac{\sqrt3}{160} & 0 & -\frac{\sqrt{15}}{800} & 0 \\
-\frac{3\sqrt{10}}{40} & 0 & 0 & 0 & -\frac{3\sqrt2}{56} & 0 & 0 & \frac{\sqrt{15}}{800} & 0 & -\frac{\sqrt3}{160} & 0 & \frac{\sqrt5}{5600} & 0 & -\frac{3\sqrt{105}}{800} \\
0 & 0 & 0 & \frac{3\sqrt2}{56} & 0 & \frac{3\sqrt5}{140} & 0 & 0 & -\frac{7\sqrt{10}}{800} & 0 & -\frac{\sqrt6}{560} & 0 & -\frac{13\sqrt{30}}{5600} & 0 \\
0 & 0 & \frac{3\sqrt{10}}{40} & 0 & -\frac{3\sqrt5}{140} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{160} & 0 & \frac{\sqrt2}{112} & 0 & \frac{\sqrt{42}}{1120}
\end{bmatrix}$$

| No. | multipole | matrix |
|---|---|---|
| 673 | symmetry | $\dfrac{\sqrt5\,xz\left(x^2-6y^2+z^2\right)}{2}$ |
|  | $\mathbb{G}_{4,2}^{(1,0;a)}(E_u,2)$ | (matrix below) |

$$\begin{bmatrix}
\frac{\sqrt5 i}{1120} & 0 & -\frac{\sqrt2 i}{224} & 0 & -\frac{i}{32} & 0 & 0 & -\frac{27\sqrt{30}i}{2800} & 0 & \frac{9\sqrt6 i}{280} & 0 & \frac{27\sqrt{10}i}{400} & 0 & 0 \\
0 & -\frac{\sqrt3 i}{224} & 0 & \frac{\sqrt6 i}{224} & 0 & \frac{\sqrt{15}i}{160} & \frac{9\sqrt{70}i}{400} & 0 & \frac{9\sqrt{30}i}{700} & 0 & -\frac{9\sqrt2 i}{560} & 0 & \frac{9\sqrt{10}i}{200} & 0 \\
\frac{\sqrt{15}i}{160} & 0 & \frac{\sqrt6 i}{224} & 0 & -\frac{\sqrt3 i}{224} & 0 & 0 & -\frac{9\sqrt{10}i}{200} & 0 & \frac{9\sqrt2 i}{560} & 0 & -\frac{9\sqrt{30}i}{700} & 0 & -\frac{9\sqrt{70}i}{400} \\
0 & -\frac{i}{32} & 0 & -\frac{\sqrt2 i}{224} & 0 & \frac{\sqrt5 i}{1120} & 0 & 0 & -\frac{27\sqrt{10}i}{400} & 0 & -\frac{9\sqrt6 i}{280} & 0 & \frac{27\sqrt{30}i}{2800} & 0 \\
0 & \frac{3\sqrt5 i}{140} & 0 & \frac{3\sqrt{10}i}{40} & 0 & 0 & -\frac{\sqrt{42}i}{1120} & 0 & \frac{\sqrt2 i}{112} & 0 & \frac{\sqrt{30}i}{160} & 0 & 0 & 0 \\
\frac{3\sqrt5 i}{140} & 0 & -\frac{3\sqrt2 i}{56} & 0 & 0 & 0 & 0 & \frac{13\sqrt{30}i}{5600} & 0 & -\frac{\sqrt6 i}{560} & 0 & \frac{7\sqrt{10}i}{800} & 0 & 0 \\
0 & -\frac{3\sqrt2 i}{56} & 0 & 0 & 0 & -\frac{3\sqrt{10}i}{40} & -\frac{3\sqrt{105}i}{800} & 0 & -\frac{\sqrt5 i}{5600} & 0 & -\frac{\sqrt3 i}{160} & 0 & -\frac{\sqrt{15}i}{800} & 0 \\
\frac{3\sqrt{10}i}{40} & 0 & 0 & 0 & \frac{3\sqrt2 i}{56} & 0 & 0 & -\frac{\sqrt{15}i}{800} & 0 & -\frac{\sqrt3 i}{160} & 0 & -\frac{\sqrt5 i}{5600} & 0 & -\frac{3\sqrt{105}i}{800} \\
0 & 0 & 0 & \frac{3\sqrt2 i}{56} & 0 & -\frac{3\sqrt5 i}{140} & 0 & 0 & \frac{7\sqrt{10}i}{800} & 0 & -\frac{\sqrt6 i}{560} & 0 & \frac{13\sqrt{30}i}{5600} & 0 \\
0 & 0 & -\frac{3\sqrt{10}i}{40} & 0 & -\frac{3\sqrt5 i}{140} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{160} & 0 & \frac{\sqrt2 i}{112} & 0 & -\frac{\sqrt{42}i}{1120}
\end{bmatrix}$$

| No. | multipole | matrix |
|---|---|---|
| 674 | symmetry | $1$ |

*continued …*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_0^{(1,1;a)}(A_{1u})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{3}i}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{3}i}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{3}i}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{3}i}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

| 675 | symmetry | $-\frac{x^2}{2} - \frac{y^2}{2} + z^2$ |
|---|---|---|

$\mathbb{G}_2^{(1,1;a)}(A_{1u})$

$$\begin{bmatrix}
0 & \frac{12i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}i}{140} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{2\sqrt{6}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{9\sqrt{2}i}{140} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{2\sqrt{6}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{9\sqrt{2}i}{140} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{12i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}i}{140} & 0 & 0 \\
\frac{3i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{21} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{3i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{35} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{6i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{3}i}{105} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{6i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt{3}i}{105} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{3i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{35} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{3i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{21} & 0
\end{bmatrix}$$

| 676 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |
|---|---|---|

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Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_2^{(1,1;a)}(B_{1u})$

$$\begin{bmatrix}
0 & 0 & 0 & \frac{2\sqrt{6}i}{35} & 0 & 0 & -\frac{3\sqrt{70}i}{280} & 0 & 0 & 0 & -\frac{3\sqrt{2}i}{280} & 0 & 0 & 0 \\
-\frac{4\sqrt{5}i}{35} & 0 & 0 & 0 & \frac{8i}{35} & 0 & 0 & -\frac{3\sqrt{30}i}{280} & 0 & 0 & 0 & -\frac{3\sqrt{10}i}{280} & 0 & 0 \\
0 & -\frac{8i}{35} & 0 & 0 & 0 & \frac{4\sqrt{5}i}{35} & 0 & 0 & -\frac{3\sqrt{10}i}{280} & 0 & 0 & 0 & -\frac{3\sqrt{30}i}{280} & 0 \\
0 & 0 & -\frac{2\sqrt{6}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{2}i}{280} & 0 & 0 & 0 & -\frac{3\sqrt{70}i}{280} \\
0 & 0 & \frac{3\sqrt{30}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{105} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{9\sqrt{6}i}{140} & 0 & 0 & \frac{\sqrt{70}i}{105} & 0 & 0 & 0 & -\frac{4\sqrt{2}i}{105} & 0 & 0 & 0 \\
\frac{3\sqrt{30}i}{140} & 0 & 0 & 0 & \frac{9\sqrt{6}i}{140} & 0 & 0 & \frac{4\sqrt{5}i}{105} & 0 & 0 & 0 & -\frac{2\sqrt{15}i}{105} & 0 & 0 \\
0 & \frac{9\sqrt{6}i}{140} & 0 & 0 & 0 & \frac{3\sqrt{30}i}{140} & 0 & 0 & \frac{2\sqrt{15}i}{105} & 0 & 0 & 0 & -\frac{4\sqrt{5}i}{105} & 0 \\
0 & 0 & \frac{9\sqrt{6}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{4\sqrt{2}i}{105} & 0 & 0 & 0 & -\frac{\sqrt{70}i}{105} \\
0 & 0 & 0 & \frac{3\sqrt{30}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{105} & 0 & 0 & 0
\end{bmatrix}$$

| 677 | symmetry | $\sqrt{3}xy$ |

$\mathbb{G}_2^{(1,1;a)}(B_{2u})$

$$\begin{bmatrix}
0 & 0 & 0 & \frac{2\sqrt{6}}{35} & 0 & 0 & \frac{3\sqrt{70}}{280} & 0 & 0 & 0 & -\frac{3\sqrt{2}}{280} & 0 & 0 & 0 \\
\frac{4\sqrt{5}}{35} & 0 & 0 & 0 & \frac{8}{35} & 0 & 0 & \frac{3\sqrt{30}}{280} & 0 & 0 & 0 & -\frac{3\sqrt{10}}{280} & 0 & 0 \\
0 & \frac{8}{35} & 0 & 0 & 0 & \frac{4\sqrt{5}}{35} & 0 & 0 & \frac{3\sqrt{10}}{280} & 0 & 0 & 0 & -\frac{3\sqrt{30}}{280} & 0 \\
0 & 0 & \frac{2\sqrt{6}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{2}}{280} & 0 & 0 & 0 & -\frac{3\sqrt{70}}{280} \\
0 & 0 & \frac{3\sqrt{30}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{105} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{9\sqrt{6}}{140} & 0 & 0 & -\frac{\sqrt{70}}{105} & 0 & 0 & 0 & -\frac{4\sqrt{2}}{105} & 0 & 0 & 0 \\
-\frac{3\sqrt{30}}{140} & 0 & 0 & 0 & \frac{9\sqrt{6}}{140} & 0 & 0 & -\frac{4\sqrt{5}}{105} & 0 & 0 & 0 & -\frac{2\sqrt{15}}{105} & 0 & 0 \\
0 & -\frac{9\sqrt{6}}{140} & 0 & 0 & 0 & \frac{3\sqrt{30}}{140} & 0 & 0 & -\frac{2\sqrt{15}}{105} & 0 & 0 & 0 & -\frac{4\sqrt{5}}{105} & 0 \\
0 & 0 & -\frac{9\sqrt{6}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{4\sqrt{2}}{105} & 0 & 0 & 0 & -\frac{\sqrt{70}}{105} \\
0 & 0 & 0 & -\frac{3\sqrt{30}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{105} & 0 & 0 & 0
\end{bmatrix}$$

| 678 | symmetry | $\sqrt{3}yz$ |

continued ...

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_{2,1}^{(1,1;a)}(E_u)$

$$\begin{bmatrix}
\frac{2\sqrt{15}}{35} & 0 & \frac{3\sqrt6}{35} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}}{140} & 0 & -\frac{3\sqrt2}{140} & 0 & 0 & 0 \\
0 & -\frac{2}{35} & 0 & \frac{\sqrt2}{7} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}}{140} & 0 & -\frac{3\sqrt6}{140} & 0 & 0 \\
0 & 0 & -\frac{\sqrt2}{7} & 0 & \frac{2}{35} & 0 & 0 & 0 & 0 & -\frac{3\sqrt6}{140} & 0 & -\frac{3\sqrt{10}}{140} & 0 \\
0 & 0 & 0 & -\frac{3\sqrt6}{35} & 0 & -\frac{2\sqrt{15}}{35} & 0 & 0 & 0 & 0 & -\frac{3\sqrt2}{140} & 0 & -\frac{3\sqrt{10}}{140} \\
0 & \frac{3\sqrt{15}}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{42} & 0 & -\frac{\sqrt6}{42} & 0 & 0 & 0 & 0 \\
-\frac{3\sqrt{15}}{70} & 0 & \frac{3\sqrt6}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{210} & 0 & -\frac{11\sqrt2}{210} & 0 & 0 & 0 \\
0 & -\frac{3\sqrt6}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{105} & 0 & -\frac{1}{15} & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{3\sqrt6}{70} & 0 & 0 & 0 & 0 & \frac{1}{15} & 0 & -\frac{\sqrt{15}}{105} & 0 \\
0 & 0 & 0 & \frac{3\sqrt6}{70} & 0 & -\frac{3\sqrt{15}}{70} & 0 & 0 & 0 & 0 & \frac{11\sqrt2}{210} & 0 & \frac{\sqrt{10}}{210} \\
0 & 0 & 0 & 0 & \frac{3\sqrt{15}}{70} & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt6}{42} & 0 & \frac{\sqrt{14}}{42}
\end{bmatrix}$$

| 679 | symmetry | $-\sqrt{3}xz$ |
|---|---|---|

$\mathbb{G}_{2,2}^{(1,1;a)}(E_u)$

$$\begin{bmatrix}
\frac{2\sqrt{15}i}{35} & 0 & -\frac{3\sqrt6i}{35} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}i}{140} & 0 & \frac{3\sqrt2i}{140} & 0 & 0 & 0 \\
0 & -\frac{2i}{35} & 0 & -\frac{\sqrt2i}{7} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}i}{140} & 0 & \frac{3\sqrt6i}{140} & 0 & 0 \\
0 & 0 & -\frac{\sqrt2i}{7} & 0 & -\frac{2i}{35} & 0 & 0 & 0 & 0 & -\frac{3\sqrt6i}{140} & 0 & \frac{3\sqrt{10}i}{140} & 0 \\
0 & 0 & 0 & -\frac{3\sqrt6i}{35} & 0 & \frac{2\sqrt{15}i}{35} & 0 & 0 & 0 & 0 & -\frac{3\sqrt2i}{140} & 0 & \frac{3\sqrt{10}i}{140} \\
0 & -\frac{3\sqrt{15}i}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}i}{42} & 0 & \frac{\sqrt6i}{42} & 0 & 0 & 0 & 0 \\
-\frac{3\sqrt{15}i}{70} & 0 & -\frac{3\sqrt6i}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{210} & 0 & \frac{11\sqrt2i}{210} & 0 & 0 & 0 \\
0 & -\frac{3\sqrt6i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{105} & 0 & \frac{i}{15} & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{3\sqrt6i}{70} & 0 & 0 & 0 & 0 & \frac{i}{15} & 0 & \frac{\sqrt{15}i}{105} & 0 \\
0 & 0 & 0 & \frac{3\sqrt6i}{70} & 0 & \frac{3\sqrt{15}i}{70} & 0 & 0 & 0 & 0 & \frac{11\sqrt2i}{210} & 0 & -\frac{\sqrt{10}i}{210} \\
0 & 0 & 0 & 0 & \frac{3\sqrt{15}i}{70} & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt6i}{42} & 0 & -\frac{\sqrt{14}i}{42}
\end{bmatrix}$$

| 680 | symmetry | $\dfrac{\sqrt{21}\left(x^4-3x^2y^2-3x^2z^2+y^4-3y^2z^2+z^4\right)}{6}$ |
|---|---|---|

*continued …*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_4^{(1,1;a)}(A_{1u},1)$

$$\begin{pmatrix}
0 & -\frac{\sqrt{770}i}{210} & 0 & 0 & 0 & -\frac{\sqrt{154}i}{42} & 0 & 0 & \frac{\sqrt{77}i}{140} & 0 & 0 & 0 & \frac{\sqrt{231}i}{420} & 0 \\
0 & 0 & \frac{\sqrt{1155}i}{105} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{385}i}{420} & 0 & 0 & 0 & \frac{\sqrt{11}i}{60} \\
0 & 0 & 0 & -\frac{\sqrt{1155}i}{105} & 0 & 0 & \frac{\sqrt{11}i}{60} & 0 & 0 & 0 & -\frac{\sqrt{385}i}{420} & 0 & 0 & 0 \\
\frac{\sqrt{154}i}{42} & 0 & 0 & 0 & \frac{\sqrt{770}i}{210} & 0 & 0 & \frac{\sqrt{231}i}{420} & 0 & 0 & 0 & \frac{\sqrt{77}i}{140} & 0 & 0 \\
-\frac{\sqrt{770}i}{840} & 0 & 0 & 0 & -\frac{\sqrt{154}i}{168} & 0 & 0 & \frac{\sqrt{1155}i}{1155} & 0 & 0 & 0 & \frac{\sqrt{385}i}{1155} & 0 & 0 \\
0 & \frac{\sqrt{770}i}{280} & 0 & 0 & 0 & -\frac{\sqrt{154}i}{168} & 0 & 0 & -\frac{4\sqrt{77}i}{1155} & 0 & 0 & 0 & \frac{2\sqrt{231}i}{1155} & 0 \\
0 & 0 & -\frac{\sqrt{770}i}{420} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2310}i}{2310} & 0 & 0 & 0 & \frac{\sqrt{66}i}{330} \\
0 & 0 & 0 & -\frac{\sqrt{770}i}{420} & 0 & 0 & -\frac{\sqrt{66}i}{330} & 0 & 0 & 0 & \frac{\sqrt{2310}i}{2310} & 0 & 0 & 0 \\
-\frac{\sqrt{154}i}{168} & 0 & 0 & 0 & \frac{\sqrt{770}i}{280} & 0 & 0 & -\frac{2\sqrt{231}i}{1155} & 0 & 0 & 0 & \frac{4\sqrt{77}i}{1155} & 0 & 0 \\
0 & -\frac{\sqrt{154}i}{168} & 0 & 0 & 0 & -\frac{\sqrt{770}i}{840} & 0 & 0 & -\frac{\sqrt{385}i}{1155} & 0 & 0 & 0 & -\frac{\sqrt{1155}i}{1155} & 0 \\
\end{pmatrix}$$

| 681 | symmetry | $-\dfrac{\sqrt{15}\left(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4\right)}{12}$ |
|---|---|---|

$\mathbb{G}_4^{(1,1;a)}(A_{1u},2)$

$$\begin{bmatrix}
0 & -\frac{\sqrt{22}i}{42} & 0 & 0 & 0 & \frac{\sqrt{110}i}{30} & 0 & 0 & \frac{\sqrt{55}i}{140} & 0 & 0 & 0 & -\frac{\sqrt{165}i}{300} & 0 \\
0 & 0 & \frac{\sqrt{33}i}{21} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{11}i}{84} & 0 & 0 & 0 & -\frac{\sqrt{385}i}{300} \\
0 & 0 & 0 & -\frac{\sqrt{33}i}{21} & 0 & 0 & -\frac{\sqrt{385}i}{300} & 0 & 0 & 0 & -\frac{\sqrt{11}i}{84} & 0 & 0 & 0 \\
-\frac{\sqrt{110}i}{30} & 0 & 0 & 0 & \frac{\sqrt{22}i}{42} & 0 & 0 & -\frac{\sqrt{165}i}{300} & 0 & 0 & 0 & \frac{\sqrt{55}i}{140} & 0 & 0 \\
-\frac{\sqrt{22}i}{168} & 0 & 0 & 0 & \frac{\sqrt{110}i}{120} & 0 & 0 & \frac{\sqrt{33}i}{231} & 0 & 0 & 0 & -\frac{\sqrt{11}i}{165} & 0 & 0 \\
0 & \frac{\sqrt{22}i}{56} & 0 & 0 & 0 & \frac{\sqrt{110}i}{120} & 0 & 0 & -\frac{4\sqrt{55}i}{1155} & 0 & 0 & 0 & -\frac{2\sqrt{165}i}{825} & 0 \\
0 & 0 & -\frac{\sqrt{22}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{66}i}{462} & 0 & 0 & 0 & -\frac{\sqrt{2310}i}{1650} \\
0 & 0 & 0 & -\frac{\sqrt{22}i}{84} & 0 & 0 & \frac{\sqrt{2310}i}{1650} & 0 & 0 & 0 & \frac{\sqrt{66}i}{462} & 0 & 0 & 0 \\
\frac{\sqrt{110}i}{120} & 0 & 0 & 0 & \frac{\sqrt{22}i}{56} & 0 & 0 & \frac{2\sqrt{165}i}{825} & 0 & 0 & 0 & \frac{4\sqrt{55}i}{1155} & 0 & 0 \\
0 & \frac{\sqrt{110}i}{120} & 0 & 0 & 0 & -\frac{\sqrt{22}i}{168} & 0 & 0 & \frac{\sqrt{11}i}{165} & 0 & 0 & 0 & -\frac{\sqrt{33}i}{231} & 0 \\
\end{bmatrix}$$

| 682 | symmetry | $\dfrac{\sqrt{35}xy(x-y)(x+y)}{2}$ |
|---|---|---|

Table 9

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{G}_4^{(1,1;a)}(A_{2u})$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2310}}{105}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{385}}{350}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{165}}{150}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{165}}{150}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{2310}}{105}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{385}}{350}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2310}}{420}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{2\sqrt{231}}{1155}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2310}}{420}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{4\sqrt{385}}{1925}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{110}}{275}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{110}}{275}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $\frac{\sqrt{2310}}{420}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{4\sqrt{385}}{1925}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{2310}}{420}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{2\sqrt{231}}{1155}$ | $0$ | $0$ | $0$ | $0$ | $0$ |

| 683 | symmetry | $\dfrac{\sqrt{5}(x-y)(x+y)\left(x^2+y^2-6z^2\right)}{4}$ |
|---|---|---|

| | $\mathbb{G}_4^{(1,1;a)}(B_{1u})$ | $0$ | $0$ | $0$ | $\frac{\sqrt{33}i}{21}$ | $0$ | $0$ | $-\frac{\sqrt{385}i}{700}$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{11}i}{140}$ | $0$ | $0$ | $0$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $-\frac{\sqrt{110}i}{70}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{22}i}{14}$ | $0$ | $0$ | $\frac{11\sqrt{165}i}{2100}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{55}i}{700}$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{22}i}{14}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{110}i}{70}$ | $0$ | $0$ | $-\frac{\sqrt{55}i}{700}$ | $0$ | $0$ | $0$ | $\frac{11\sqrt{165}i}{2100}$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{33}i}{21}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{11}i}{140}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{385}i}{700}$ |
| | | $0$ | $0$ | $\frac{\sqrt{165}i}{140}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{55}i}{385}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{\sqrt{33}i}{84}$ | $0$ | $0$ | $\frac{3\sqrt{385}i}{1925}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{11}i}{385}$ | $0$ | $0$ | $0$ |
| | | $\frac{\sqrt{165}i}{140}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{33}i}{84}$ | $0$ | $0$ | $-\frac{9\sqrt{110}i}{3850}$ | $0$ | $0$ | $0$ | $\frac{17\sqrt{330}i}{11550}$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{33}i}{84}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{165}i}{140}$ | $0$ | $0$ | $-\frac{17\sqrt{330}i}{11550}$ | $0$ | $0$ | $0$ | $\frac{9\sqrt{110}i}{3850}$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{33}i}{84}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{11}i}{385}$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{385}i}{1925}$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{165}i}{140}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{2\sqrt{55}i}{385}$ | $0$ | $0$ | $0$ |

| 684 | symmetry | $-\dfrac{\sqrt{5}xy\left(x^2+y^2-6z^2\right)}{2}$ |
|---|---|---|

*continued ...*

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Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_4^{(1,1;a)}(B_{2u})$

$$\begin{bmatrix}
0 & 0 & 0 & -\frac{\sqrt{33}}{21} & 0 & 0 & -\frac{\sqrt{385}}{700} & 0 & 0 & 0 & \frac{3\sqrt{11}}{140} & 0 & 0 & 0 \\
-\frac{\sqrt{110}}{70} & 0 & 0 & 0 & \frac{\sqrt{22}}{14} & 0 & 0 & \frac{11\sqrt{165}}{2100} & 0 & 0 & 0 & \frac{\sqrt{55}}{700} & 0 & 0 \\
0 & \frac{\sqrt{22}}{14} & 0 & 0 & 0 & -\frac{\sqrt{110}}{70} & 0 & 0 & -\frac{\sqrt{55}}{700} & 0 & 0 & 0 & -\frac{11\sqrt{165}}{2100} & 0 \\
0 & 0 & -\frac{\sqrt{33}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{11}}{140} & 0 & 0 & 0 & \frac{\sqrt{385}}{700} \\
0 & 0 & -\frac{\sqrt{165}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt{55}}{385} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{33}}{84} & 0 & 0 & \frac{3\sqrt{385}}{1925} & 0 & 0 & 0 & \frac{\sqrt{11}}{385} & 0 & 0 & 0 \\
\frac{\sqrt{165}}{140} & 0 & 0 & 0 & \frac{\sqrt{33}}{84} & 0 & 0 & -\frac{9\sqrt{110}}{3850} & 0 & 0 & 0 & -\frac{17\sqrt{330}}{11550} & 0 & 0 \\
0 & -\frac{\sqrt{33}}{84} & 0 & 0 & 0 & -\frac{\sqrt{165}}{140} & 0 & 0 & -\frac{17\sqrt{330}}{11550} & 0 & 0 & 0 & -\frac{9\sqrt{110}}{3850} & 0 \\
0 & 0 & -\frac{\sqrt{33}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{11}}{385} & 0 & 0 & 0 & \frac{3\sqrt{385}}{1925} \\
0 & 0 & 0 & \frac{\sqrt{165}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt{55}}{385} & 0 & 0 & 0
\end{bmatrix}$$

| 685 | symmetry | $\dfrac{\sqrt{35}\,yz(y-z)(y+z)}{2}$ |
|---|---|---|

$\mathbb{G}_{4,1}^{(1,1;a)}(E_u,1)$

$$\begin{bmatrix}
\frac{\sqrt{2310}}{840} & 0 & \frac{\sqrt{231}}{84} & 0 & \frac{\sqrt{462}}{168} & 0 & 0 & -\frac{3\sqrt{385}}{1400} & 0 & -\frac{\sqrt{77}}{140} & 0 & -\frac{\sqrt{1155}}{1400} & 0 & 0 \\
0 & -\frac{\sqrt{154}}{56} & 0 & -\frac{\sqrt{77}}{28} & 0 & -\frac{\sqrt{770}}{280} & \frac{\sqrt{165}}{600} & 0 & \frac{\sqrt{385}}{350} & 0 & \frac{\sqrt{231}}{840} & 0 & -\frac{\sqrt{1155}}{2100} & 0 \\
\frac{\sqrt{770}}{280} & 0 & \frac{\sqrt{77}}{28} & 0 & \frac{\sqrt{154}}{56} & 0 & 0 & -\frac{\sqrt{1155}}{2100} & 0 & \frac{\sqrt{231}}{840} & 0 & \frac{\sqrt{385}}{350} & 0 & \frac{\sqrt{165}}{600} \\
0 & -\frac{\sqrt{462}}{168} & 0 & -\frac{\sqrt{231}}{84} & 0 & -\frac{\sqrt{2310}}{840} & 0 & 0 & -\frac{\sqrt{1155}}{1400} & 0 & -\frac{\sqrt{77}}{140} & 0 & -\frac{3\sqrt{385}}{1400} & 0 \\
0 & \frac{\sqrt{2310}}{840} & 0 & \frac{\sqrt{1155}}{840} & 0 & 0 & -\frac{\sqrt{11}}{220} & 0 & -\frac{\sqrt{231}}{462} & 0 & -\frac{\sqrt{385}}{1540} & 0 & 0 & 0 \\
-\frac{\sqrt{2310}}{840} & 0 & -\frac{\sqrt{231}}{168} & 0 & 0 & 0 & 0 & \frac{13\sqrt{385}}{7700} & 0 & \frac{\sqrt{77}}{770} & 0 & -\frac{\sqrt{1155}}{3300} & 0 & 0 \\
0 & \frac{\sqrt{231}}{168} & 0 & 0 & 0 & -\frac{\sqrt{1155}}{840} & -\frac{3\sqrt{110}}{2200} & 0 & -\frac{\sqrt{2310}}{46200} & 0 & \frac{\sqrt{154}}{440} & 0 & \frac{\sqrt{770}}{15400} & 0 \\
-\frac{\sqrt{1155}}{840} & 0 & 0 & 0 & \frac{\sqrt{231}}{168} & 0 & 0 & -\frac{\sqrt{770}}{15400} & 0 & -\frac{\sqrt{154}}{440} & 0 & \frac{\sqrt{2310}}{46200} & 0 & \frac{3\sqrt{110}}{2200} \\
0 & 0 & 0 & -\frac{\sqrt{231}}{168} & 0 & -\frac{\sqrt{2310}}{840} & 0 & 0 & \frac{\sqrt{1155}}{3300} & 0 & -\frac{\sqrt{77}}{770} & 0 & -\frac{13\sqrt{385}}{7700} & 0 \\
0 & 0 & \frac{\sqrt{1155}}{840} & 0 & \frac{\sqrt{2310}}{840} & 0 & 0 & 0 & 0 & \frac{\sqrt{385}}{1540} & 0 & \frac{\sqrt{231}}{462} & 0 & \frac{\sqrt{11}}{220}
\end{bmatrix}$$

| 686 | symmetry | $-\dfrac{\sqrt{35}\,xz(x-z)(x+z)}{2}$ |
|---|---|---|

**Table 9**

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{G}_{4,2}^{(1,1;a)}(E_u,1):$$

$$\begin{bmatrix}
\frac{\sqrt{2310}i}{840} & 0 & -\frac{\sqrt{231}i}{84} & 0 & \frac{\sqrt{462}i}{168} & 0 & 0 & -\frac{3\sqrt{385}i}{1400} & 0 & \frac{\sqrt{77}i}{140} & 0 & -\frac{\sqrt{1155}i}{1400} & 0 & 0 \\
0 & -\frac{\sqrt{154}i}{56} & 0 & \frac{\sqrt{77}i}{28} & 0 & -\frac{\sqrt{770}i}{280} & -\frac{\sqrt{165}i}{600} & 0 & \frac{\sqrt{385}i}{350} & 0 & -\frac{\sqrt{231}i}{840} & 0 & -\frac{\sqrt{1155}i}{2100} & 0 \\
-\frac{\sqrt{770}i}{280} & 0 & \frac{\sqrt{77}i}{28} & 0 & -\frac{\sqrt{154}i}{56} & 0 & 0 & \frac{\sqrt{1155}i}{2100} & 0 & \frac{\sqrt{231}i}{840} & 0 & -\frac{\sqrt{385}i}{350} & 0 & \frac{\sqrt{165}i}{600} \\
0 & \frac{\sqrt{462}i}{168} & 0 & -\frac{\sqrt{231}i}{84} & 0 & \frac{\sqrt{2310}i}{840} & 0 & 0 & \frac{\sqrt{1155}i}{1400} & 0 & -\frac{\sqrt{77}i}{140} & 0 & \frac{3\sqrt{385}i}{1400} & 0 \\
0 & -\frac{\sqrt{2310}i}{840} & 0 & \frac{\sqrt{1155}i}{840} & 0 & 0 & -\frac{\sqrt{11}i}{220} & 0 & \frac{\sqrt{231}i}{462} & 0 & -\frac{\sqrt{385}i}{1540} & 0 & 0 & 0 \\
-\frac{\sqrt{2310}i}{840} & 0 & \frac{\sqrt{231}i}{168} & 0 & 0 & 0 & 0 & \frac{13\sqrt{385}i}{7700} & 0 & -\frac{\sqrt{77}i}{770} & 0 & -\frac{\sqrt{1155}i}{3300} & 0 & 0 \\
0 & \frac{\sqrt{231}i}{168} & 0 & 0 & 0 & -\frac{\sqrt{1155}i}{840} & \frac{3\sqrt{110}i}{2200} & 0 & -\frac{\sqrt{2310}i}{46200} & 0 & -\frac{\sqrt{154}i}{440} & 0 & \frac{\sqrt{770}i}{15400} & 0 \\
\frac{\sqrt{1155}i}{840} & 0 & 0 & 0 & -\frac{\sqrt{231}i}{168} & 0 & 0 & \frac{\sqrt{770}i}{15400} & 0 & -\frac{\sqrt{154}i}{440} & 0 & -\frac{\sqrt{2310}i}{46200} & 0 & \frac{3\sqrt{110}i}{2200} \\
0 & 0 & 0 & -\frac{\sqrt{231}i}{168} & 0 & \frac{\sqrt{2310}i}{840} & 0 & 0 & -\frac{\sqrt{1155}i}{3300} & 0 & -\frac{\sqrt{77}i}{770} & 0 & \frac{13\sqrt{385}i}{7700} & 0 \\
0 & 0 & -\frac{\sqrt{1155}i}{840} & 0 & \frac{\sqrt{2310}i}{840} & 0 & 0 & 0 & 0 & -\frac{\sqrt{385}i}{1540} & 0 & \frac{\sqrt{231}i}{462} & 0 & -\frac{\sqrt{11}i}{220}
\end{bmatrix}$$

| No. | multipole | matrix |
|---|---|---|
| 687 | symmetry | $\dfrac{\sqrt{5}yz\left(6x^2-y^2-z^2\right)}{2}$ |

$$\mathbb{G}_{4,1}^{(1,1;a)}(E_u,2):$$

$$\begin{bmatrix}
\frac{\sqrt{330}}{840} & 0 & \frac{\sqrt{33}}{84} & 0 & -\frac{\sqrt{66}}{24} & 0 & 0 & -\frac{3\sqrt{55}}{1400} & 0 & -\frac{\sqrt{11}}{140} & 0 & \frac{\sqrt{165}}{200} & 0 & 0 \\
0 & -\frac{\sqrt{22}}{56} & 0 & -\frac{\sqrt{11}}{28} & 0 & \frac{\sqrt{110}}{40} & -\frac{\sqrt{1155}}{600} & 0 & \frac{\sqrt{55}}{350} & 0 & \frac{\sqrt{33}}{840} & 0 & \frac{\sqrt{165}}{300} & 0 \\
-\frac{\sqrt{110}}{40} & 0 & \frac{\sqrt{11}}{28} & 0 & \frac{\sqrt{22}}{56} & 0 & 0 & \frac{\sqrt{165}}{300} & 0 & \frac{\sqrt{33}}{840} & 0 & \frac{\sqrt{55}}{350} & 0 & -\frac{\sqrt{1155}}{600} \\
0 & \frac{\sqrt{66}}{24} & 0 & -\frac{\sqrt{33}}{84} & 0 & -\frac{\sqrt{330}}{840} & 0 & 0 & \frac{\sqrt{165}}{200} & 0 & -\frac{\sqrt{11}}{140} & 0 & -\frac{3\sqrt{55}}{1400} & 0 \\
0 & \frac{\sqrt{330}}{840} & 0 & -\frac{\sqrt{165}}{120} & 0 & 0 & -\frac{\sqrt{77}}{1540} & 0 & -\frac{\sqrt{33}}{462} & 0 & \frac{\sqrt{55}}{220} & 0 & 0 & 0 \\
-\frac{\sqrt{330}}{840} & 0 & -\frac{\sqrt{33}}{168} & 0 & 0 & 0 & 0 & \frac{13\sqrt{55}}{7700} & 0 & \frac{\sqrt{11}}{770} & 0 & \frac{7\sqrt{165}}{3300} & 0 & 0 \\
0 & \frac{\sqrt{33}}{168} & 0 & 0 & 0 & \frac{\sqrt{165}}{120} & \frac{3\sqrt{770}}{2200} & 0 & -\frac{\sqrt{330}}{46200} & 0 & \frac{\sqrt{22}}{440} & 0 & -\frac{\sqrt{110}}{2200} & 0 \\
\frac{\sqrt{165}}{120} & 0 & 0 & 0 & \frac{\sqrt{33}}{168} & 0 & 0 & \frac{\sqrt{110}}{2200} & 0 & -\frac{\sqrt{22}}{440} & 0 & \frac{\sqrt{330}}{46200} & 0 & -\frac{3\sqrt{770}}{2200} \\
0 & 0 & 0 & -\frac{\sqrt{33}}{168} & 0 & -\frac{\sqrt{330}}{840} & 0 & 0 & -\frac{7\sqrt{165}}{3300} & 0 & -\frac{\sqrt{11}}{770} & 0 & -\frac{13\sqrt{55}}{7700} & 0 \\
0 & 0 & -\frac{\sqrt{165}}{120} & 0 & \frac{\sqrt{330}}{840} & 0 & 0 & 0 & 0 & -\frac{\sqrt{55}}{220} & 0 & \frac{\sqrt{33}}{462} & 0 & \frac{\sqrt{77}}{1540}
\end{bmatrix}$$

| No. | multipole | matrix |
|---|---|---|
| 688 | symmetry | $\dfrac{\sqrt{5}xz\left(x^2-6y^2+z^2\right)}{2}$ |

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_{4,2}^{(1,1;a)}(E_u,2)$

$$\begin{bmatrix}
\frac{\sqrt{330}i}{840} & 0 & -\frac{\sqrt{33}i}{84} & 0 & -\frac{\sqrt{66}i}{24} & 0 & 0 & -\frac{3\sqrt{55}i}{1400} & 0 & \frac{\sqrt{11}i}{140} & 0 & \frac{\sqrt{165}i}{200} & 0 & 0 \\
0 & -\frac{\sqrt{22}i}{56} & 0 & \frac{\sqrt{11}i}{28} & 0 & \frac{\sqrt{110}i}{40} & \frac{\sqrt{1155}i}{600} & 0 & \frac{\sqrt{55}i}{350} & 0 & -\frac{\sqrt{33}i}{840} & 0 & \frac{\sqrt{165}i}{300} & 0 \\
\frac{\sqrt{110}i}{40} & 0 & \frac{\sqrt{11}i}{28} & 0 & -\frac{\sqrt{22}i}{56} & 0 & 0 & -\frac{\sqrt{165}i}{300} & 0 & \frac{\sqrt{33}i}{840} & 0 & -\frac{\sqrt{55}i}{350} & 0 & -\frac{\sqrt{1155}i}{600} \\
0 & -\frac{\sqrt{66}i}{24} & 0 & -\frac{\sqrt{33}i}{84} & 0 & \frac{\sqrt{330}i}{840} & 0 & 0 & -\frac{\sqrt{165}i}{200} & 0 & -\frac{\sqrt{11}i}{140} & 0 & \frac{3\sqrt{55}i}{1400} & 0 \\
0 & -\frac{\sqrt{330}i}{840} & 0 & -\frac{\sqrt{165}i}{120} & 0 & 0 & -\frac{\sqrt{77}i}{1540} & 0 & \frac{\sqrt{33}i}{462} & 0 & \frac{\sqrt{55}i}{220} & 0 & 0 & 0 \\
-\frac{\sqrt{330}i}{840} & 0 & \frac{\sqrt{33}i}{168} & 0 & 0 & 0 & 0 & \frac{13\sqrt{55}i}{7700} & 0 & -\frac{\sqrt{11}i}{770} & 0 & \frac{7\sqrt{165}i}{3300} & 0 & 0 \\
0 & \frac{\sqrt{33}i}{168} & 0 & 0 & 0 & \frac{\sqrt{165}i}{120} & -\frac{3\sqrt{770}i}{2200} & 0 & -\frac{\sqrt{330}i}{46200} & 0 & -\frac{\sqrt{22}i}{440} & 0 & -\frac{\sqrt{110}i}{2200} & 0 \\
-\frac{\sqrt{165}i}{120} & 0 & 0 & 0 & -\frac{\sqrt{33}i}{168} & 0 & 0 & -\frac{\sqrt{110}i}{2200} & 0 & -\frac{\sqrt{22}i}{440} & 0 & -\frac{\sqrt{330}i}{46200} & 0 & -\frac{3\sqrt{770}i}{2200} \\
0 & 0 & 0 & -\frac{\sqrt{33}i}{168} & 0 & \frac{\sqrt{330}i}{840} & 0 & 0 & \frac{7\sqrt{165}i}{3300} & 0 & -\frac{\sqrt{11}i}{770} & 0 & \frac{13\sqrt{55}i}{7700} & 0 \\
0 & 0 & \frac{\sqrt{165}i}{120} & 0 & \frac{\sqrt{330}i}{840} & 0 & 0 & 0 & 0 & \frac{\sqrt{55}i}{220} & 0 & \frac{\sqrt{33}i}{462} & 0 & -\frac{\sqrt{77}i}{1540}
\end{bmatrix}$$

| 689 | symmetry | $z$ |
|---|---|---|

$\mathbb{T}_1^{(a)}(A_{2u})$

$$\begin{bmatrix}
0 & \frac{i}{5} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{6}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{6}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{i}{5} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{14} & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{3i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{14} & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{7} & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{7} & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{3i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{14} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{14}
\end{bmatrix}$$

| 690 | symmetry | $x$ |
|---|---|---|

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}^{(a)}_{1,1}(E_u)$

$$\begin{pmatrix}
-\frac{\sqrt{5}i}{10} & 0 & \frac{\sqrt{2}i}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{3}i}{10} & 0 & \frac{\sqrt{6}i}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{6}i}{20} & 0 & \frac{\sqrt{3}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{2}i}{20} & 0 & \frac{\sqrt{5}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{5}i}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}i}{28} & 0 & \frac{\sqrt{2}i}{28} & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{5}i}{70} & 0 & -\frac{\sqrt{2}i}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{28} & 0 & \frac{\sqrt{6}i}{28} & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{2}i}{35} & 0 & -\frac{3i}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}i}{14} & 0 & \frac{\sqrt{3}i}{14} & 0 & 0 & 0 \\
0 & 0 & -\frac{3i}{70} & 0 & -\frac{\sqrt{2}i}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{14} & 0 & \frac{\sqrt{5}i}{14} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{2}i}{35} & 0 & -\frac{\sqrt{5}i}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{28} & 0 & \frac{\sqrt{30}i}{28} & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{5}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{28} & 0 & \frac{\sqrt{42}i}{28}
\end{pmatrix}$$

| 691 | symmetry | $y$ |
|---|---|---|

$\mathbb{T}^{(a)}_{1,2}(E_u)$

$$\begin{pmatrix}
\frac{\sqrt{5}}{10} & 0 & \frac{\sqrt{2}}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{3}}{10} & 0 & \frac{\sqrt{6}}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{6}}{20} & 0 & \frac{\sqrt{3}}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{2}}{20} & 0 & \frac{\sqrt{5}}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{5}}{70} & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{28} & 0 & \frac{\sqrt{2}}{28} & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{5}}{70} & 0 & -\frac{\sqrt{2}}{35} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{28} & 0 & \frac{\sqrt{6}}{28} & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{2}}{35} & 0 & -\frac{3}{70} & 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{14} & 0 & \frac{\sqrt{3}}{14} & 0 & 0 & 0 \\
0 & 0 & \frac{3}{70} & 0 & -\frac{\sqrt{2}}{35} & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{14} & 0 & \frac{\sqrt{5}}{14} & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{2}}{35} & 0 & -\frac{\sqrt{5}}{70} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{28} & 0 & \frac{\sqrt{30}}{28} & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{5}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{28} & 0 & \frac{\sqrt{42}}{28}
\end{pmatrix}$$

| 692 | symmetry | $-\frac{z\left(3x^2+3y^2-2z^2\right)}{2}$ |
|---|---|---|

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Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_3^{(a)}(A_{2u})$

$$\begin{pmatrix}
0 & -\frac{3\sqrt{21}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{84} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{3\sqrt{14}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}i}{84} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{3\sqrt{14}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{84} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{3\sqrt{21}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{84} & 0 & 0 \\
\frac{\sqrt{21}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{21}i}{30} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{2\sqrt{21}i}{105} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{14} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{2\sqrt{21}i}{105} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{14} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{21}i}{30} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}i}{14} & 0
\end{pmatrix}$$

| 693 | symmetry | $\sqrt{15}xyz$ |
|---|---|---|

$\mathbb{T}_3^{(a)}(B_{1u})$

$$\begin{pmatrix}
0 & 0 & 0 & -\frac{3\sqrt{70}}{140} & 0 & 0 & \frac{\sqrt{6}}{24} & 0 & 0 & 0 & -\frac{\sqrt{210}}{168} & 0 & 0 & 0 \\
-\frac{\sqrt{21}}{28} & 0 & 0 & 0 & -\frac{\sqrt{105}}{140} & 0 & 0 & -\frac{\sqrt{14}}{56} & 0 & 0 & 0 & -\frac{\sqrt{42}}{56} & 0 & 0 \\
0 & \frac{\sqrt{105}}{140} & 0 & 0 & 0 & \frac{\sqrt{21}}{28} & 0 & 0 & -\frac{\sqrt{42}}{56} & 0 & 0 & 0 & -\frac{\sqrt{14}}{56} & 0 \\
0 & 0 & \frac{3\sqrt{70}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{168} & 0 & 0 & 0 & \frac{\sqrt{6}}{24} \\
0 & 0 & \frac{\sqrt{14}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}}{42} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{70}}{140} & 0 & 0 & -\frac{\sqrt{6}}{12} & 0 & 0 & 0 & -\frac{\sqrt{210}}{84} & 0 & 0 & 0 \\
-\frac{\sqrt{14}}{28} & 0 & 0 & 0 & -\frac{\sqrt{70}}{140} & 0 & 0 & -\frac{\sqrt{21}}{84} & 0 & 0 & 0 & -\frac{\sqrt{7}}{28} & 0 & 0 \\
0 & -\frac{\sqrt{70}}{140} & 0 & 0 & 0 & -\frac{\sqrt{14}}{28} & 0 & 0 & \frac{\sqrt{7}}{28} & 0 & 0 & 0 & \frac{\sqrt{21}}{84} & 0 \\
0 & 0 & \frac{\sqrt{70}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{84} & 0 & 0 & 0 & \frac{\sqrt{6}}{12} \\
0 & 0 & 0 & \frac{\sqrt{14}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{42} & 0 & 0 & 0
\end{pmatrix}$$

| 694 | symmetry | $\frac{\sqrt{15}z(x-y)(x+y)}{2}$ |
|---|---|---|

*continued ...*

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Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_3^{(a)}(B_{2u})$

$$\begin{bmatrix}
0 & 0 & 0 & -\frac{3\sqrt{70}i}{140} & 0 & 0 & -\frac{\sqrt{6}i}{24} & 0 & 0 & 0 & -\frac{\sqrt{210}i}{168} & 0 & 0 & 0 \\
\frac{\sqrt{21}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{105}i}{140} & 0 & 0 & \frac{\sqrt{14}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{42}i}{56} & 0 & 0 \\
0 & -\frac{\sqrt{105}i}{140} & 0 & 0 & 0 & \frac{\sqrt{21}i}{28} & 0 & 0 & \frac{\sqrt{42}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{14}i}{56} & 0 \\
0 & 0 & -\frac{3\sqrt{70}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{168} & 0 & 0 & 0 & \frac{\sqrt{6}i}{24} \\
0 & 0 & \frac{\sqrt{14}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}i}{42} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{70}i}{140} & 0 & 0 & \frac{\sqrt{6}i}{12} & 0 & 0 & 0 & -\frac{\sqrt{210}i}{84} & 0 & 0 & 0 \\
\frac{\sqrt{14}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{70}i}{140} & 0 & 0 & \frac{\sqrt{21}i}{84} & 0 & 0 & 0 & -\frac{\sqrt{7}i}{28} & 0 & 0 \\
0 & \frac{\sqrt{70}i}{140} & 0 & 0 & 0 & -\frac{\sqrt{14}i}{28} & 0 & 0 & -\frac{\sqrt{7}i}{28} & 0 & 0 & 0 & \frac{\sqrt{21}i}{84} & 0 \\
0 & 0 & -\frac{\sqrt{70}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{84} & 0 & 0 & 0 & \frac{\sqrt{6}i}{12} \\
0 & 0 & 0 & -\frac{\sqrt{14}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}i}{42} & 0 & 0 & 0
\end{bmatrix}$$

| 695 | symmetry | $\dfrac{x\left(2x^2-3y^2-3z^2\right)}{2}$ |
|---|---|---|

$\mathbb{T}_{3,1}^{(a)}(E_u,1)$

$$\begin{bmatrix}
-\frac{3\sqrt{105}i}{560} & 0 & \frac{9\sqrt{42}i}{560} & 0 & -\frac{3\sqrt{21}i}{112} & 0 & 0 & -\frac{\sqrt{70}i}{112} & 0 & \frac{\sqrt{14}i}{56} & 0 & -\frac{\sqrt{210}i}{336} & 0 & 0 \\
0 & \frac{3\sqrt{7}i}{80} & 0 & -\frac{3\sqrt{14}i}{560} & 0 & -\frac{3\sqrt{35}i}{112} & -\frac{\sqrt{30}i}{48} & 0 & 0 & 0 & \frac{\sqrt{42}i}{112} & 0 & -\frac{\sqrt{210}i}{168} & 0 \\
\frac{3\sqrt{35}i}{112} & 0 & \frac{3\sqrt{14}i}{560} & 0 & -\frac{3\sqrt{7}i}{80} & 0 & 0 & -\frac{\sqrt{210}i}{168} & 0 & \frac{\sqrt{42}i}{112} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{48} \\
0 & \frac{3\sqrt{21}i}{112} & 0 & -\frac{9\sqrt{42}i}{560} & 0 & \frac{3\sqrt{105}i}{560} & 0 & 0 & -\frac{\sqrt{210}i}{336} & 0 & \frac{\sqrt{14}i}{56} & 0 & -\frac{\sqrt{70}i}{112} & 0 \\
0 & -\frac{\sqrt{105}i}{140} & 0 & \frac{\sqrt{210}i}{168} & 0 & 0 & -\frac{\sqrt{2}i}{16} & 0 & \frac{\sqrt{42}i}{56} & 0 & -\frac{\sqrt{70}i}{112} & 0 & 0 & 0 \\
-\frac{\sqrt{105}i}{140} & 0 & \frac{\sqrt{42}i}{280} & 0 & \frac{\sqrt{21}i}{42} & 0 & 0 & \frac{\sqrt{70}i}{112} & 0 & \frac{\sqrt{14}i}{56} & 0 & -\frac{\sqrt{210}i}{112} & 0 & 0 \\
0 & \frac{\sqrt{42}i}{280} & 0 & \frac{\sqrt{21}i}{70} & 0 & \frac{\sqrt{210}i}{168} & \frac{\sqrt{5}i}{16} & 0 & \frac{\sqrt{105}i}{112} & 0 & -\frac{\sqrt{7}i}{112} & 0 & -\frac{3\sqrt{35}i}{112} & 0 \\
\frac{\sqrt{210}i}{168} & 0 & \frac{\sqrt{21}i}{70} & 0 & \frac{\sqrt{42}i}{280} & 0 & 0 & \frac{3\sqrt{35}i}{112} & 0 & \frac{\sqrt{7}i}{112} & 0 & -\frac{\sqrt{105}i}{112} & 0 & -\frac{\sqrt{5}i}{16} \\
0 & \frac{\sqrt{21}i}{42} & 0 & \frac{\sqrt{42}i}{280} & 0 & -\frac{\sqrt{105}i}{140} & 0 & 0 & \frac{\sqrt{210}i}{112} & 0 & -\frac{\sqrt{14}i}{56} & 0 & -\frac{\sqrt{70}i}{112} & 0 \\
0 & 0 & \frac{\sqrt{210}i}{168} & 0 & -\frac{\sqrt{105}i}{140} & 0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{112} & 0 & -\frac{\sqrt{42}i}{56} & 0 & \frac{\sqrt{2}i}{16}
\end{bmatrix}$$

| 696 | symmetry | $-\dfrac{y\left(3x^2-2y^2+3z^2\right)}{2}$ |
|---|---|---|

Table 9

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{T}^{(a)}_{3,2}(E_u,1)$

$$\begin{bmatrix}
\frac{3\sqrt{105}}{560} & 0 & \frac{9\sqrt{42}}{560} & 0 & \frac{3\sqrt{21}}{112} & 0 & 0 & \frac{\sqrt{70}}{112} & 0 & \frac{\sqrt{14}}{56} & 0 & \frac{\sqrt{210}}{336} & 0 & 0 \\
0 & -\frac{3\sqrt{7}}{80} & 0 & -\frac{3\sqrt{14}}{560} & 0 & \frac{3\sqrt{35}}{112} & -\frac{\sqrt{30}}{48} & 0 & 0 & 0 & \frac{\sqrt{42}}{112} & 0 & \frac{\sqrt{210}}{168} & 0 \\
\frac{3\sqrt{35}}{112} & 0 & -\frac{3\sqrt{14}}{560} & 0 & -\frac{3\sqrt{7}}{80} & 0 & 0 & -\frac{\sqrt{210}}{168} & 0 & -\frac{\sqrt{42}}{112} & 0 & 0 & 0 & \frac{\sqrt{30}}{48} \\
0 & \frac{3\sqrt{21}}{112} & 0 & \frac{9\sqrt{42}}{560} & 0 & \frac{3\sqrt{105}}{560} & 0 & 0 & -\frac{\sqrt{210}}{336} & 0 & -\frac{\sqrt{14}}{56} & 0 & -\frac{\sqrt{70}}{112} & 0 \\
0 & -\frac{\sqrt{105}}{140} & 0 & -\frac{\sqrt{210}}{168} & 0 & 0 & \frac{\sqrt{2}}{16} & 0 & \frac{\sqrt{42}}{56} & 0 & \frac{\sqrt{70}}{112} & 0 & 0 & 0 \\
\frac{\sqrt{105}}{140} & 0 & \frac{\sqrt{42}}{280} & 0 & -\frac{\sqrt{21}}{42} & 0 & 0 & -\frac{\sqrt{70}}{112} & 0 & \frac{\sqrt{14}}{56} & 0 & \frac{\sqrt{210}}{112} & 0 & 0 \\
0 & -\frac{\sqrt{42}}{280} & 0 & \frac{\sqrt{21}}{70} & 0 & -\frac{\sqrt{210}}{168} & \frac{\sqrt{5}}{16} & 0 & -\frac{\sqrt{105}}{112} & 0 & -\frac{\sqrt{7}}{112} & 0 & \frac{3\sqrt{35}}{112} & 0 \\
\frac{\sqrt{210}}{168} & 0 & -\frac{\sqrt{21}}{70} & 0 & \frac{\sqrt{42}}{280} & 0 & 0 & \frac{3\sqrt{35}}{112} & 0 & -\frac{\sqrt{7}}{112} & 0 & -\frac{\sqrt{105}}{112} & 0 & \frac{\sqrt{5}}{16} \\
0 & \frac{\sqrt{21}}{42} & 0 & -\frac{\sqrt{42}}{280} & 0 & -\frac{\sqrt{105}}{140} & 0 & 0 & \frac{\sqrt{210}}{112} & 0 & \frac{\sqrt{14}}{56} & 0 & -\frac{\sqrt{70}}{112} & 0 \\
0 & 0 & \frac{\sqrt{210}}{168} & 0 & \frac{\sqrt{105}}{140} & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{112} & 0 & \frac{\sqrt{42}}{56} & 0 & \frac{\sqrt{2}}{16}
\end{bmatrix}$$

697    symmetry    $\dfrac{\sqrt{15}x(y-z)(y+z)}{2}$

$\mathbb{T}^{(a)}_{3,1}(E_u,2)$

$$\begin{bmatrix}
-\frac{3\sqrt{7}i}{112} & 0 & \frac{9\sqrt{70}i}{560} & 0 & \frac{9\sqrt{35}i}{560} & 0 & 0 & -\frac{5\sqrt{42}i}{336} & 0 & \frac{\sqrt{210}i}{168} & 0 & \frac{\sqrt{14}i}{112} & 0 & 0 \\
0 & \frac{\sqrt{105}i}{80} & 0 & -\frac{\sqrt{210}i}{560} & 0 & \frac{3\sqrt{21}i}{112} & \frac{\sqrt{2}i}{16} & 0 & 0 & 0 & \frac{\sqrt{70}i}{112} & 0 & \frac{\sqrt{14}i}{56} & 0 \\
-\frac{3\sqrt{21}i}{112} & 0 & \frac{\sqrt{210}i}{560} & 0 & -\frac{\sqrt{105}i}{80} & 0 & 0 & \frac{\sqrt{14}i}{56} & 0 & \frac{\sqrt{70}i}{112} & 0 & 0 & 0 & \frac{\sqrt{2}i}{16} \\
0 & -\frac{9\sqrt{35}i}{560} & 0 & -\frac{9\sqrt{70}i}{560} & 0 & \frac{3\sqrt{7}i}{112} & 0 & 0 & \frac{\sqrt{14}i}{112} & 0 & \frac{\sqrt{210}i}{168} & 0 & -\frac{5\sqrt{42}i}{336} & 0 \\
0 & -\frac{\sqrt{7}i}{28} & 0 & -\frac{\sqrt{14}i}{56} & 0 & 0 & -\frac{\sqrt{30}i}{48} & 0 & \frac{\sqrt{70}i}{56} & 0 & \frac{\sqrt{42}i}{112} & 0 & 0 & 0 \\
-\frac{\sqrt{7}i}{28} & 0 & \frac{\sqrt{70}i}{280} & 0 & -\frac{\sqrt{35}i}{70} & 0 & 0 & \frac{5\sqrt{42}i}{336} & 0 & \frac{\sqrt{210}i}{168} & 0 & \frac{3\sqrt{14}i}{112} & 0 & 0 \\
0 & \frac{\sqrt{70}i}{280} & 0 & \frac{\sqrt{35}i}{70} & 0 & -\frac{\sqrt{14}i}{56} & -\frac{\sqrt{3}i}{16} & 0 & \frac{5\sqrt{7}i}{112} & 0 & -\frac{\sqrt{105}i}{336} & 0 & \frac{3\sqrt{21}i}{112} & 0 \\
-\frac{\sqrt{14}i}{56} & 0 & \frac{\sqrt{35}i}{70} & 0 & \frac{\sqrt{70}i}{280} & 0 & 0 & -\frac{3\sqrt{21}i}{112} & 0 & \frac{\sqrt{105}i}{336} & 0 & -\frac{5\sqrt{7}i}{112} & 0 & \frac{\sqrt{3}i}{16} \\
0 & -\frac{\sqrt{35}i}{70} & 0 & \frac{\sqrt{70}i}{280} & 0 & -\frac{\sqrt{7}i}{28} & 0 & 0 & -\frac{3\sqrt{14}i}{112} & 0 & -\frac{\sqrt{210}i}{168} & 0 & -\frac{5\sqrt{42}i}{336} & 0 \\
0 & 0 & -\frac{\sqrt{14}i}{56} & 0 & -\frac{\sqrt{7}i}{28} & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}i}{112} & 0 & -\frac{\sqrt{70}i}{56} & 0 & \frac{\sqrt{30}i}{48}
\end{bmatrix}$$

698    symmetry    $\dfrac{\sqrt{15}y(x-z)(x+z)}{2}$

*continued ...*

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Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_{3,2}^{(a)}(E_u,2)$

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\frac{3\sqrt{7}}{112}$ | $0$ | $\frac{9\sqrt{70}}{560}$ | $0$ | $-\frac{9\sqrt{35}}{560}$ | $0$ | $0$ | $\frac{5\sqrt{42}}{336}$ | $0$ | $\frac{\sqrt{210}}{168}$ | $0$ | $-\frac{\sqrt{14}}{112}$ | $0$ | $0$ |
| $0$ | $-\frac{\sqrt{105}}{80}$ | $0$ | $-\frac{\sqrt{210}}{560}$ | $0$ | $-\frac{3\sqrt{21}}{112}$ | $\frac{\sqrt{2}}{16}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{70}}{112}$ | $0$ | $-\frac{\sqrt{14}}{56}$ | $0$ |
| $-\frac{3\sqrt{21}}{112}$ | $0$ | $-\frac{\sqrt{210}}{560}$ | $0$ | $-\frac{\sqrt{105}}{80}$ | $0$ | $0$ | $\frac{\sqrt{14}}{56}$ | $0$ | $-\frac{\sqrt{70}}{112}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2}}{16}$ |
| $0$ | $-\frac{9\sqrt{35}}{560}$ | $0$ | $\frac{9\sqrt{70}}{560}$ | $0$ | $\frac{3\sqrt{7}}{112}$ | $0$ | $0$ | $\frac{\sqrt{14}}{112}$ | $0$ | $-\frac{\sqrt{210}}{168}$ | $0$ | $-\frac{5\sqrt{42}}{336}$ | $0$ |
| $0$ | $-\frac{\sqrt{7}}{28}$ | $0$ | $\frac{\sqrt{14}}{56}$ | $0$ | $0$ | $\frac{\sqrt{30}}{48}$ | $0$ | $\frac{\sqrt{70}}{56}$ | $0$ | $-\frac{\sqrt{42}}{112}$ | $0$ | $0$ | $0$ |
| $\frac{\sqrt{7}}{28}$ | $0$ | $\frac{\sqrt{70}}{280}$ | $0$ | $\frac{\sqrt{35}}{70}$ | $0$ | $0$ | $-\frac{5\sqrt{42}}{336}$ | $0$ | $\frac{\sqrt{210}}{168}$ | $0$ | $-\frac{3\sqrt{14}}{112}$ | $0$ | $0$ |
| $0$ | $-\frac{\sqrt{70}}{280}$ | $0$ | $\frac{\sqrt{35}}{70}$ | $0$ | $\frac{\sqrt{14}}{56}$ | $-\frac{\sqrt{3}}{16}$ | $0$ | $-\frac{5\sqrt{7}}{112}$ | $0$ | $-\frac{\sqrt{105}}{336}$ | $0$ | $-\frac{3\sqrt{21}}{112}$ | $0$ |
| $-\frac{\sqrt{14}}{56}$ | $0$ | $-\frac{\sqrt{35}}{70}$ | $0$ | $\frac{\sqrt{70}}{280}$ | $0$ | $0$ | $-\frac{3\sqrt{21}}{112}$ | $0$ | $-\frac{\sqrt{105}}{336}$ | $0$ | $-\frac{5\sqrt{7}}{112}$ | $0$ | $-\frac{\sqrt{3}}{16}$ |
| $0$ | $-\frac{\sqrt{35}}{70}$ | $0$ | $-\frac{\sqrt{70}}{280}$ | $0$ | $-\frac{\sqrt{7}}{28}$ | $0$ | $0$ | $-\frac{3\sqrt{14}}{112}$ | $0$ | $\frac{\sqrt{210}}{168}$ | $0$ | $-\frac{5\sqrt{42}}{336}$ | $0$ |
| $0$ | $0$ | $-\frac{\sqrt{14}}{56}$ | $0$ | $\frac{\sqrt{7}}{28}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{42}}{112}$ | $0$ | $\frac{\sqrt{70}}{56}$ | $0$ | $\frac{\sqrt{30}}{48}$ |

| 699 | symmetry | $\frac{3\sqrt{35}xyz(x-y)(x+y)}{2}$ |
|---|---|---|

$\mathbb{T}_5^{(a)}(A_{1u})$

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{7}}{10}$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{3}}{10}$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{3}}{10}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{7}}{10}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{42}}{28}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{105}}{70}$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{42}}{28}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{7}}{70}$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2}}{10}$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{2}}{10}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $\frac{\sqrt{42}}{28}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{7}}{70}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $-\frac{\sqrt{42}}{28}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{105}}{70}$ | $0$ | $0$ | $0$ | $0$ | $0$ |

| 700 | symmetry | $\frac{z\left(15x^4+30x^2y^2-40x^2z^2+15y^4-40y^2z^2+8z^4\right)}{8}$ |
|---|---|---|

222

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_5^{(a)}(A_{2u},1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{30} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{6} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{6} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{30} & 0 & 0 \\
-\frac{\sqrt{6}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{i}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{5\sqrt{6}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{15}i}{70} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{5\sqrt{6}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{14} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{5\sqrt{6}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{14} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{5\sqrt{6}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{15}i}{70} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{i}{14} & 0
\end{bmatrix}$$

701    symmetry

$$\frac{3\sqrt{35}\,z\left(x^2-2xy-y^2\right)\left(x^2+2xy-y^2\right)}{8}$$

$\mathbb{T}_5^{(a)}(A_{2u},2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{10} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{10} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{42}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}i}{70} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{70} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{10} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{42}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{42}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}i}{70} & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

702    symmetry

$$\frac{\sqrt{105}\,xyz\left(x^2+y^2-2z^2\right)}{2}$$

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_5^{(a)}(B_{1u})$:

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{60} & 0 & 0 & 0 & -\frac{\sqrt{105}}{60} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{20} & 0 & 0 & 0 & \frac{\sqrt{21}}{20} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}}{20} & 0 & 0 & 0 & -\frac{\sqrt{7}}{20} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}}{60} & 0 & 0 & 0 & \frac{\sqrt{3}}{60} \\
0 & 0 & \frac{\sqrt{7}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}}{42} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{35}}{28} & 0 & 0 & -\frac{\sqrt{3}}{30} & 0 & 0 & 0 & \frac{\sqrt{105}}{105} & 0 & 0 & 0 \\
-\frac{\sqrt{7}}{28} & 0 & 0 & 0 & \frac{\sqrt{35}}{28} & 0 & 0 & \frac{2\sqrt{42}}{105} & 0 & 0 & 0 & \frac{\sqrt{14}}{70} & 0 & 0 \\
0 & \frac{\sqrt{35}}{28} & 0 & 0 & 0 & -\frac{\sqrt{7}}{28} & 0 & 0 & -\frac{\sqrt{14}}{70} & 0 & 0 & 0 & -\frac{2\sqrt{42}}{105} & 0 \\
0 & 0 & -\frac{\sqrt{35}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}}{105} & 0 & 0 & 0 & \frac{\sqrt{3}}{30} \\
0 & 0 & 0 & \frac{\sqrt{7}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}}{42} & 0 & 0 & 0
\end{bmatrix}$$

703    symmetry

$$-\frac{\sqrt{105}\,z(x-y)(x+y)\left(x^2+y^2-2z^2\right)}{4}$$

$\mathbb{T}_5^{(a)}(B_{2u})$:

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{60} & 0 & 0 & 0 & \frac{\sqrt{105}i}{60} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{20} & 0 & 0 & 0 & -\frac{\sqrt{21}i}{20} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}i}{20} & 0 & 0 & 0 & \frac{\sqrt{7}i}{20} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}i}{60} & 0 & 0 & 0 & -\frac{\sqrt{3}i}{60} \\
0 & 0 & -\frac{\sqrt{7}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}i}{42} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{35}i}{28} & 0 & 0 & -\frac{\sqrt{3}i}{30} & 0 & 0 & 0 & -\frac{\sqrt{105}i}{105} & 0 & 0 & 0 \\
-\frac{\sqrt{7}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{35}i}{28} & 0 & 0 & \frac{2\sqrt{42}i}{105} & 0 & 0 & 0 & -\frac{\sqrt{14}i}{70} & 0 & 0 \\
0 & \frac{\sqrt{35}i}{28} & 0 & 0 & 0 & \frac{\sqrt{7}i}{28} & 0 & 0 & -\frac{\sqrt{14}i}{70} & 0 & 0 & 0 & \frac{2\sqrt{42}i}{105} & 0 \\
0 & 0 & -\frac{\sqrt{35}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}i}{105} & 0 & 0 & 0 & -\frac{\sqrt{3}i}{30} \\
0 & 0 & 0 & \frac{\sqrt{7}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}i}{42} & 0 & 0 & 0
\end{bmatrix}$$

704    symmetry

$$\frac{x\left(8x^4-40x^2y^2-40x^2z^2+15y^4+30y^2z^2+15z^4\right)}{8}$$

*continued ...*

224

Table 9

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{T}_{5,1}^{(a)}(E_u,1)$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}i}{80} & 0 & \frac{i}{16} & 0 & -\frac{7\sqrt{15}i}{240} & 0 & \frac{3\sqrt{35}i}{80} \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}i}{240} & 0 & \frac{3\sqrt{5}i}{80} & 0 & -\frac{\sqrt{3}i}{16} & 0 & \frac{7\sqrt{15}i}{240} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{7\sqrt{15}i}{240} & 0 & -\frac{\sqrt{3}i}{16} & 0 & \frac{3\sqrt{5}i}{80} & 0 & -\frac{\sqrt{105}i}{240} \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{35}i}{80} & 0 & -\frac{7\sqrt{15}i}{240} & 0 & \frac{i}{16} & 0 & -\frac{\sqrt{5}i}{80} & 0 \\ 0 & -\frac{\sqrt{30}i}{224} & 0 & \frac{\sqrt{15}i}{48} & 0 & -\frac{3\sqrt{6}i}{32} & -\frac{\sqrt{7}i}{224} & 0 & \frac{5\sqrt{3}i}{224} & 0 & -\frac{\sqrt{5}i}{32} & 0 & \frac{3i}{32} & 0 \\ -\frac{\sqrt{30}i}{224} & 0 & \frac{5\sqrt{3}i}{112} & 0 & -\frac{5\sqrt{6}i}{96} & 0 & 0 & \frac{23\sqrt{5}i}{1120} & 0 & -\frac{13i}{224} & 0 & \frac{\sqrt{15}i}{160} & 0 & \frac{3\sqrt{35}i}{160} \\ 0 & \frac{5\sqrt{3}i}{112} & 0 & -\frac{5\sqrt{6}i}{112} & 0 & \frac{\sqrt{15}i}{48} & \frac{\sqrt{70}i}{160} & 0 & -\frac{11\sqrt{30}i}{1120} & 0 & \frac{\sqrt{2}i}{224} & 0 & \frac{3\sqrt{10}i}{160} & 0 \\ \frac{\sqrt{15}i}{48} & 0 & -\frac{5\sqrt{6}i}{112} & 0 & \frac{5\sqrt{3}i}{112} & 0 & 0 & -\frac{3\sqrt{10}i}{160} & 0 & -\frac{\sqrt{2}i}{224} & 0 & \frac{11\sqrt{30}i}{1120} & 0 & -\frac{\sqrt{70}i}{160} \\ 0 & -\frac{5\sqrt{6}i}{96} & 0 & \frac{5\sqrt{3}i}{112} & 0 & -\frac{\sqrt{30}i}{224} & -\frac{3\sqrt{35}i}{160} & 0 & -\frac{\sqrt{15}i}{160} & 0 & \frac{13i}{224} & 0 & -\frac{23\sqrt{5}i}{1120} & 0 \\ -\frac{3\sqrt{6}i}{32} & 0 & \frac{\sqrt{15}i}{48} & 0 & -\frac{\sqrt{30}i}{224} & 0 & 0 & -\frac{3i}{32} & 0 & \frac{\sqrt{5}i}{32} & 0 & -\frac{5\sqrt{3}i}{224} & 0 & \frac{\sqrt{7}i}{224} \end{bmatrix}$ |

| 705 | symmetry | $\dfrac{y\left(15x^4 - 40x^2y^2 + 30x^2z^2 + 8y^4 - 40y^2z^2 + 15z^4\right)}{8}$ |

| | $\mathbb{T}_{5,2}^{(a)}(E_u,1)$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{80} & 0 & \frac{1}{16} & 0 & \frac{7\sqrt{15}}{240} & 0 & \frac{3\sqrt{35}}{80} \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}}{240} & 0 & -\frac{3\sqrt{5}}{80} & 0 & -\frac{\sqrt{3}}{16} & 0 & -\frac{7\sqrt{15}}{240} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{7\sqrt{15}}{240} & 0 & \frac{\sqrt{3}}{16} & 0 & \frac{3\sqrt{5}}{80} & 0 & \frac{\sqrt{105}}{240} \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{35}}{80} & 0 & -\frac{7\sqrt{15}}{240} & 0 & -\frac{1}{16} & 0 & -\frac{\sqrt{5}}{80} & 0 \\ 0 & -\frac{\sqrt{30}}{224} & 0 & -\frac{\sqrt{15}}{48} & 0 & -\frac{3\sqrt{6}}{32} & \frac{\sqrt{7}}{224} & 0 & \frac{5\sqrt{3}}{224} & 0 & \frac{\sqrt{5}}{32} & 0 & \frac{3}{32} & 0 \\ \frac{\sqrt{30}}{224} & 0 & \frac{5\sqrt{3}}{112} & 0 & \frac{5\sqrt{6}}{96} & 0 & 0 & -\frac{23\sqrt{5}}{1120} & 0 & -\frac{13}{224} & 0 & -\frac{\sqrt{15}}{160} & 0 & \frac{3\sqrt{35}}{160} \\ 0 & -\frac{5\sqrt{3}}{112} & 0 & -\frac{5\sqrt{6}}{112} & 0 & -\frac{\sqrt{15}}{48} & \frac{\sqrt{70}}{160} & 0 & \frac{11\sqrt{30}}{1120} & 0 & \frac{\sqrt{2}}{224} & 0 & -\frac{3\sqrt{10}}{160} & 0 \\ \frac{\sqrt{15}}{48} & 0 & \frac{5\sqrt{6}}{112} & 0 & \frac{5\sqrt{3}}{112} & 0 & 0 & -\frac{3\sqrt{10}}{160} & 0 & \frac{\sqrt{2}}{224} & 0 & \frac{11\sqrt{30}}{1120} & 0 & \frac{\sqrt{70}}{160} \\ 0 & -\frac{5\sqrt{6}}{96} & 0 & -\frac{5\sqrt{3}}{112} & 0 & -\frac{\sqrt{30}}{224} & \frac{3\sqrt{35}}{160} & 0 & -\frac{\sqrt{15}}{160} & 0 & -\frac{13}{224} & 0 & -\frac{23\sqrt{5}}{1120} & 0 \\ \frac{3\sqrt{6}}{32} & 0 & \frac{\sqrt{15}}{48} & 0 & \frac{\sqrt{30}}{224} & 0 & 0 & \frac{3}{32} & 0 & \frac{\sqrt{5}}{32} & 0 & \frac{5\sqrt{3}}{224} & 0 & \frac{\sqrt{7}}{224} \end{bmatrix}$ |

| 706 | symmetry | $\dfrac{3\sqrt{35}x\left(y^2-2yz-z^2\right)\left(y^2+2yz-z^2\right)}{8}$ |

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_{5,1}^{(a)}(E_u,2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{80} & 0 & \frac{\sqrt{35}i}{80} & 0 & \frac{3\sqrt{21}i}{80} & 0 & \frac{i}{16} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{3}i}{80} & 0 & \frac{3\sqrt{7}i}{80} & 0 & -\frac{\sqrt{105}i}{80} & 0 & -\frac{3\sqrt{21}i}{80} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{21}i}{80} & 0 & -\frac{\sqrt{105}i}{80} & 0 & \frac{3\sqrt{7}i}{80} & 0 & \frac{3\sqrt{3}i}{80} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{i}{16} & 0 & \frac{3\sqrt{21}i}{80} & 0 & \frac{\sqrt{35}i}{80} & 0 & -\frac{\sqrt{7}i}{80} & 0 \\
0 & -\frac{\sqrt{42}i}{224} & 0 & -\frac{3\sqrt{21}i}{112} & 0 & -\frac{\sqrt{210}i}{224} & -\frac{\sqrt{5}i}{160} & 0 & \frac{\sqrt{105}i}{224} & 0 & \frac{9\sqrt{7}i}{224} & 0 & \frac{\sqrt{35}i}{224} & 0 \\
-\frac{\sqrt{42}i}{224} & 0 & \frac{\sqrt{105}i}{112} & 0 & \frac{3\sqrt{210}i}{224} & 0 & 0 & \frac{23\sqrt{7}i}{1120} & 0 & -\frac{13\sqrt{35}i}{1120} & 0 & -\frac{9\sqrt{21}i}{1120} & 0 & \frac{i}{32} \\
0 & \frac{\sqrt{105}i}{112} & 0 & -\frac{\sqrt{210}i}{112} & 0 & -\frac{3\sqrt{21}i}{112} & -\frac{9\sqrt{2}i}{160} & 0 & -\frac{11\sqrt{42}i}{1120} & 0 & \frac{\sqrt{70}i}{1120} & 0 & -\frac{27\sqrt{14}i}{1120} & 0 \\
-\frac{3\sqrt{21}i}{112} & 0 & -\frac{\sqrt{210}i}{112} & 0 & \frac{\sqrt{105}i}{112} & 0 & 0 & \frac{27\sqrt{14}i}{1120} & 0 & -\frac{\sqrt{70}i}{1120} & 0 & \frac{11\sqrt{42}i}{1120} & 0 & \frac{9\sqrt{2}i}{160} \\
0 & \frac{3\sqrt{210}i}{224} & 0 & \frac{\sqrt{105}i}{112} & 0 & -\frac{\sqrt{42}i}{224} & -\frac{i}{32} & 0 & \frac{9\sqrt{21}i}{1120} & 0 & \frac{13\sqrt{35}i}{1120} & 0 & -\frac{23\sqrt{7}i}{1120} & 0 \\
-\frac{\sqrt{210}i}{224} & 0 & -\frac{3\sqrt{21}i}{112} & 0 & -\frac{\sqrt{42}i}{224} & 0 & 0 & -\frac{\sqrt{35}i}{224} & 0 & -\frac{9\sqrt{7}i}{224} & 0 & -\frac{\sqrt{105}i}{224} & 0 & \frac{\sqrt{5}i}{160}
\end{bmatrix}$$

| 707 | symmetry | $\dfrac{3\sqrt{35}\,y\left(x^2-2xz-z^2\right)\left(x^2+2xz-z^2\right)}{8}$ |
|---|---|---|

$\mathbb{T}_{5,2}^{(a)}(E_u,2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{80} & 0 & \frac{\sqrt{35}}{80} & 0 & -\frac{3\sqrt{21}}{80} & 0 & \frac{1}{16} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{3}}{80} & 0 & -\frac{3\sqrt{7}}{80} & 0 & -\frac{\sqrt{105}}{80} & 0 & \frac{3\sqrt{21}}{80} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{21}}{80} & 0 & \frac{\sqrt{105}}{80} & 0 & \frac{3\sqrt{7}}{80} & 0 & -\frac{3\sqrt{3}}{80} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{16} & 0 & \frac{3\sqrt{21}}{80} & 0 & -\frac{\sqrt{35}}{80} & 0 & -\frac{\sqrt{7}}{80} & 0 \\
0 & -\frac{\sqrt{42}}{224} & 0 & \frac{3\sqrt{21}}{112} & 0 & -\frac{\sqrt{210}}{224} & \frac{\sqrt{5}}{160} & 0 & \frac{\sqrt{105}}{224} & 0 & -\frac{9\sqrt{7}}{224} & 0 & \frac{\sqrt{35}}{224} & 0 \\
\frac{\sqrt{42}}{224} & 0 & \frac{\sqrt{105}}{112} & 0 & -\frac{3\sqrt{210}}{224} & 0 & 0 & -\frac{23\sqrt{7}}{1120} & 0 & -\frac{13\sqrt{35}}{1120} & 0 & \frac{9\sqrt{21}}{1120} & 0 & \frac{1}{32} \\
0 & -\frac{\sqrt{105}}{112} & 0 & -\frac{\sqrt{210}}{112} & 0 & \frac{3\sqrt{21}}{112} & -\frac{9\sqrt{2}}{160} & 0 & \frac{11\sqrt{42}}{1120} & 0 & \frac{\sqrt{70}}{1120} & 0 & \frac{27\sqrt{14}}{1120} & 0 \\
-\frac{3\sqrt{21}}{112} & 0 & \frac{\sqrt{210}}{112} & 0 & \frac{\sqrt{105}}{112} & 0 & 0 & \frac{27\sqrt{14}}{1120} & 0 & \frac{\sqrt{70}}{1120} & 0 & \frac{11\sqrt{42}}{1120} & 0 & -\frac{9\sqrt{2}}{160} \\
0 & \frac{3\sqrt{210}}{224} & 0 & -\frac{\sqrt{105}}{112} & 0 & -\frac{\sqrt{42}}{224} & \frac{1}{32} & 0 & \frac{9\sqrt{21}}{1120} & 0 & -\frac{13\sqrt{35}}{1120} & 0 & -\frac{23\sqrt{7}}{1120} & 0 \\
\frac{\sqrt{210}}{224} & 0 & -\frac{3\sqrt{21}}{112} & 0 & \frac{\sqrt{42}}{224} & 0 & 0 & \frac{\sqrt{35}}{224} & 0 & -\frac{9\sqrt{7}}{224} & 0 & \frac{\sqrt{105}}{224} & 0 & \frac{\sqrt{5}}{160}
\end{bmatrix}$$

| 708 | symmetry | $\dfrac{\sqrt{105}\,x(y-z)(y+z)\left(2x^2-y^2-z^2\right)}{4}$ |
|---|---|---|

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_{5,1}^{(a)}(E_u,3)$

$$
\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{120} & 0 & \frac{\sqrt{105}i}{120} & 0 & -\frac{\sqrt{7}i}{40} & 0 & -\frac{\sqrt{3}i}{8}\\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{i}{40} & 0 & \frac{\sqrt{21}i}{40} & 0 & -\frac{\sqrt{35}i}{40} & 0 & \frac{\sqrt{7}i}{40} & 0\\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{40} & 0 & -\frac{\sqrt{35}i}{40} & 0 & \frac{\sqrt{21}i}{40} & 0 & -\frac{i}{40}\\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{8} & 0 & -\frac{\sqrt{7}i}{40} & 0 & \frac{\sqrt{105}i}{120} & 0 & -\frac{\sqrt{21}i}{120} & 0\\
0 & -\frac{\sqrt{14}i}{112} & 0 & \frac{\sqrt{7}i}{56} & 0 & \frac{3\sqrt{70}i}{112} & -\frac{\sqrt{15}i}{240} & 0 & \frac{\sqrt{35}i}{112} & 0 & -\frac{\sqrt{21}i}{112} & 0 & -\frac{\sqrt{105}i}{112} & 0\\
-\frac{\sqrt{14}i}{112} & 0 & \frac{\sqrt{35}i}{56} & 0 & -\frac{\sqrt{70}i}{112} & 0 & 0 & \frac{23\sqrt{21}i}{1680} & 0 & -\frac{13\sqrt{105}i}{1680} & 0 & \frac{3\sqrt{7}i}{560} & 0 & -\frac{\sqrt{3}i}{16}\\
0 & \frac{\sqrt{35}i}{56} & 0 & -\frac{\sqrt{70}i}{56} & 0 & \frac{\sqrt{7}i}{56} & \frac{\sqrt{6}i}{80} & 0 & -\frac{11\sqrt{14}i}{560} & 0 & \frac{\sqrt{210}i}{1680} & 0 & \frac{3\sqrt{42}i}{560} & 0\\
\frac{\sqrt{7}i}{56} & 0 & -\frac{\sqrt{70}i}{56} & 0 & \frac{\sqrt{35}i}{56} & 0 & 0 & -\frac{3\sqrt{42}i}{560} & 0 & -\frac{\sqrt{210}i}{1680} & 0 & \frac{11\sqrt{14}i}{560} & 0 & -\frac{\sqrt{6}i}{80}\\
0 & -\frac{\sqrt{70}i}{112} & 0 & \frac{\sqrt{35}i}{56} & 0 & -\frac{\sqrt{14}i}{112} & \frac{\sqrt{3}i}{16} & 0 & -\frac{3\sqrt{7}i}{560} & 0 & \frac{13\sqrt{105}i}{1680} & 0 & -\frac{23\sqrt{21}i}{1680} & 0\\
\frac{3\sqrt{70}i}{112} & 0 & \frac{\sqrt{7}i}{56} & 0 & -\frac{\sqrt{14}i}{112} & 0 & 0 & \frac{\sqrt{105}i}{112} & 0 & \frac{\sqrt{21}i}{112} & 0 & -\frac{\sqrt{35}i}{112} & 0 & \frac{\sqrt{15}i}{240}
\end{bmatrix}
$$

| No. | symmetry | |
|---|---|---|
| 709 | symmetry | $-\dfrac{\sqrt{105}\,y(x-z)(x+z)\left(x^2-2y^2+z^2\right)}{4}$ |

$\mathbb{T}_{5,2}^{(a)}(E_u,3)$

$$
\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}}{120} & 0 & \frac{\sqrt{105}}{120} & 0 & \frac{\sqrt{7}}{40} & 0 & -\frac{\sqrt{3}}{8}\\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{40} & 0 & -\frac{\sqrt{21}}{40} & 0 & -\frac{\sqrt{35}}{40} & 0 & -\frac{\sqrt{7}}{40} & 0\\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{40} & 0 & \frac{\sqrt{35}}{40} & 0 & \frac{\sqrt{21}}{40} & 0 & \frac{1}{40}\\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{8} & 0 & -\frac{\sqrt{7}}{40} & 0 & -\frac{\sqrt{105}}{120} & 0 & -\frac{\sqrt{21}}{120} & 0\\
0 & -\frac{\sqrt{14}}{112} & 0 & -\frac{\sqrt{7}}{56} & 0 & \frac{3\sqrt{70}}{112} & \frac{\sqrt{15}}{240} & 0 & \frac{\sqrt{35}}{112} & 0 & \frac{\sqrt{21}}{112} & 0 & -\frac{\sqrt{105}}{112} & 0\\
\frac{\sqrt{14}}{112} & 0 & \frac{\sqrt{35}}{56} & 0 & \frac{\sqrt{70}}{112} & 0 & 0 & -\frac{23\sqrt{21}}{1680} & 0 & -\frac{13\sqrt{105}}{1680} & 0 & -\frac{3\sqrt{7}}{560} & 0 & -\frac{\sqrt{3}}{16}\\
0 & -\frac{\sqrt{35}}{56} & 0 & -\frac{\sqrt{70}}{56} & 0 & -\frac{\sqrt{7}}{56} & \frac{\sqrt{6}}{80} & 0 & \frac{11\sqrt{14}}{560} & 0 & \frac{\sqrt{210}}{1680} & 0 & -\frac{3\sqrt{42}}{560} & 0\\
\frac{\sqrt{7}}{56} & 0 & \frac{\sqrt{70}}{56} & 0 & \frac{\sqrt{35}}{56} & 0 & 0 & -\frac{3\sqrt{42}}{560} & 0 & \frac{\sqrt{210}}{1680} & 0 & \frac{11\sqrt{14}}{560} & 0 & \frac{\sqrt{6}}{80}\\
0 & -\frac{\sqrt{70}}{112} & 0 & -\frac{\sqrt{35}}{56} & 0 & -\frac{\sqrt{14}}{112} & -\frac{\sqrt{3}}{16} & 0 & -\frac{3\sqrt{7}}{560} & 0 & -\frac{13\sqrt{105}}{1680} & 0 & -\frac{23\sqrt{21}}{1680} & 0\\
-\frac{3\sqrt{70}}{112} & 0 & \frac{\sqrt{7}}{56} & 0 & \frac{\sqrt{14}}{112} & 0 & 0 & -\frac{\sqrt{105}}{112} & 0 & \frac{\sqrt{21}}{112} & 0 & \frac{\sqrt{35}}{112} & 0 & \frac{\sqrt{15}}{240}
\end{bmatrix}
$$

| No. | symmetry | |
|---|---|---|
| 710 | symmetry | $-\dfrac{z\left(3x^2+3y^2-2z^2\right)}{2}$ |

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_3^{(1,-1;a)}(A_{2u})$

$$\begin{bmatrix}
0 & -\frac{\sqrt{6}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{14} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{2i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{14} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{2i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{14} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{14} & 0 & 0 \\
\frac{\sqrt{6}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{2i}{7} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{6}i}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{6}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{7} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{6}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{7} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{2i}{7} & 0
\end{bmatrix}$$

| 711 | symmetry | $\sqrt{15}xyz$ |
|---|---|---|

$\mathbb{T}_3^{(1,-1;a)}(B_{1u})$

$$\begin{bmatrix}
0 & 0 & 0 & -\frac{\sqrt{5}}{35} & 0 & 0 & \frac{\sqrt{21}}{28} & 0 & 0 & 0 & -\frac{\sqrt{15}}{28} & 0 & 0 & 0 \\
-\frac{\sqrt{6}}{42} & 0 & 0 & 0 & -\frac{\sqrt{30}}{210} & 0 & 0 & -\frac{3}{28} & 0 & 0 & 0 & -\frac{3\sqrt{3}}{28} & 0 & 0 \\
0 & \frac{\sqrt{30}}{210} & 0 & 0 & 0 & \frac{\sqrt{6}}{42} & 0 & 0 & -\frac{3\sqrt{3}}{28} & 0 & 0 & 0 & -\frac{3}{28} & 0 \\
0 & 0 & \frac{\sqrt{5}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{28} & 0 & 0 & 0 & \frac{\sqrt{21}}{28} \\
0 & 0 & \frac{3}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt{3}}{21} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{3\sqrt{5}}{140} & 0 & 0 & \frac{\sqrt{21}}{21} & 0 & 0 & 0 & \frac{\sqrt{15}}{21} & 0 & 0 & 0 \\
-\frac{3}{28} & 0 & 0 & 0 & -\frac{3\sqrt{5}}{140} & 0 & 0 & \frac{\sqrt{6}}{42} & 0 & 0 & 0 & \frac{\sqrt{2}}{14} & 0 & 0 \\
0 & -\frac{3\sqrt{5}}{140} & 0 & 0 & 0 & -\frac{3}{28} & 0 & 0 & -\frac{\sqrt{2}}{14} & 0 & 0 & 0 & -\frac{\sqrt{6}}{42} & 0 \\
0 & 0 & \frac{3\sqrt{5}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{21} & 0 & 0 & 0 & -\frac{\sqrt{21}}{21} \\
0 & 0 & 0 & \frac{3}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{3}}{21} & 0 & 0 & 0
\end{bmatrix}$$

| 712 | symmetry | $\frac{\sqrt{15}z(x-y)(x+y)}{2}$ |
|---|---|---|

continued ...

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_3^{(1,-1;a)}(B_{2u})$

$$\begin{bmatrix}
0 & 0 & 0 & -\frac{\sqrt5 i}{35} & 0 & 0 & -\frac{\sqrt{21}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{28} & 0 & 0 & 0 \\
\frac{\sqrt6 i}{42} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{210} & 0 & 0 & \frac{3i}{28} & 0 & 0 & 0 & -\frac{3\sqrt3 i}{28} & 0 & 0 \\
0 & -\frac{\sqrt{30}i}{210} & 0 & 0 & 0 & \frac{\sqrt6 i}{42} & 0 & 0 & \frac{3\sqrt3 i}{28} & 0 & 0 & 0 & -\frac{3i}{28} & 0 \\
0 & 0 & -\frac{\sqrt5 i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{28} & 0 & 0 & 0 & \frac{\sqrt{21}i}{28} \\
0 & 0 & \frac{3i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt3 i}{21} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{3\sqrt5 i}{140} & 0 & 0 & -\frac{\sqrt{21}i}{21} & 0 & 0 & 0 & \frac{\sqrt{15}i}{21} & 0 & 0 & 0 \\
\frac{3i}{28} & 0 & 0 & 0 & -\frac{3\sqrt5 i}{140} & 0 & 0 & -\frac{\sqrt6 i}{42} & 0 & 0 & 0 & \frac{\sqrt2 i}{14} & 0 & 0 \\
0 & \frac{3\sqrt5 i}{140} & 0 & 0 & 0 & -\frac{3i}{28} & 0 & 0 & \frac{\sqrt2 i}{14} & 0 & 0 & 0 & -\frac{\sqrt6 i}{42} & 0 \\
0 & 0 & -\frac{3\sqrt5 i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{21} & 0 & 0 & 0 & -\frac{\sqrt{21}i}{21} \\
0 & 0 & 0 & -\frac{3i}{28} & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt3 i}{21} & 0 & 0 & 0 & 0
\end{bmatrix}$$

| 713 | symmetry | $\frac{x\left(2x^2-3y^2-3z^2\right)}{2}$ |
|---|---|---|

$\mathbb{T}_{3,1}^{(1,-1;a)}(E_u,1)$

$$\begin{bmatrix}
-\frac{\sqrt{30}i}{280} & 0 & \frac{3\sqrt3 i}{140} & 0 & -\frac{\sqrt6 i}{56} & 0 & 0 & -\frac{3\sqrt5 i}{56} & 0 & \frac{3i}{28} & 0 & -\frac{\sqrt{15}i}{56} & 0 & 0 \\
0 & \frac{\sqrt2 i}{40} & 0 & -\frac{i}{140} & 0 & -\frac{\sqrt{10}i}{56} & -\frac{\sqrt{105}i}{56} & 0 & 0 & 0 & \frac{3\sqrt3 i}{56} & 0 & -\frac{\sqrt{15}i}{28} & 0 \\
\frac{\sqrt{10}i}{56} & 0 & \frac{i}{140} & 0 & -\frac{\sqrt2 i}{40} & 0 & 0 & -\frac{\sqrt{15}i}{28} & 0 & \frac{3\sqrt3 i}{56} & 0 & 0 & 0 & -\frac{\sqrt{105}i}{56} \\
0 & \frac{\sqrt6 i}{56} & 0 & -\frac{3\sqrt3 i}{140} & 0 & \frac{\sqrt{30}i}{280} & 0 & 0 & -\frac{\sqrt{15}i}{56} & 0 & \frac{3i}{28} & 0 & -\frac{3\sqrt5 i}{56} & 0 \\
0 & -\frac{3\sqrt{30}i}{280} & 0 & \frac{\sqrt{15}i}{56} & 0 & 0 & \frac{\sqrt7 i}{28} & 0 & -\frac{\sqrt3 i}{14} & 0 & \frac{\sqrt5 i}{28} & 0 & 0 & 0 \\
-\frac{3\sqrt{30}i}{280} & 0 & \frac{3\sqrt3 i}{280} & 0 & \frac{\sqrt6 i}{28} & 0 & 0 & -\frac{\sqrt5 i}{28} & 0 & -\frac{i}{14} & 0 & \frac{\sqrt{15}i}{28} & 0 & 0 \\
0 & \frac{3\sqrt3 i}{280} & 0 & \frac{3\sqrt6 i}{140} & 0 & \frac{\sqrt{15}i}{56} & -\frac{\sqrt{70}i}{56} & 0 & -\frac{\sqrt{30}i}{56} & 0 & \frac{\sqrt2 i}{56} & 0 & \frac{3\sqrt{10}i}{56} & 0 \\
\frac{\sqrt{15}i}{56} & 0 & \frac{3\sqrt6 i}{140} & 0 & \frac{3\sqrt3 i}{280} & 0 & 0 & -\frac{3\sqrt{10}i}{56} & 0 & -\frac{\sqrt2 i}{56} & 0 & \frac{\sqrt{30}i}{56} & 0 & \frac{\sqrt{70}i}{56} \\
0 & \frac{\sqrt6 i}{28} & 0 & \frac{3\sqrt3 i}{280} & 0 & -\frac{3\sqrt{30}i}{280} & 0 & 0 & -\frac{\sqrt{15}i}{28} & 0 & \frac{i}{14} & 0 & \frac{\sqrt5 i}{28} & 0 \\
0 & 0 & \frac{\sqrt{15}i}{56} & 0 & -\frac{3\sqrt{30}i}{280} & 0 & 0 & 0 & 0 & -\frac{\sqrt5 i}{28} & 0 & \frac{\sqrt3 i}{14} & 0 & -\frac{\sqrt7 i}{28}
\end{bmatrix}$$

| 714 | symmetry | $-\frac{y\left(3x^2-2y^2+3z^2\right)}{2}$ |
|---|---|---|

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_{3,2}^{(1,-1;a)}(E_u, 1)$

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\frac{\sqrt{30}}{280}$ | $0$ | $\frac{3\sqrt{3}}{140}$ | $0$ | $\frac{\sqrt{6}}{56}$ | $0$ | $0$ | $\frac{3\sqrt{5}}{56}$ | $0$ | $\frac{3}{28}$ | $0$ | $\frac{\sqrt{15}}{56}$ | $0$ | $0$ |
| $0$ | $-\frac{\sqrt{2}}{40}$ | $0$ | $-\frac{1}{140}$ | $0$ | $\frac{\sqrt{10}}{56}$ | $-\frac{\sqrt{105}}{56}$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{3}}{56}$ | $0$ | $\frac{\sqrt{15}}{28}$ | $0$ |
| $\frac{\sqrt{10}}{56}$ | $0$ | $-\frac{1}{140}$ | $0$ | $-\frac{\sqrt{2}}{40}$ | $0$ | $0$ | $-\frac{\sqrt{15}}{28}$ | $0$ | $-\frac{3\sqrt{3}}{56}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{105}}{56}$ |
| $0$ | $\frac{\sqrt{6}}{56}$ | $0$ | $\frac{3\sqrt{3}}{140}$ | $0$ | $\frac{\sqrt{30}}{280}$ | $0$ | $0$ | $-\frac{\sqrt{15}}{56}$ | $0$ | $-\frac{3}{28}$ | $0$ | $-\frac{3\sqrt{5}}{56}$ | $0$ |
| $0$ | $-\frac{3\sqrt{30}}{280}$ | $0$ | $-\frac{\sqrt{15}}{56}$ | $0$ | $0$ | $-\frac{\sqrt{7}}{28}$ | $0$ | $-\frac{\sqrt{3}}{14}$ | $0$ | $-\frac{\sqrt{5}}{28}$ | $0$ | $0$ | $0$ |
| $\frac{3\sqrt{30}}{280}$ | $0$ | $\frac{3\sqrt{3}}{280}$ | $0$ | $-\frac{\sqrt{6}}{28}$ | $0$ | $0$ | $\frac{\sqrt{5}}{28}$ | $0$ | $-\frac{1}{14}$ | $0$ | $-\frac{\sqrt{15}}{28}$ | $0$ | $0$ |
| $0$ | $-\frac{3\sqrt{3}}{280}$ | $0$ | $\frac{3\sqrt{6}}{140}$ | $0$ | $-\frac{\sqrt{15}}{56}$ | $-\frac{\sqrt{70}}{56}$ | $0$ | $\frac{\sqrt{30}}{56}$ | $0$ | $\frac{\sqrt{2}}{56}$ | $0$ | $-\frac{3\sqrt{10}}{56}$ | $0$ |
| $\frac{\sqrt{15}}{56}$ | $0$ | $-\frac{3\sqrt{6}}{140}$ | $0$ | $\frac{3\sqrt{3}}{280}$ | $0$ | $0$ | $-\frac{3\sqrt{10}}{56}$ | $0$ | $\frac{\sqrt{2}}{56}$ | $0$ | $\frac{\sqrt{30}}{56}$ | $0$ | $-\frac{\sqrt{70}}{56}$ |
| $0$ | $\frac{\sqrt{6}}{28}$ | $0$ | $-\frac{3\sqrt{3}}{280}$ | $0$ | $-\frac{3\sqrt{30}}{280}$ | $0$ | $0$ | $-\frac{\sqrt{15}}{28}$ | $0$ | $-\frac{1}{14}$ | $0$ | $\frac{\sqrt{5}}{28}$ | $0$ |
| $0$ | $0$ | $\frac{\sqrt{15}}{56}$ | $0$ | $\frac{3\sqrt{30}}{280}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{5}}{28}$ | $0$ | $-\frac{\sqrt{3}}{14}$ | $0$ | $-\frac{\sqrt{7}}{28}$ |

| No. | | |
|---|---|---|
| 715 | symmetry | $\frac{\sqrt{15}x(y-z)(y+z)}{2}$ |

$\mathbb{T}_{3,1}^{(1,-1;a)}(E_u, 2)$

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $-\frac{\sqrt{2}i}{56}$ | $0$ | $\frac{3\sqrt{5}i}{140}$ | $0$ | $\frac{3\sqrt{10}i}{280}$ | $0$ | $0$ | $-\frac{5\sqrt{3}i}{56}$ | $0$ | $\frac{\sqrt{15}i}{28}$ | $0$ | $\frac{3i}{56}$ | $0$ | $0$ |
| $0$ | $\frac{\sqrt{30}i}{120}$ | $0$ | $-\frac{\sqrt{15}i}{420}$ | $0$ | $\frac{\sqrt{6}i}{56}$ | $\frac{3\sqrt{7}i}{56}$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{5}i}{56}$ | $0$ | $\frac{3i}{28}$ | $0$ |
| $-\frac{\sqrt{6}i}{56}$ | $0$ | $\frac{\sqrt{15}i}{420}$ | $0$ | $-\frac{\sqrt{30}i}{120}$ | $0$ | $0$ | $\frac{3i}{28}$ | $0$ | $\frac{3\sqrt{5}i}{56}$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{7}i}{56}$ |
| $0$ | $-\frac{3\sqrt{10}i}{280}$ | $0$ | $-\frac{3\sqrt{5}i}{140}$ | $0$ | $\frac{\sqrt{2}i}{56}$ | $0$ | $0$ | $\frac{3i}{56}$ | $0$ | $\frac{\sqrt{15}i}{28}$ | $0$ | $-\frac{5\sqrt{3}i}{56}$ | $0$ |
| $0$ | $-\frac{3\sqrt{2}i}{56}$ | $0$ | $-\frac{3i}{56}$ | $0$ | $0$ | $\frac{\sqrt{105}i}{84}$ | $0$ | $-\frac{\sqrt{5}i}{14}$ | $0$ | $-\frac{\sqrt{3}i}{28}$ | $0$ | $0$ | $0$ |
| $-\frac{3\sqrt{2}i}{56}$ | $0$ | $\frac{3\sqrt{5}i}{280}$ | $0$ | $-\frac{3\sqrt{10}i}{140}$ | $0$ | $0$ | $-\frac{5\sqrt{3}i}{84}$ | $0$ | $-\frac{\sqrt{15}i}{42}$ | $0$ | $-\frac{3i}{28}$ | $0$ | $0$ |
| $0$ | $\frac{3\sqrt{5}i}{280}$ | $0$ | $\frac{3\sqrt{10}i}{140}$ | $0$ | $-\frac{3i}{56}$ | $\frac{\sqrt{42}i}{56}$ | $0$ | $-\frac{5\sqrt{2}i}{56}$ | $0$ | $\frac{\sqrt{30}i}{168}$ | $0$ | $-\frac{3\sqrt{6}i}{56}$ | $0$ |
| $-\frac{3i}{56}$ | $0$ | $\frac{3\sqrt{10}i}{140}$ | $0$ | $\frac{3\sqrt{5}i}{280}$ | $0$ | $0$ | $\frac{3\sqrt{6}i}{56}$ | $0$ | $-\frac{\sqrt{30}i}{168}$ | $0$ | $\frac{5\sqrt{2}i}{56}$ | $0$ | $-\frac{\sqrt{42}i}{56}$ |
| $0$ | $-\frac{3\sqrt{10}i}{140}$ | $0$ | $\frac{3\sqrt{5}i}{280}$ | $0$ | $-\frac{3\sqrt{2}i}{56}$ | $0$ | $0$ | $\frac{3i}{28}$ | $0$ | $\frac{\sqrt{15}i}{42}$ | $0$ | $\frac{5\sqrt{3}i}{84}$ | $0$ |
| $0$ | $0$ | $-\frac{3i}{56}$ | $0$ | $-\frac{3\sqrt{2}i}{56}$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{3}i}{28}$ | $0$ | $\frac{\sqrt{5}i}{14}$ | $0$ | $-\frac{\sqrt{105}i}{84}$ |

| No. | | |
|---|---|---|
| 716 | symmetry | $\frac{\sqrt{15}y(x-z)(x+z)}{2}$ |

*continued ...*

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_{3,2}^{(1,-1;a)}(E_u,2)$

$$
\begin{bmatrix}
\frac{\sqrt2}{56} & 0 & \frac{3\sqrt5}{140} & 0 & -\frac{3\sqrt{10}}{280} & 0 & 0 & \frac{5\sqrt3}{56} & 0 & \frac{\sqrt{15}}{28} & 0 & -\frac{3}{56} & 0 & 0 \\
0 & -\frac{\sqrt{30}}{120} & 0 & -\frac{\sqrt{15}}{420} & 0 & -\frac{\sqrt6}{56} & \frac{3\sqrt7}{56} & 0 & 0 & 0 & \frac{3\sqrt5}{56} & 0 & -\frac{3}{28} & 0 \\
-\frac{\sqrt6}{56} & 0 & -\frac{\sqrt{15}}{420} & 0 & -\frac{\sqrt{30}}{120} & 0 & 0 & \frac{3}{28} & 0 & -\frac{3\sqrt5}{56} & 0 & 0 & 0 & -\frac{3\sqrt7}{56} \\
0 & -\frac{3\sqrt{10}}{280} & 0 & \frac{3\sqrt5}{140} & 0 & \frac{\sqrt2}{56} & 0 & 0 & \frac{3}{56} & 0 & -\frac{\sqrt{15}}{28} & 0 & -\frac{5\sqrt3}{56} & 0 \\
0 & -\frac{3\sqrt2}{56} & 0 & \frac{3}{56} & 0 & 0 & -\frac{\sqrt{105}}{84} & 0 & -\frac{\sqrt5}{14} & 0 & \frac{\sqrt3}{28} & 0 & 0 & 0 \\
\frac{3\sqrt2}{56} & 0 & \frac{3\sqrt5}{280} & 0 & \frac{3\sqrt{10}}{140} & 0 & 0 & \frac{5\sqrt3}{84} & 0 & -\frac{\sqrt{15}}{42} & 0 & \frac{3}{28} & 0 & 0 \\
0 & -\frac{3\sqrt5}{280} & 0 & \frac{3\sqrt{10}}{140} & 0 & \frac{3}{56} & \frac{\sqrt{42}}{56} & 0 & \frac{5\sqrt2}{56} & 0 & \frac{\sqrt{30}}{168} & 0 & \frac{3\sqrt6}{56} & 0 \\
-\frac{3}{56} & 0 & -\frac{3\sqrt{10}}{140} & 0 & \frac{3\sqrt5}{280} & 0 & 0 & \frac{3\sqrt6}{56} & 0 & \frac{\sqrt{30}}{168} & 0 & \frac{5\sqrt2}{56} & 0 & \frac{\sqrt{42}}{56} \\
0 & -\frac{3\sqrt{10}}{140} & 0 & -\frac{3\sqrt5}{280} & 0 & -\frac{3\sqrt2}{56} & 0 & 0 & \frac{3}{28} & 0 & -\frac{\sqrt{15}}{42} & 0 & \frac{5\sqrt3}{84} & 0 \\
0 & 0 & -\frac{3}{56} & 0 & \frac{3\sqrt2}{56} & 0 & 0 & 0 & 0 & \frac{\sqrt3}{28} & 0 & -\frac{\sqrt5}{14} & 0 & -\frac{\sqrt{105}}{84}
\end{bmatrix}
$$

| 717 | symmetry | $\dfrac{3\sqrt{35}\,xyz(x-y)(x+y)}{2}$ |

$\mathbb{T}_5^{(1,-1;a)}(A_{1u})$

$$
\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{100} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}}{100} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}}{100} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{100} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{35}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{14}}{35} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{35}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{175} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt{15}}{25} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{15}}{25} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{35}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{175} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{35}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{14}}{35} & 0 & 0 & 0 & 0 & 0
\end{bmatrix}
$$

| 718 | symmetry | $\dfrac{z\left(15x^4+30x^2y^2-40x^2z^2+15y^4-40y^2z^2+8z^4\right)}{8}$ |

*continued ...*

231

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_5^{(1,-1;a)}(A_{2u},1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{20} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{20} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{20} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{20} & 0 \\
-\frac{\sqrt{5}i}{210} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{35} & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{5}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{9\sqrt{2}i}{35} & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{5}i}{21} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{15}i}{35} & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{5}i}{21} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{15}i}{35} & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{5}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{9\sqrt{2}i}{35} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}i}{210} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{35}
\end{bmatrix}$$

| 719 | symmetry | $\dfrac{3\sqrt{35}z\left(x^2-2xy-y^2\right)\left(x^2+2xy-y^2\right)}{8}$ |
|---|---|---|

$\mathbb{T}_5^{(1,-1;a)}(A_{2u},2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{100} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}i}{100} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{10}i}{100} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{100} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{35}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{14}i}{35} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{35}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{175} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt{15}i}{25} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt{15}i}{25} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{35}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{175} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{35}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{14}i}{35} & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

| 720 | symmetry | $\dfrac{\sqrt{105}xyz\left(x^2+y^2-2z^2\right)}{2}$ |
|---|---|---|

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_5^{(1,-1;a)}(B_{1u})$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{200} & 0 & 0 & 0 & -\frac{\sqrt{14}}{40} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{200} & 0 & 0 & 0 & \frac{3\sqrt{70}}{200} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{70}}{200} & 0 & 0 & 0 & -\frac{\sqrt{210}}{200} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{40} & 0 & 0 & 0 & \frac{\sqrt{10}}{200} \\
0 & 0 & \frac{\sqrt{210}}{420} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{35} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{42}}{84} & 0 & 0 & \frac{\sqrt{10}}{25} & 0 & 0 & 0 & -\frac{2\sqrt{14}}{35} & 0 & 0 & 0 \\
-\frac{\sqrt{210}}{420} & 0 & 0 & 0 & \frac{\sqrt{42}}{84} & 0 & 0 & -\frac{8\sqrt{35}}{175} & 0 & 0 & 0 & -\frac{2\sqrt{105}}{175} & 0 & 0 \\
0 & \frac{\sqrt{42}}{84} & 0 & 0 & 0 & -\frac{\sqrt{210}}{420} & 0 & 0 & \frac{2\sqrt{105}}{175} & 0 & 0 & 0 & \frac{8\sqrt{35}}{175} & 0 \\
0 & 0 & -\frac{\sqrt{42}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt{14}}{35} & 0 & 0 & 0 & -\frac{\sqrt{10}}{25} \\
0 & 0 & 0 & \frac{\sqrt{210}}{420} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{35} & 0 & 0 & 0
\end{pmatrix}$$

| 721 | symmetry | $-\dfrac{\sqrt{105}\,z(x-y)(x+y)\left(x^2+y^2-2z^2\right)}{4}$ |
|---|---|---|

$\mathbb{T}_5^{(1,-1;a)}(B_{2u})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{200} & 0 & 0 & 0 & \frac{\sqrt{14}i}{40} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{200} & 0 & 0 & 0 & -\frac{3\sqrt{70}i}{200} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{70}i}{200} & 0 & 0 & 0 & \frac{\sqrt{210}i}{200} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}i}{40} & 0 & 0 & 0 & -\frac{\sqrt{10}i}{200} \\
0 & 0 & -\frac{\sqrt{210}i}{420} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{35} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{42}i}{84} & 0 & 0 & \frac{\sqrt{10}i}{25} & 0 & 0 & 0 & \frac{2\sqrt{14}i}{35} & 0 & 0 & 0 \\
-\frac{\sqrt{210}i}{420} & 0 & 0 & 0 & -\frac{\sqrt{42}i}{84} & 0 & 0 & -\frac{8\sqrt{35}i}{175} & 0 & 0 & 0 & \frac{2\sqrt{105}i}{175} & 0 & 0 \\
0 & \frac{\sqrt{42}i}{84} & 0 & 0 & 0 & \frac{\sqrt{210}i}{420} & 0 & 0 & \frac{2\sqrt{105}i}{175} & 0 & 0 & 0 & -\frac{8\sqrt{35}i}{175} & 0 \\
0 & 0 & -\frac{\sqrt{42}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt{14}i}{35} & 0 & 0 & 0 & \frac{\sqrt{10}i}{25} \\
0 & 0 & 0 & \frac{\sqrt{210}i}{420} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{35} & 0 & 0 & 0
\end{bmatrix}$$

| 722 | symmetry | $\dfrac{x\left(8x^4-40x^2y^2-40x^2z^2+15y^4+30y^2z^2+15z^4\right)}{8}$ |
|---|---|---|

*continued …*

Table 9

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{T}_{5,1}^{(1,-1;a)}(E_u,1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{160} & 0 & \frac{\sqrt{30}i}{160} & 0 & -\frac{7\sqrt{2}i}{160} & 0 & \frac{3\sqrt{42}i}{160} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}i}{160} & 0 & \frac{3\sqrt{6}i}{160} & 0 & -\frac{3\sqrt{10}i}{160} & 0 & \frac{7\sqrt{2}i}{160} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{7\sqrt{2}i}{160} & 0 & -\frac{3\sqrt{10}i}{160} & 0 & \frac{3\sqrt{6}i}{160} & 0 & -\frac{\sqrt{14}i}{160} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{42}i}{160} & 0 & -\frac{7\sqrt{2}i}{160} & 0 & \frac{\sqrt{30}i}{160} & 0 & -\frac{\sqrt{6}i}{160} & 0 \\
0 & -\frac{i}{112} & 0 & \frac{\sqrt{2}i}{48} & 0 & -\frac{3\sqrt{5}i}{80} & \frac{\sqrt{210}i}{560} & 0 & -\frac{3\sqrt{10}i}{112} & 0 & \frac{\sqrt{6}i}{16} & 0 & -\frac{3\sqrt{30}i}{80} & 0 \\
-\frac{i}{112} & 0 & \frac{\sqrt{10}i}{112} & 0 & -\frac{\sqrt{5}i}{48} & 0 & 0 & -\frac{23\sqrt{6}i}{560} & 0 & \frac{13\sqrt{30}i}{560} & 0 & -\frac{3\sqrt{2}i}{80} & 0 & -\frac{3\sqrt{42}i}{80} \\
0 & \frac{\sqrt{10}i}{112} & 0 & -\frac{\sqrt{5}i}{56} & 0 & \frac{\sqrt{2}i}{48} & -\frac{\sqrt{21}i}{40} & 0 & \frac{33i}{280} & 0 & -\frac{\sqrt{15}i}{280} & 0 & -\frac{3\sqrt{3}i}{40} & 0 \\
\frac{\sqrt{2}i}{48} & 0 & -\frac{\sqrt{5}i}{56} & 0 & \frac{\sqrt{10}i}{112} & 0 & 0 & \frac{3\sqrt{3}i}{40} & 0 & \frac{\sqrt{15}i}{280} & 0 & -\frac{33i}{280} & 0 & \frac{\sqrt{21}i}{40} \\
0 & -\frac{\sqrt{5}i}{48} & 0 & \frac{\sqrt{10}i}{112} & 0 & -\frac{i}{112} & \frac{3\sqrt{42}i}{80} & 0 & \frac{3\sqrt{2}i}{80} & 0 & -\frac{13\sqrt{30}i}{560} & 0 & \frac{23\sqrt{6}i}{560} & 0 \\
-\frac{3\sqrt{5}i}{80} & 0 & \frac{\sqrt{2}i}{48} & 0 & -\frac{i}{112} & 0 & 0 & \frac{3\sqrt{30}i}{80} & 0 & -\frac{\sqrt{6}i}{16} & 0 & \frac{3\sqrt{10}i}{112} & 0 & -\frac{\sqrt{210}i}{560}
\end{bmatrix}$$

| 723 | symmetry | $\dfrac{y\left(15x^4-40x^2y^2+30x^2z^2+8y^4-40y^2z^2+15z^4\right)}{8}$ |

$\mathbb{T}_{5,2}^{(1,-1;a)}(E_u,1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{160} & 0 & \frac{\sqrt{30}}{160} & 0 & \frac{7\sqrt{2}}{160} & 0 & \frac{3\sqrt{42}}{160} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{160} & 0 & -\frac{3\sqrt{6}}{160} & 0 & -\frac{3\sqrt{10}}{160} & 0 & -\frac{7\sqrt{2}}{160} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{7\sqrt{2}}{160} & 0 & \frac{3\sqrt{10}}{160} & 0 & \frac{3\sqrt{6}}{160} & 0 & \frac{\sqrt{14}}{160} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{42}}{160} & 0 & -\frac{7\sqrt{2}}{160} & 0 & -\frac{\sqrt{30}}{160} & 0 & -\frac{\sqrt{6}}{160} & 0 \\
0 & -\frac{1}{112} & 0 & -\frac{\sqrt{2}}{48} & 0 & -\frac{3\sqrt{5}}{80} & -\frac{\sqrt{210}}{560} & 0 & -\frac{3\sqrt{10}}{112} & 0 & -\frac{\sqrt{6}}{16} & 0 & -\frac{3\sqrt{30}}{80} & 0 \\
\frac{1}{112} & 0 & \frac{\sqrt{10}}{112} & 0 & \frac{\sqrt{5}}{48} & 0 & 0 & \frac{23\sqrt{6}}{560} & 0 & \frac{13\sqrt{30}}{560} & 0 & \frac{3\sqrt{2}}{80} & 0 & -\frac{3\sqrt{42}}{80} \\
0 & -\frac{\sqrt{10}}{112} & 0 & -\frac{\sqrt{5}}{56} & 0 & -\frac{\sqrt{2}}{48} & -\frac{\sqrt{21}}{40} & 0 & -\frac{33}{280} & 0 & -\frac{\sqrt{15}}{280} & 0 & \frac{3\sqrt{3}}{40} & 0 \\
\frac{\sqrt{2}}{48} & 0 & \frac{\sqrt{5}}{56} & 0 & \frac{\sqrt{10}}{112} & 0 & 0 & \frac{3\sqrt{3}}{40} & 0 & -\frac{\sqrt{15}}{280} & 0 & -\frac{33}{280} & 0 & -\frac{\sqrt{21}}{40} \\
0 & -\frac{\sqrt{5}}{48} & 0 & -\frac{\sqrt{10}}{112} & 0 & -\frac{1}{112} & -\frac{3\sqrt{42}}{80} & 0 & \frac{3\sqrt{2}}{80} & 0 & \frac{13\sqrt{30}}{560} & 0 & \frac{23\sqrt{6}}{560} & 0 \\
\frac{3\sqrt{5}}{80} & 0 & \frac{\sqrt{2}}{48} & 0 & \frac{1}{112} & 0 & 0 & -\frac{3\sqrt{30}}{80} & 0 & -\frac{\sqrt{6}}{16} & 0 & -\frac{3\sqrt{10}}{112} & 0 & -\frac{\sqrt{210}}{560}
\end{bmatrix}$$

| 724 | symmetry | $\dfrac{3\sqrt{35}x\left(y^2-2yz-z^2\right)\left(y^2+2yz-z^2\right)}{8}$ |

234

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_{5,1}^{(1,-1;a)}(E_u,2)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{800} & 0 & \frac{\sqrt{42}i}{160} & 0 & \frac{9\sqrt{70}i}{800} & 0 & \frac{\sqrt{30}i}{160} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{9\sqrt{10}i}{800} & 0 & \frac{3\sqrt{210}i}{800} & 0 & -\frac{3\sqrt{14}i}{160} & 0 & -\frac{9\sqrt{70}i}{800} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{9\sqrt{70}i}{800} & 0 & -\frac{3\sqrt{14}i}{160} & 0 & \frac{3\sqrt{210}i}{800} & 0 & \frac{9\sqrt{10}i}{800} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{160} & 0 & \frac{9\sqrt{70}i}{800} & 0 & \frac{\sqrt{42}i}{160} & 0 & -\frac{\sqrt{210}i}{800} & 0 \\
0 & -\frac{\sqrt{35}i}{560} & 0 & -\frac{3\sqrt{70}i}{560} & 0 & -\frac{\sqrt{7}i}{112} & \frac{\sqrt{6}i}{80} & 0 & -\frac{3\sqrt{14}i}{112} & 0 & -\frac{9\sqrt{210}i}{560} & 0 & -\frac{\sqrt{42}i}{112} & 0 \\
-\frac{\sqrt{35}i}{560} & 0 & \frac{\sqrt{14}i}{112} & 0 & \frac{3\sqrt{7}i}{112} & 0 & 0 & -\frac{23\sqrt{210}i}{2800} & 0 & \frac{13\sqrt{42}i}{560} & 0 & \frac{27\sqrt{70}i}{2800} & 0 & -\frac{\sqrt{30}i}{80} \\
0 & \frac{\sqrt{14}i}{112} & 0 & -\frac{\sqrt{7}i}{56} & 0 & -\frac{3\sqrt{70}i}{560} & \frac{9\sqrt{15}i}{200} & 0 & \frac{33\sqrt{35}i}{1400} & 0 & -\frac{\sqrt{21}i}{280} & 0 & \frac{27\sqrt{105}i}{1400} & 0 \\
-\frac{3\sqrt{70}i}{560} & 0 & -\frac{\sqrt{7}i}{56} & 0 & \frac{\sqrt{14}i}{112} & 0 & 0 & -\frac{27\sqrt{105}i}{1400} & 0 & \frac{\sqrt{21}i}{280} & 0 & -\frac{33\sqrt{35}i}{1400} & 0 & -\frac{9\sqrt{15}i}{200} \\
0 & \frac{3\sqrt{7}i}{112} & 0 & \frac{\sqrt{14}i}{112} & 0 & -\frac{\sqrt{35}i}{560} & \frac{\sqrt{30}i}{80} & 0 & -\frac{27\sqrt{70}i}{2800} & 0 & -\frac{13\sqrt{42}i}{560} & 0 & \frac{23\sqrt{210}i}{2800} & 0 \\
-\frac{\sqrt{7}i}{112} & 0 & -\frac{3\sqrt{70}i}{560} & 0 & -\frac{\sqrt{35}i}{560} & 0 & 0 & \frac{\sqrt{42}i}{112} & 0 & \frac{9\sqrt{210}i}{560} & 0 & \frac{3\sqrt{14}i}{112} & 0 & -\frac{\sqrt{6}i}{80}
\end{pmatrix}$$

| 725 | symmetry | $\dfrac{3\sqrt{35}y\left(x^2-2xz-z^2\right)\left(x^2+2xz-z^2\right)}{8}$ |
|---|---|---|

$\mathbb{T}_{5,2}^{(1,-1;a)}(E_u,2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{800} & 0 & \frac{\sqrt{42}}{160} & 0 & -\frac{9\sqrt{70}}{800} & 0 & \frac{\sqrt{30}}{160} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{9\sqrt{10}}{800} & 0 & -\frac{3\sqrt{210}}{800} & 0 & -\frac{3\sqrt{14}}{160} & 0 & \frac{9\sqrt{70}}{800} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{9\sqrt{70}}{800} & 0 & \frac{3\sqrt{14}}{160} & 0 & \frac{3\sqrt{210}}{800} & 0 & -\frac{9\sqrt{10}}{800} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{160} & 0 & \frac{9\sqrt{70}}{800} & 0 & -\frac{\sqrt{42}}{160} & 0 & -\frac{\sqrt{210}}{800} & 0 \\
0 & -\frac{\sqrt{35}}{560} & 0 & \frac{3\sqrt{70}}{560} & 0 & -\frac{\sqrt{7}}{112} & -\frac{\sqrt{6}}{80} & 0 & -\frac{3\sqrt{14}}{112} & 0 & \frac{9\sqrt{210}}{560} & 0 & -\frac{\sqrt{42}}{112} & 0 \\
\frac{\sqrt{35}}{560} & 0 & \frac{\sqrt{14}}{112} & 0 & -\frac{3\sqrt{7}}{112} & 0 & 0 & \frac{23\sqrt{210}}{2800} & 0 & \frac{13\sqrt{42}}{560} & 0 & -\frac{27\sqrt{70}}{2800} & 0 & -\frac{\sqrt{30}}{80} \\
0 & -\frac{\sqrt{14}}{112} & 0 & -\frac{\sqrt{7}}{56} & 0 & \frac{3\sqrt{70}}{560} & \frac{9\sqrt{15}}{200} & 0 & -\frac{33\sqrt{35}}{1400} & 0 & -\frac{\sqrt{21}}{280} & 0 & -\frac{27\sqrt{105}}{1400} & 0 \\
-\frac{3\sqrt{70}}{560} & 0 & \frac{\sqrt{7}}{56} & 0 & \frac{\sqrt{14}}{112} & 0 & 0 & -\frac{27\sqrt{105}}{1400} & 0 & -\frac{\sqrt{21}}{280} & 0 & -\frac{33\sqrt{35}}{1400} & 0 & \frac{9\sqrt{15}}{200} \\
0 & \frac{3\sqrt{7}}{112} & 0 & -\frac{\sqrt{14}}{112} & 0 & -\frac{\sqrt{35}}{560} & -\frac{\sqrt{30}}{80} & 0 & -\frac{27\sqrt{70}}{2800} & 0 & \frac{13\sqrt{42}}{560} & 0 & \frac{23\sqrt{210}}{2800} & 0 \\
\frac{\sqrt{7}}{112} & 0 & -\frac{3\sqrt{70}}{560} & 0 & \frac{\sqrt{35}}{560} & 0 & 0 & -\frac{\sqrt{42}}{112} & 0 & \frac{9\sqrt{210}}{560} & 0 & -\frac{3\sqrt{14}}{112} & 0 & -\frac{\sqrt{6}}{80}
\end{bmatrix}$$

| 726 | symmetry | $\dfrac{\sqrt{105}x(y-z)(y+z)\left(2x^2-y^2-z^2\right)}{4}$ |
|---|---|---|

Table 9

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{T}_{5,1}^{(1,-1;a)}(E_u,3)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{400} & 0 & \frac{\sqrt{14}i}{80} & 0 & -\frac{\sqrt{210}i}{400} & 0 & -\frac{3\sqrt{10}i}{80} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{400} & 0 & \frac{3\sqrt{70}i}{400} & 0 & -\frac{\sqrt{42}i}{80} & 0 & \frac{\sqrt{210}i}{400} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{400} & 0 & -\frac{\sqrt{42}i}{80} & 0 & \frac{3\sqrt{70}i}{400} & 0 & -\frac{\sqrt{30}i}{400} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}i}{80} & 0 & -\frac{\sqrt{210}i}{400} & 0 & \frac{\sqrt{14}i}{80} & 0 & -\frac{\sqrt{70}i}{400} & 0 \\
0 & -\frac{\sqrt{105}i}{840} & 0 & \frac{\sqrt{210}i}{840} & 0 & \frac{\sqrt{21}i}{56} & \frac{\sqrt{2}i}{40} & 0 & -\frac{\sqrt{42}i}{56} & 0 & \frac{3\sqrt{70}i}{280} & 0 & \frac{3\sqrt{14}i}{56} & 0 \\
-\frac{\sqrt{105}i}{840} & 0 & \frac{\sqrt{42}i}{168} & 0 & -\frac{\sqrt{21}i}{168} & 0 & 0 & -\frac{23\sqrt{70}i}{1400} & 0 & \frac{13\sqrt{14}i}{280} & 0 & -\frac{3\sqrt{210}i}{1400} & 0 & \frac{3\sqrt{10}i}{40} \\
0 & \frac{\sqrt{42}i}{168} & 0 & -\frac{\sqrt{21}i}{84} & 0 & \frac{\sqrt{210}i}{840} & -\frac{3\sqrt{5}i}{100} & 0 & \frac{11\sqrt{105}i}{700} & 0 & -\frac{\sqrt{7}i}{140} & 0 & -\frac{9\sqrt{35}i}{700} & 0 \\
\frac{\sqrt{210}i}{840} & 0 & -\frac{\sqrt{21}i}{84} & 0 & \frac{\sqrt{42}i}{168} & 0 & 0 & \frac{9\sqrt{35}i}{700} & 0 & \frac{\sqrt{7}i}{140} & 0 & -\frac{11\sqrt{105}i}{700} & 0 & \frac{3\sqrt{5}i}{100} \\
0 & -\frac{\sqrt{21}i}{168} & 0 & \frac{\sqrt{42}i}{168} & 0 & -\frac{\sqrt{105}i}{840} & -\frac{3\sqrt{10}i}{40} & 0 & \frac{3\sqrt{210}i}{1400} & 0 & -\frac{13\sqrt{14}i}{280} & 0 & \frac{23\sqrt{70}i}{1400} & 0 \\
\frac{\sqrt{21}i}{56} & 0 & \frac{\sqrt{210}i}{840} & 0 & -\frac{\sqrt{105}i}{840} & 0 & 0 & -\frac{3\sqrt{14}i}{56} & 0 & -\frac{3\sqrt{70}i}{280} & 0 & \frac{\sqrt{42}i}{56} & 0 & -\frac{\sqrt{2}i}{40}
\end{bmatrix}$$

| 727 | symmetry | $-\frac{\sqrt{105}\,y(x-z)(x+z)\left(x^2-2y^2+z^2\right)}{4}$ |

$\mathbb{T}_{5,2}^{(1,-1;a)}(E_u,3)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{400} & 0 & \frac{\sqrt{14}}{80} & 0 & \frac{\sqrt{210}}{400} & 0 & -\frac{3\sqrt{10}}{80} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{400} & 0 & -\frac{3\sqrt{70}}{400} & 0 & -\frac{\sqrt{42}}{80} & 0 & -\frac{\sqrt{210}}{400} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{400} & 0 & \frac{\sqrt{42}}{80} & 0 & \frac{3\sqrt{70}}{400} & 0 & \frac{\sqrt{30}}{400} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{10}}{80} & 0 & -\frac{\sqrt{210}}{400} & 0 & -\frac{\sqrt{14}}{80} & 0 & -\frac{\sqrt{70}}{400} & 0 \\
0 & -\frac{\sqrt{105}}{840} & 0 & -\frac{\sqrt{210}}{840} & 0 & \frac{\sqrt{21}}{56} & -\frac{\sqrt{2}}{40} & 0 & -\frac{\sqrt{42}}{56} & 0 & -\frac{3\sqrt{70}}{280} & 0 & \frac{3\sqrt{14}}{56} & 0 \\
\frac{\sqrt{105}}{840} & 0 & \frac{\sqrt{42}}{168} & 0 & \frac{\sqrt{21}}{168} & 0 & 0 & \frac{23\sqrt{70}}{1400} & 0 & \frac{13\sqrt{14}}{280} & 0 & \frac{3\sqrt{210}}{1400} & 0 & \frac{3\sqrt{10}}{40} \\
0 & -\frac{\sqrt{42}}{168} & 0 & -\frac{\sqrt{21}}{84} & 0 & -\frac{\sqrt{210}}{840} & -\frac{3\sqrt{5}}{100} & 0 & -\frac{11\sqrt{105}}{700} & 0 & -\frac{\sqrt{7}}{140} & 0 & \frac{9\sqrt{35}}{700} & 0 \\
\frac{\sqrt{210}}{840} & 0 & \frac{\sqrt{21}}{84} & 0 & \frac{\sqrt{42}}{168} & 0 & 0 & \frac{9\sqrt{35}}{700} & 0 & -\frac{\sqrt{7}}{140} & 0 & -\frac{11\sqrt{105}}{700} & 0 & -\frac{3\sqrt{5}}{100} \\
0 & -\frac{\sqrt{21}}{168} & 0 & -\frac{\sqrt{42}}{168} & 0 & -\frac{\sqrt{105}}{840} & \frac{3\sqrt{10}}{40} & 0 & \frac{3\sqrt{210}}{1400} & 0 & \frac{13\sqrt{14}}{280} & 0 & \frac{23\sqrt{70}}{1400} & 0 \\
-\frac{\sqrt{21}}{56} & 0 & \frac{\sqrt{210}}{840} & 0 & \frac{\sqrt{105}}{840} & 0 & 0 & \frac{3\sqrt{14}}{56} & 0 & -\frac{3\sqrt{70}}{280} & 0 & -\frac{\sqrt{42}}{56} & 0 & -\frac{\sqrt{2}}{40}
\end{bmatrix}$$

| 728 | symmetry | $z$ |

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_1^{(1,0;a)}(A_{2u})$

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $0$ | $\frac{\sqrt{2}i}{10}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $\frac{\sqrt{3}i}{10}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $\frac{\sqrt{3}i}{10}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{2}i}{10}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $-\frac{3\sqrt{2}i}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{3}i}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $-\frac{9\sqrt{2}i}{70}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{5}i}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $-\frac{3\sqrt{2}i}{70}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{6}i}{14}$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $\frac{3\sqrt{2}i}{70}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{6}i}{14}$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $\frac{9\sqrt{2}i}{70}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{5}i}{14}$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{2}i}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{3}i}{14}$ | $0$ |

| 729 | symmetry | $x$ |
|---|---|---|

$\mathbb{T}_{1,1}^{(1,0;a)}(E_u)$

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $-\frac{\sqrt{10}i}{20}$ | $0$ | $\frac{i}{20}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $-\frac{\sqrt{6}i}{20}$ | $0$ | $\frac{\sqrt{3}i}{20}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $-\frac{\sqrt{3}i}{20}$ | $0$ | $\frac{\sqrt{6}i}{20}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $-\frac{i}{20}$ | $0$ | $\frac{\sqrt{10}i}{20}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $-\frac{3\sqrt{10}i}{70}$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{21}i}{28}$ | $0$ | $-\frac{i}{28}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $-\frac{3\sqrt{10}i}{70}$ | $0$ | $-\frac{6i}{35}$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{15}i}{28}$ | $0$ | $-\frac{\sqrt{3}i}{28}$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $-\frac{6i}{35}$ | $0$ | $-\frac{9\sqrt{2}i}{70}$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{10}i}{28}$ | $0$ | $-\frac{\sqrt{6}i}{28}$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $-\frac{9\sqrt{2}i}{70}$ | $0$ | $-\frac{6i}{35}$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{6}i}{28}$ | $0$ | $-\frac{\sqrt{10}i}{28}$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $-\frac{6i}{35}$ | $0$ | $-\frac{3\sqrt{10}i}{70}$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{3}i}{28}$ | $0$ | $-\frac{\sqrt{15}i}{28}$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{10}i}{70}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{i}{28}$ | $0$ | $-\frac{\sqrt{21}i}{28}$ |

| 730 | symmetry | $y$ |
|---|---|---|

237

Table 9

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{T}_{1,2}^{(1,0;a)}(E_u) = \begin{pmatrix}
\frac{\sqrt{10}}{20} & 0 & \frac{1}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{6}}{20} & 0 & \frac{\sqrt{3}}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{3}}{20} & 0 & \frac{\sqrt{6}}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{1}{20} & 0 & \frac{\sqrt{10}}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{3\sqrt{10}}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}}{28} & 0 & -\frac{1}{28} & 0 & 0 & 0 & 0 & 0 \\
\frac{3\sqrt{10}}{70} & 0 & -\frac{6}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{28} & 0 & -\frac{\sqrt{3}}{28} & 0 & 0 & 0 & 0 \\
0 & \frac{6}{35} & 0 & -\frac{9\sqrt{2}}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{28} & 0 & -\frac{\sqrt{6}}{28} & 0 & 0 & 0 \\
0 & 0 & \frac{9\sqrt{2}}{70} & 0 & -\frac{6}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{28} & 0 & -\frac{\sqrt{10}}{28} & 0 & 0 \\
0 & 0 & 0 & \frac{6}{35} & 0 & -\frac{3\sqrt{10}}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{28} & 0 & -\frac{\sqrt{15}}{28} & 0 \\
0 & 0 & 0 & 0 & \frac{3\sqrt{10}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{28} & 0 & -\frac{\sqrt{21}}{28}
\end{pmatrix}$$

| 731 | symmetry | $-\dfrac{z\left(3x^2+3y^2-2z^2\right)}{2}$ |
|---|---|---|

$$\mathbb{T}_{3}^{(1,0;a)}(A_{2u}) = \begin{bmatrix}
0 & -\frac{3\sqrt{7}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{28} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{42}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}i}{28} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{42}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}i}{28} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{3\sqrt{7}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{28} & 0 & 0 \\
\frac{\sqrt{7}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{7}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{2\sqrt{7}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{84} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{2\sqrt{7}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{84} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{84} & 0
\end{bmatrix}$$

| 732 | symmetry | $\sqrt{15}xyz$ |
|---|---|---|

238

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_3^{(1,0;a)}(B_{1u})$

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $0$ | $0$ | $0$ | $-\frac{\sqrt{210}}{280}$ | $0$ | $0$ | $-\frac{\sqrt{2}}{8}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{70}}{56}$ | $0$ | $0$ | $0$ |
| $-\frac{\sqrt{7}}{56}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{35}}{280}$ | $0$ | $0$ | $\frac{\sqrt{42}}{56}$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{14}}{56}$ | $0$ | $0$ |
| $0$ | $\frac{\sqrt{35}}{280}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{7}}{56}$ | $0$ | $0$ | $\frac{3\sqrt{14}}{56}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{42}}{56}$ | $0$ |
| $0$ | $0$ | $\frac{\sqrt{210}}{280}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{70}}{56}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2}}{8}$ |
| $0$ | $0$ | $\frac{\sqrt{42}}{28}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{14}}{84}$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $\frac{\sqrt{210}}{140}$ | $0$ | $0$ | $\frac{\sqrt{2}}{24}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{70}}{168}$ | $0$ | $0$ | $0$ |
| $-\frac{\sqrt{42}}{28}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{210}}{140}$ | $0$ | $0$ | $\frac{\sqrt{7}}{168}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{21}}{168}$ | $0$ | $0$ |
| $0$ | $-\frac{\sqrt{210}}{140}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{42}}{28}$ | $0$ | $0$ | $-\frac{\sqrt{21}}{168}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{7}}{168}$ | $0$ |
| $0$ | $0$ | $\frac{\sqrt{210}}{140}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{70}}{168}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2}}{24}$ |
| $0$ | $0$ | $0$ | $\frac{\sqrt{42}}{28}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{14}}{84}$ | $0$ | $0$ | $0$ |

| No. | symmetry | |
|---|---|---|
| 733 | symmetry | $\frac{\sqrt{15}z(x-y)(x+y)}{2}$ |

$\mathbb{T}_3^{(1,0;a)}(B_{2u})$

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $0$ | $0$ | $0$ | $-\frac{\sqrt{210}i}{280}$ | $0$ | $0$ | $\frac{\sqrt{2}i}{8}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{70}i}{56}$ | $0$ | $0$ | $0$ |
| $\frac{\sqrt{7}i}{56}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{35}i}{280}$ | $0$ | $0$ | $-\frac{\sqrt{42}i}{56}$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{14}i}{56}$ | $0$ | $0$ |
| $0$ | $-\frac{\sqrt{35}i}{280}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{7}i}{56}$ | $0$ | $0$ | $-\frac{3\sqrt{14}i}{56}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{42}i}{56}$ | $0$ |
| $0$ | $0$ | $-\frac{\sqrt{210}i}{280}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{70}i}{56}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2}i}{8}$ |
| $0$ | $0$ | $\frac{\sqrt{42}i}{28}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{14}i}{84}$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $\frac{\sqrt{210}i}{140}$ | $0$ | $0$ | $-\frac{\sqrt{2}i}{24}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{70}i}{168}$ | $0$ | $0$ | $0$ |
| $\frac{\sqrt{42}i}{28}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{210}i}{140}$ | $0$ | $0$ | $-\frac{\sqrt{7}i}{168}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{21}i}{168}$ | $0$ | $0$ |
| $0$ | $\frac{\sqrt{210}i}{140}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{42}i}{28}$ | $0$ | $0$ | $\frac{\sqrt{21}i}{168}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{7}i}{168}$ | $0$ |
| $0$ | $0$ | $-\frac{\sqrt{210}i}{140}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{70}i}{168}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2}i}{24}$ |
| $0$ | $0$ | $0$ | $-\frac{\sqrt{42}i}{28}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{14}i}{84}$ | $0$ | $0$ | $0$ |

| No. | symmetry | |
|---|---|---|
| 734 | symmetry | $\frac{x\left(2x^2-3y^2-3z^2\right)}{2}$ |

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_{3,1}^{(1,0;a)}(E_u,1)$

$$\begin{bmatrix}
-\frac{3\sqrt{35}i}{1120} & 0 & \frac{9\sqrt{14}i}{1120} & 0 & -\frac{3\sqrt{7}i}{224} & 0 & 0 & \frac{\sqrt{210}i}{112} & 0 & -\frac{\sqrt{42}i}{56} & 0 & \frac{\sqrt{70}i}{112} & 0 & 0 \\
0 & \frac{\sqrt{21}i}{160} & 0 & -\frac{\sqrt{42}i}{1120} & 0 & -\frac{\sqrt{105}i}{224} & \frac{\sqrt{10}i}{16} & 0 & 0 & 0 & -\frac{3\sqrt{14}i}{112} & 0 & \frac{\sqrt{70}i}{56} & 0 \\
\frac{\sqrt{105}i}{224} & 0 & \frac{\sqrt{42}i}{1120} & 0 & -\frac{\sqrt{21}i}{160} & 0 & 0 & \frac{\sqrt{70}i}{56} & 0 & -\frac{3\sqrt{14}i}{112} & 0 & 0 & 0 & \frac{\sqrt{10}i}{16} \\
0 & \frac{3\sqrt{7}i}{224} & 0 & -\frac{9\sqrt{14}i}{1120} & 0 & \frac{3\sqrt{35}i}{1120} & 0 & 0 & \frac{\sqrt{70}i}{112} & 0 & -\frac{\sqrt{42}i}{56} & 0 & \frac{\sqrt{210}i}{112} & 0 \\
0 & -\frac{3\sqrt{35}i}{140} & 0 & \frac{\sqrt{70}i}{56} & 0 & 0 & \frac{\sqrt{6}i}{96} & 0 & -\frac{\sqrt{14}i}{112} & 0 & \frac{\sqrt{210}i}{672} & 0 & 0 & 0 \\
-\frac{3\sqrt{35}i}{140} & 0 & \frac{3\sqrt{14}i}{280} & 0 & \frac{\sqrt{7}i}{14} & 0 & 0 & -\frac{\sqrt{210}i}{672} & 0 & -\frac{\sqrt{42}i}{336} & 0 & \frac{\sqrt{70}i}{224} & 0 & 0 \\
0 & \frac{3\sqrt{14}i}{280} & 0 & \frac{3\sqrt{7}i}{70} & 0 & \frac{\sqrt{70}i}{56} & -\frac{\sqrt{15}i}{96} & 0 & -\frac{\sqrt{35}i}{224} & 0 & \frac{\sqrt{21}i}{672} & 0 & \frac{\sqrt{105}i}{224} & 0 \\
\frac{\sqrt{70}i}{56} & 0 & \frac{3\sqrt{7}i}{70} & 0 & \frac{3\sqrt{14}i}{280} & 0 & 0 & -\frac{\sqrt{105}i}{224} & 0 & -\frac{\sqrt{21}i}{672} & 0 & \frac{\sqrt{35}i}{224} & 0 & \frac{\sqrt{15}i}{96} \\
0 & \frac{\sqrt{7}i}{14} & 0 & \frac{3\sqrt{14}i}{280} & 0 & -\frac{3\sqrt{35}i}{140} & 0 & 0 & -\frac{\sqrt{70}i}{224} & 0 & \frac{\sqrt{42}i}{336} & 0 & \frac{\sqrt{210}i}{672} & 0 \\
0 & 0 & \frac{\sqrt{70}i}{56} & 0 & -\frac{3\sqrt{35}i}{140} & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{672} & 0 & \frac{\sqrt{14}i}{112} & 0 & -\frac{\sqrt{6}i}{96}
\end{bmatrix}$$

| 735 | symmetry | $-\dfrac{y\left(3x^2-2y^2+3z^2\right)}{2}$ |
|---|---|---|

$\mathbb{T}_{3,2}^{(1,0;a)}(E_u,1)$

$$\begin{bmatrix}
\frac{3\sqrt{35}}{1120} & 0 & \frac{9\sqrt{14}}{1120} & 0 & \frac{3\sqrt{7}}{224} & 0 & 0 & -\frac{\sqrt{210}}{112} & 0 & -\frac{\sqrt{42}}{56} & 0 & -\frac{\sqrt{70}}{112} & 0 & 0 \\
0 & -\frac{\sqrt{21}}{160} & 0 & -\frac{\sqrt{42}}{1120} & 0 & \frac{\sqrt{105}}{224} & \frac{\sqrt{10}}{16} & 0 & 0 & 0 & -\frac{3\sqrt{14}}{112} & 0 & -\frac{\sqrt{70}}{56} & 0 \\
\frac{\sqrt{105}}{224} & 0 & -\frac{\sqrt{42}}{1120} & 0 & -\frac{\sqrt{21}}{160} & 0 & 0 & \frac{\sqrt{70}}{56} & 0 & \frac{3\sqrt{14}}{112} & 0 & 0 & 0 & -\frac{\sqrt{10}}{16} \\
0 & \frac{3\sqrt{7}}{224} & 0 & \frac{9\sqrt{14}}{1120} & 0 & \frac{3\sqrt{35}}{1120} & 0 & 0 & \frac{\sqrt{70}}{112} & 0 & \frac{\sqrt{42}}{56} & 0 & \frac{\sqrt{210}}{112} & 0 \\
0 & -\frac{3\sqrt{35}}{140} & 0 & -\frac{\sqrt{70}}{56} & 0 & 0 & -\frac{\sqrt{6}}{96} & 0 & -\frac{\sqrt{14}}{112} & 0 & -\frac{\sqrt{210}}{672} & 0 & 0 & 0 \\
\frac{3\sqrt{35}}{140} & 0 & \frac{3\sqrt{14}}{280} & 0 & -\frac{\sqrt{7}}{14} & 0 & 0 & \frac{\sqrt{210}}{672} & 0 & -\frac{\sqrt{42}}{336} & 0 & -\frac{\sqrt{70}}{224} & 0 & 0 \\
0 & -\frac{3\sqrt{14}}{280} & 0 & \frac{3\sqrt{7}}{70} & 0 & -\frac{\sqrt{70}}{56} & -\frac{\sqrt{15}}{96} & 0 & \frac{\sqrt{35}}{224} & 0 & \frac{\sqrt{21}}{672} & 0 & -\frac{\sqrt{105}}{224} & 0 \\
\frac{\sqrt{70}}{56} & 0 & -\frac{3\sqrt{7}}{70} & 0 & \frac{3\sqrt{14}}{280} & 0 & 0 & -\frac{\sqrt{105}}{224} & 0 & \frac{\sqrt{21}}{672} & 0 & \frac{\sqrt{35}}{224} & 0 & -\frac{\sqrt{15}}{96} \\
0 & \frac{\sqrt{7}}{14} & 0 & -\frac{3\sqrt{14}}{280} & 0 & -\frac{3\sqrt{35}}{140} & 0 & 0 & -\frac{\sqrt{70}}{224} & 0 & -\frac{\sqrt{42}}{336} & 0 & \frac{\sqrt{210}}{672} & 0 \\
0 & 0 & \frac{\sqrt{70}}{56} & 0 & \frac{3\sqrt{35}}{140} & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{672} & 0 & -\frac{\sqrt{14}}{112} & 0 & -\frac{\sqrt{6}}{96}
\end{bmatrix}$$

| 736 | symmetry | $\dfrac{\sqrt{15}x(y-z)(y+z)}{2}$ |
|---|---|---|

*continued ...*

Table 9

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{T}_{3,1}^{(1,0;a)}(E_u,2)$

$$
\begin{pmatrix}
-\frac{\sqrt{21}i}{224} & 0 & \frac{3\sqrt{210}i}{1120} & 0 & \frac{3\sqrt{105}i}{1120} & 0 & 0 & \frac{5\sqrt{14}i}{112} & 0 & -\frac{\sqrt{70}i}{56} & 0 & -\frac{\sqrt{42}i}{112} & 0 & 0 \\
0 & \frac{\sqrt{35}i}{160} & 0 & -\frac{\sqrt{70}i}{1120} & 0 & \frac{3\sqrt{7}i}{224} & -\frac{\sqrt{6}i}{16} & 0 & 0 & 0 & -\frac{\sqrt{210}i}{112} & 0 & -\frac{\sqrt{42}i}{56} & 0 \\
-\frac{3\sqrt{7}i}{224} & 0 & \frac{\sqrt{70}i}{1120} & 0 & -\frac{\sqrt{35}i}{160} & 0 & 0 & -\frac{\sqrt{42}i}{56} & 0 & -\frac{\sqrt{210}i}{112} & 0 & 0 & 0 & -\frac{\sqrt{6}i}{16} \\
0 & -\frac{3\sqrt{105}i}{1120} & 0 & -\frac{3\sqrt{210}i}{1120} & 0 & \frac{\sqrt{21}i}{224} & 0 & 0 & -\frac{\sqrt{42}i}{112} & 0 & -\frac{\sqrt{70}i}{56} & 0 & \frac{5\sqrt{14}i}{112} & 0 \\
0 & -\frac{\sqrt{21}i}{28} & 0 & -\frac{\sqrt{42}i}{56} & 0 & 0 & \frac{\sqrt{10}i}{96} & 0 & -\frac{\sqrt{210}i}{336} & 0 & -\frac{\sqrt{14}i}{224} & 0 & 0 & 0 \\
-\frac{\sqrt{21}i}{28} & 0 & \frac{\sqrt{210}i}{280} & 0 & -\frac{\sqrt{105}i}{70} & 0 & 0 & -\frac{5\sqrt{14}i}{672} & 0 & -\frac{\sqrt{70}i}{336} & 0 & -\frac{\sqrt{42}i}{224} & 0 & 0 \\
0 & \frac{\sqrt{210}i}{280} & 0 & \frac{\sqrt{105}i}{70} & 0 & -\frac{\sqrt{42}i}{56} & \frac{i}{32} & 0 & -\frac{5\sqrt{21}i}{672} & 0 & \frac{\sqrt{35}i}{672} & 0 & -\frac{3\sqrt{7}i}{224} & 0 \\
-\frac{\sqrt{42}i}{56} & 0 & \frac{\sqrt{105}i}{70} & 0 & \frac{\sqrt{210}i}{280} & 0 & 0 & \frac{3\sqrt{7}i}{224} & 0 & -\frac{\sqrt{35}i}{672} & 0 & \frac{5\sqrt{21}i}{672} & 0 & -\frac{i}{32} \\
0 & -\frac{\sqrt{105}i}{70} & 0 & \frac{\sqrt{210}i}{280} & 0 & -\frac{\sqrt{21}i}{28} & 0 & 0 & \frac{\sqrt{42}i}{224} & 0 & \frac{\sqrt{70}i}{336} & 0 & \frac{5\sqrt{14}i}{672} & 0 \\
0 & 0 & -\frac{\sqrt{42}i}{56} & 0 & -\frac{\sqrt{21}i}{28} & 0 & 0 & 0 & 0 & \frac{\sqrt{14}i}{224} & 0 & \frac{\sqrt{210}i}{336} & 0 & -\frac{\sqrt{10}i}{96}
\end{pmatrix}
$$

| No. | | |
|-----|---|---|
| 737 | symmetry | $\frac{\sqrt{15}y(x-z)(x+z)}{2}$ |

$\mathbb{T}_{3,2}^{(1,0;a)}(E_u,2)$

$$
\begin{pmatrix}
\frac{\sqrt{21}}{224} & 0 & \frac{3\sqrt{210}}{1120} & 0 & -\frac{3\sqrt{105}}{1120} & 0 & 0 & -\frac{5\sqrt{14}}{112} & 0 & -\frac{\sqrt{70}}{56} & 0 & \frac{\sqrt{42}}{112} & 0 & 0 \\
0 & -\frac{\sqrt{35}}{160} & 0 & -\frac{\sqrt{70}}{1120} & 0 & -\frac{3\sqrt{7}}{224} & -\frac{\sqrt{6}}{16} & 0 & 0 & 0 & -\frac{\sqrt{210}}{112} & 0 & \frac{\sqrt{42}}{56} & 0 \\
-\frac{3\sqrt{7}}{224} & 0 & -\frac{\sqrt{70}}{1120} & 0 & -\frac{\sqrt{35}}{160} & 0 & 0 & -\frac{\sqrt{42}}{56} & 0 & \frac{\sqrt{210}}{112} & 0 & 0 & 0 & \frac{\sqrt{6}}{16} \\
0 & -\frac{3\sqrt{105}}{1120} & 0 & \frac{3\sqrt{210}}{1120} & 0 & \frac{\sqrt{21}}{224} & 0 & 0 & -\frac{\sqrt{42}}{112} & 0 & \frac{\sqrt{70}}{56} & 0 & \frac{5\sqrt{14}}{112} & 0 \\
0 & -\frac{\sqrt{21}}{28} & 0 & \frac{\sqrt{42}}{56} & 0 & 0 & -\frac{\sqrt{10}}{96} & 0 & -\frac{\sqrt{210}}{336} & 0 & \frac{\sqrt{14}}{224} & 0 & 0 & 0 \\
\frac{\sqrt{21}}{28} & 0 & \frac{\sqrt{210}}{280} & 0 & \frac{\sqrt{105}}{70} & 0 & 0 & \frac{5\sqrt{14}}{672} & 0 & -\frac{\sqrt{70}}{336} & 0 & \frac{\sqrt{42}}{224} & 0 & 0 \\
0 & -\frac{\sqrt{210}}{280} & 0 & \frac{\sqrt{105}}{70} & 0 & \frac{\sqrt{42}}{56} & \frac{1}{32} & 0 & \frac{5\sqrt{21}}{672} & 0 & \frac{\sqrt{35}}{672} & 0 & \frac{3\sqrt{7}}{224} & 0 \\
-\frac{\sqrt{42}}{56} & 0 & -\frac{\sqrt{105}}{70} & 0 & \frac{\sqrt{210}}{280} & 0 & 0 & \frac{3\sqrt{7}}{224} & 0 & \frac{\sqrt{35}}{672} & 0 & \frac{5\sqrt{21}}{672} & 0 & \frac{1}{32} \\
0 & -\frac{\sqrt{105}}{70} & 0 & -\frac{\sqrt{210}}{280} & 0 & -\frac{\sqrt{21}}{28} & 0 & 0 & \frac{\sqrt{42}}{224} & 0 & -\frac{\sqrt{70}}{336} & 0 & \frac{5\sqrt{14}}{672} & 0 \\
0 & 0 & -\frac{\sqrt{42}}{56} & 0 & \frac{\sqrt{21}}{28} & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{224} & 0 & -\frac{\sqrt{210}}{336} & 0 & -\frac{\sqrt{10}}{96}
\end{pmatrix}
$$

| No. | | |
|-----|---|---|
| 738 | symmetry | $\frac{3\sqrt{35}xyz(x-y)(x+y)}{2}$ |

*continued …*

Table 9

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{T}_5^{(1,0;a)}(A_{1u})$ | $$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{50} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{10}}{50} \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{10}}{50} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{50} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{3\sqrt{35}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{140} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{35}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{2100} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{150} \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{150} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \frac{3\sqrt{35}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{2100} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{3\sqrt{35}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{140} & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$ |
| 739 | symmetry | $\dfrac{z\left(15x^4+30x^2y^2-40x^2z^2+15y^4-40y^2z^2+8z^4\right)}{8}$ |
| | $\mathbb{T}_5^{(1,0;a)}(A_{2u},1)$ | $$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{10} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{10} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{10} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{10} & 0 & 0 \\ -\frac{\sqrt{5}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{420} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{5}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{2}i}{140} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{5}i}{7} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{210} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{5}i}{7} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{210} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{5}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{2}i}{140} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{420} & 0 \end{bmatrix}$$ |
| 740 | symmetry | $\dfrac{3\sqrt{35}z\left(x^2-2xy-y^2\right)\left(x^2+2xy-y^2\right)}{8}$ |

*continued ...*

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**Table 9**

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_5^{(1,0;a)}(A_{2u}, 2)$

$$
\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{50} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{10}i}{50} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}i}{50} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{50} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{3\sqrt{35}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}i}{140} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{35}i}{70} & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{2100} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{150} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{150} & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{3\sqrt{35}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{2100} & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{3\sqrt{35}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}i}{140} & 0 & 0 & 0 & 0 \\
\end{bmatrix}
$$

**741**    symmetry $\quad \dfrac{\sqrt{105}\,xyz\left(x^2+y^2-2z^2\right)}{2}$

$\mathbb{T}_5^{(1,0;a)}(B_{1u})$

$$
\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{100} & 0 & 0 & 0 & \frac{\sqrt{14}}{20} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{100} & 0 & 0 & 0 & -\frac{3\sqrt{70}}{100} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{70}}{100} & 0 & 0 & 0 & \frac{\sqrt{210}}{100} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{20} & 0 & 0 & 0 & -\frac{\sqrt{10}}{100} \\
0 & 0 & \frac{\sqrt{210}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{420} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{42}}{28} & 0 & 0 & \frac{\sqrt{10}}{300} & 0 & 0 & 0 & -\frac{\sqrt{14}}{210} & 0 & 0 & 0 \\
-\frac{\sqrt{210}}{140} & 0 & 0 & 0 & \frac{\sqrt{42}}{28} & 0 & 0 & -\frac{2\sqrt{35}}{525} & 0 & 0 & 0 & -\frac{\sqrt{105}}{1050} & 0 & 0 \\
0 & \frac{\sqrt{42}}{28} & 0 & 0 & 0 & -\frac{\sqrt{210}}{140} & 0 & 0 & \frac{\sqrt{105}}{1050} & 0 & 0 & 0 & \frac{2\sqrt{35}}{525} & 0 \\
0 & 0 & -\frac{\sqrt{42}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{210} & 0 & 0 & 0 & -\frac{\sqrt{10}}{300} \\
0 & 0 & 0 & \frac{\sqrt{210}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{420} & 0 & 0 & 0 \\
\end{bmatrix}
$$

**742**    symmetry $\quad -\dfrac{\sqrt{105}\,z(x-y)(x+y)\left(x^2+y^2-2z^2\right)}{4}$

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_5^{(1,0;a)}(B_{2u})$

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{10}i}{100}$ | 0 | 0 | 0 | $-\frac{\sqrt{14}i}{20}$ | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{210}i}{100}$ | 0 | 0 | 0 | $\frac{3\sqrt{70}i}{100}$ | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{3\sqrt{70}i}{100}$ | 0 | 0 | 0 | $-\frac{\sqrt{210}i}{100}$ | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{14}i}{20}$ | 0 | 0 | 0 | $\frac{\sqrt{10}i}{100}$ |
| 0 | 0 | $-\frac{\sqrt{210}i}{140}$ | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{70}i}{420}$ | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | $\frac{\sqrt{42}i}{28}$ | 0 | 0 | $\frac{\sqrt{10}i}{300}$ | 0 | 0 | 0 | $\frac{\sqrt{14}i}{210}$ | 0 | 0 | 0 |
| $-\frac{\sqrt{210}i}{140}$ | 0 | 0 | 0 | $-\frac{\sqrt{42}i}{28}$ | 0 | 0 | $-\frac{2\sqrt{35}i}{525}$ | 0 | 0 | 0 | $\frac{\sqrt{105}i}{1050}$ | 0 | 0 |
| 0 | $\frac{\sqrt{42}i}{28}$ | 0 | 0 | 0 | $\frac{\sqrt{210}i}{140}$ | 0 | 0 | $\frac{\sqrt{105}i}{1050}$ | 0 | 0 | 0 | $-\frac{2\sqrt{35}i}{525}$ | 0 |
| 0 | 0 | $-\frac{\sqrt{42}i}{28}$ | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{14}i}{210}$ | 0 | 0 | 0 | $\frac{\sqrt{10}i}{300}$ |
| 0 | 0 | 0 | $\frac{\sqrt{210}i}{140}$ | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{70}i}{420}$ | 0 | 0 | 0 |

743 symmetry

$$\frac{x\left(8x^4-40x^2y^2-40x^2z^2+15y^4+30y^2z^2+15z^4\right)}{8}$$

$\mathbb{T}_{5,1}^{(1,0;a)}(E_u,1)$

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{6}i}{80}$ | 0 | $-\frac{\sqrt{30}i}{80}$ | 0 | $\frac{7\sqrt{2}i}{80}$ | 0 | $-\frac{3\sqrt{42}i}{80}$ |
| 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{14}i}{80}$ | 0 | $-\frac{3\sqrt{6}i}{80}$ | 0 | $\frac{3\sqrt{10}i}{80}$ | 0 | $-\frac{7\sqrt{2}i}{80}$ | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{7\sqrt{2}i}{80}$ | 0 | $\frac{3\sqrt{10}i}{80}$ | 0 | $-\frac{3\sqrt{6}i}{80}$ | 0 | $\frac{\sqrt{14}i}{80}$ |
| 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{3\sqrt{42}i}{80}$ | 0 | $\frac{7\sqrt{2}i}{80}$ | 0 | $-\frac{\sqrt{30}i}{80}$ | 0 | $\frac{\sqrt{6}i}{80}$ | 0 |
| 0 | $-\frac{3i}{112}$ | 0 | $\frac{\sqrt{2}i}{16}$ | 0 | $-\frac{9\sqrt{5}i}{80}$ | $\frac{\sqrt{210}i}{6720}$ | 0 | $-\frac{\sqrt{10}i}{448}$ | 0 | $\frac{\sqrt{6}i}{192}$ | 0 | $-\frac{\sqrt{30}i}{320}$ | 0 |
| $-\frac{3i}{112}$ | 0 | $\frac{3\sqrt{10}i}{112}$ | 0 | $-\frac{\sqrt{5}i}{16}$ | 0 | 0 | $-\frac{23\sqrt{6}i}{6720}$ | 0 | $\frac{13\sqrt{30}i}{6720}$ | 0 | $-\frac{\sqrt{2}i}{320}$ | 0 | $-\frac{\sqrt{42}i}{320}$ |
| 0 | $\frac{3\sqrt{10}i}{112}$ | 0 | $-\frac{3\sqrt{5}i}{56}$ | 0 | $\frac{\sqrt{2}i}{16}$ | $-\frac{\sqrt{21}i}{480}$ | 0 | $\frac{11i}{1120}$ | 0 | $-\frac{\sqrt{15}i}{3360}$ | 0 | $-\frac{\sqrt{3}i}{160}$ | 0 |
| $\frac{\sqrt{2}i}{16}$ | 0 | $-\frac{3\sqrt{5}i}{56}$ | 0 | $\frac{3\sqrt{10}i}{112}$ | 0 | 0 | $\frac{\sqrt{3}i}{160}$ | 0 | $\frac{\sqrt{15}i}{3360}$ | 0 | $-\frac{11i}{1120}$ | 0 | $\frac{\sqrt{21}i}{480}$ |
| 0 | $-\frac{\sqrt{5}i}{16}$ | 0 | $\frac{3\sqrt{10}i}{112}$ | 0 | $-\frac{3i}{112}$ | $\frac{\sqrt{42}i}{320}$ | 0 | $\frac{\sqrt{2}i}{320}$ | 0 | $-\frac{13\sqrt{30}i}{6720}$ | 0 | $\frac{23\sqrt{6}i}{6720}$ | 0 |
| $-\frac{9\sqrt{5}i}{80}$ | 0 | $\frac{\sqrt{2}i}{16}$ | 0 | $-\frac{3i}{112}$ | 0 | 0 | $\frac{\sqrt{30}i}{320}$ | 0 | $-\frac{\sqrt{6}i}{192}$ | 0 | $\frac{\sqrt{10}i}{448}$ | 0 | $-\frac{\sqrt{210}i}{6720}$ |

744 symmetry

$$\frac{y\left(15x^4-40x^2y^2+30x^2z^2+8y^4-40y^2z^2+15z^4\right)}{8}$$

Table 9

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{T}_{5,2}^{(1,0;a)}(E_u,1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{80} & 0 & -\frac{\sqrt{30}}{80} & 0 & -\frac{7\sqrt{2}}{80} & 0 & -\frac{3\sqrt{42}}{80} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{80} & 0 & \frac{3\sqrt{6}}{80} & 0 & \frac{3\sqrt{10}}{80} & 0 & \frac{7\sqrt{2}}{80} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{7\sqrt{2}}{80} & 0 & -\frac{3\sqrt{10}}{80} & 0 & -\frac{3\sqrt{6}}{80} & 0 & -\frac{\sqrt{14}}{80} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{42}}{80} & 0 & \frac{7\sqrt{2}}{80} & 0 & \frac{\sqrt{30}}{80} & 0 & \frac{\sqrt{6}}{80} & 0 \\
0 & -\frac{3}{112} & 0 & -\frac{\sqrt{2}}{16} & 0 & -\frac{9\sqrt{5}}{80} & -\frac{\sqrt{210}}{6720} & 0 & -\frac{\sqrt{10}}{448} & 0 & -\frac{\sqrt{6}}{192} & 0 & -\frac{\sqrt{30}}{320} & 0 \\
\frac{3}{112} & 0 & \frac{3\sqrt{10}}{112} & 0 & \frac{\sqrt{5}}{16} & 0 & 0 & \frac{23\sqrt{6}}{6720} & 0 & \frac{13\sqrt{30}}{6720} & 0 & \frac{\sqrt{2}}{320} & 0 & -\frac{\sqrt{42}}{320} \\
0 & -\frac{3\sqrt{10}}{112} & 0 & -\frac{3\sqrt{5}}{56} & 0 & -\frac{\sqrt{2}}{16} & -\frac{\sqrt{21}}{480} & 0 & -\frac{11}{1120} & 0 & -\frac{\sqrt{15}}{3360} & 0 & \frac{\sqrt{3}}{160} & 0 \\
\frac{\sqrt{2}}{16} & 0 & \frac{3\sqrt{5}}{56} & 0 & \frac{3\sqrt{10}}{112} & 0 & 0 & \frac{\sqrt{3}}{160} & 0 & -\frac{\sqrt{15}}{3360} & 0 & -\frac{11}{1120} & 0 & -\frac{\sqrt{21}}{480} \\
0 & -\frac{\sqrt{5}}{16} & 0 & -\frac{3\sqrt{10}}{112} & 0 & -\frac{3}{112} & -\frac{\sqrt{42}}{320} & 0 & \frac{\sqrt{2}}{320} & 0 & \frac{13\sqrt{30}}{6720} & 0 & \frac{23\sqrt{6}}{6720} & 0 \\
\frac{9\sqrt{5}}{80} & 0 & \frac{\sqrt{2}}{16} & 0 & \frac{3}{112} & 0 & 0 & -\frac{\sqrt{30}}{320} & 0 & -\frac{\sqrt{6}}{192} & 0 & -\frac{\sqrt{10}}{448} & 0 & -\frac{\sqrt{210}}{6720}
\end{bmatrix}$$

| 745 | symmetry | $\dfrac{3\sqrt{35}\,x\left(y^2-2yz-z^2\right)\left(y^2+2yz-z^2\right)}{8}$ |

$\mathbb{T}_{5,1}^{(1,0;a)}(E_u,2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{400} & 0 & -\frac{\sqrt{42}i}{80} & 0 & -\frac{9\sqrt{70}i}{400} & 0 & -\frac{\sqrt{30}i}{80} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{9\sqrt{10}i}{400} & 0 & -\frac{3\sqrt{210}i}{400} & 0 & \frac{3\sqrt{14}i}{80} & 0 & \frac{9\sqrt{70}i}{400} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{9\sqrt{70}i}{400} & 0 & \frac{3\sqrt{14}i}{80} & 0 & -\frac{3\sqrt{210}i}{400} & 0 & -\frac{9\sqrt{10}i}{400} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{80} & 0 & -\frac{9\sqrt{70}i}{400} & 0 & -\frac{\sqrt{42}i}{80} & 0 & \frac{\sqrt{210}i}{400} & 0 \\
0 & -\frac{3\sqrt{35}i}{560} & 0 & -\frac{9\sqrt{70}i}{560} & 0 & -\frac{3\sqrt{7}i}{112} & \frac{\sqrt{6}i}{960} & 0 & -\frac{\sqrt{14}i}{448} & 0 & -\frac{3\sqrt{210}i}{2240} & 0 & -\frac{\sqrt{42}i}{1344} & 0 \\
-\frac{3\sqrt{35}i}{560} & 0 & \frac{3\sqrt{14}i}{112} & 0 & \frac{9\sqrt{7}i}{112} & 0 & 0 & -\frac{23\sqrt{210}i}{33600} & 0 & \frac{13\sqrt{42}i}{6720} & 0 & \frac{9\sqrt{70}i}{11200} & 0 & -\frac{\sqrt{30}i}{960} \\
0 & \frac{3\sqrt{14}i}{112} & 0 & -\frac{3\sqrt{7}i}{56} & 0 & -\frac{9\sqrt{70}i}{560} & \frac{3\sqrt{15}i}{800} & 0 & \frac{11\sqrt{35}i}{5600} & 0 & -\frac{\sqrt{21}i}{3360} & 0 & \frac{9\sqrt{105}i}{5600} & 0 \\
-\frac{9\sqrt{70}i}{560} & 0 & -\frac{3\sqrt{7}i}{56} & 0 & \frac{3\sqrt{14}i}{112} & 0 & 0 & -\frac{9\sqrt{105}i}{5600} & 0 & \frac{\sqrt{21}i}{3360} & 0 & -\frac{11\sqrt{35}i}{5600} & 0 & -\frac{3\sqrt{15}i}{800} \\
0 & \frac{9\sqrt{7}i}{112} & 0 & \frac{3\sqrt{14}i}{112} & 0 & -\frac{3\sqrt{35}i}{560} & \frac{\sqrt{30}i}{960} & 0 & -\frac{9\sqrt{70}i}{11200} & 0 & -\frac{13\sqrt{42}i}{6720} & 0 & \frac{23\sqrt{210}i}{33600} & 0 \\
-\frac{3\sqrt{7}i}{112} & 0 & -\frac{9\sqrt{70}i}{560} & 0 & -\frac{3\sqrt{35}i}{560} & 0 & 0 & \frac{\sqrt{42}i}{1344} & 0 & \frac{3\sqrt{210}i}{2240} & 0 & \frac{\sqrt{14}i}{448} & 0 & -\frac{\sqrt{6}i}{960}
\end{bmatrix}$$

| 746 | symmetry | $\dfrac{3\sqrt{35}\,y\left(x^2-2xz-z^2\right)\left(x^2+2xz-z^2\right)}{8}$ |

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|
|  | $\mathbb{T}^{(1,0;a)}_{5,2}(E_u,2)$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{400} & 0 & -\frac{\sqrt{42}}{80} & 0 & \frac{9\sqrt{70}}{400} & 0 & -\frac{\sqrt{30}}{80} \\[4pt] 0 & 0 & 0 & 0 & 0 & 0 & -\frac{9\sqrt{10}}{400} & 0 & \frac{3\sqrt{210}}{400} & 0 & \frac{3\sqrt{14}}{80} & 0 & -\frac{9\sqrt{70}}{400} & 0 \\[4pt] 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{9\sqrt{70}}{400} & 0 & -\frac{3\sqrt{14}}{80} & 0 & -\frac{3\sqrt{210}}{400} & 0 & \frac{9\sqrt{10}}{400} \\[4pt] 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{80} & 0 & -\frac{9\sqrt{70}}{400} & 0 & \frac{\sqrt{42}}{80} & 0 & \frac{\sqrt{210}}{400} & 0 \\[4pt] 0 & -\frac{3\sqrt{35}}{560} & 0 & \frac{9\sqrt{70}}{560} & 0 & -\frac{3\sqrt{7}}{112} & -\frac{\sqrt{6}}{960} & 0 & -\frac{\sqrt{14}}{448} & 0 & \frac{3\sqrt{210}}{2240} & 0 & -\frac{\sqrt{42}}{1344} & 0 \\[4pt] \frac{3\sqrt{35}}{560} & 0 & \frac{3\sqrt{14}}{112} & 0 & -\frac{9\sqrt{7}}{112} & 0 & 0 & \frac{23\sqrt{210}}{33600} & 0 & \frac{13\sqrt{42}}{6720} & 0 & -\frac{9\sqrt{70}}{11200} & 0 & -\frac{\sqrt{30}}{960} \\[4pt] 0 & -\frac{3\sqrt{14}}{112} & 0 & -\frac{3\sqrt{7}}{56} & 0 & \frac{9\sqrt{70}}{560} & \frac{3\sqrt{15}}{800} & 0 & -\frac{11\sqrt{35}}{5600} & 0 & -\frac{\sqrt{21}}{3360} & 0 & -\frac{9\sqrt{105}}{5600} & 0 \\[4pt] -\frac{9\sqrt{70}}{560} & 0 & \frac{3\sqrt{7}}{56} & 0 & \frac{3\sqrt{14}}{112} & 0 & 0 & -\frac{9\sqrt{105}}{5600} & 0 & -\frac{\sqrt{21}}{3360} & 0 & -\frac{11\sqrt{35}}{5600} & 0 & \frac{3\sqrt{15}}{800} \\[4pt] 0 & \frac{9\sqrt{7}}{112} & 0 & -\frac{3\sqrt{14}}{112} & 0 & -\frac{3\sqrt{35}}{560} & -\frac{\sqrt{30}}{960} & 0 & -\frac{9\sqrt{70}}{11200} & 0 & \frac{13\sqrt{42}}{6720} & 0 & \frac{23\sqrt{210}}{33600} & 0 \\[4pt] \frac{3\sqrt{7}}{112} & 0 & -\frac{9\sqrt{70}}{560} & 0 & \frac{3\sqrt{35}}{560} & 0 & 0 & -\frac{\sqrt{42}}{1344} & 0 & \frac{3\sqrt{210}}{2240} & 0 & -\frac{\sqrt{14}}{448} & 0 & -\frac{\sqrt{6}}{960} \end{bmatrix}$ |
| 747 | symmetry | $\dfrac{\sqrt{105}\,x(y-z)(y+z)\left(2x^2-y^2-z^2\right)}{4}$ |
|  | $\mathbb{T}^{(1,0;a)}_{5,1}(E_u,3)$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{200} & 0 & -\frac{\sqrt{14}i}{40} & 0 & \frac{\sqrt{210}i}{200} & 0 & \frac{3\sqrt{10}i}{40} \\[4pt] 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{200} & 0 & -\frac{3\sqrt{70}i}{200} & 0 & \frac{\sqrt{42}i}{40} & 0 & -\frac{\sqrt{210}i}{200} & 0 \\[4pt] 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{200} & 0 & \frac{\sqrt{42}i}{40} & 0 & -\frac{3\sqrt{70}i}{200} & 0 & \frac{\sqrt{30}i}{200} \\[4pt] 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{10}i}{40} & 0 & \frac{\sqrt{210}i}{200} & 0 & -\frac{\sqrt{14}i}{40} & 0 & \frac{\sqrt{70}i}{200} & 0 \\[4pt] 0 & -\frac{\sqrt{105}i}{280} & 0 & \frac{\sqrt{210}i}{280} & 0 & \frac{3\sqrt{21}i}{56} & \frac{\sqrt{2}i}{480} & 0 & -\frac{\sqrt{42}i}{672} & 0 & \frac{\sqrt{70}i}{1120} & 0 & \frac{\sqrt{14}i}{224} & 0 \\[4pt] -\frac{\sqrt{105}i}{280} & 0 & \frac{\sqrt{42}i}{56} & 0 & -\frac{\sqrt{21}i}{56} & 0 & 0 & -\frac{23\sqrt{70}i}{16800} & 0 & \frac{13\sqrt{14}i}{3360} & 0 & -\frac{\sqrt{210}i}{5600} & 0 & \frac{\sqrt{10}i}{160} \\[4pt] 0 & \frac{\sqrt{42}i}{56} & 0 & -\frac{\sqrt{21}i}{28} & 0 & \frac{\sqrt{210}i}{280} & -\frac{\sqrt{5}i}{400} & 0 & \frac{11\sqrt{105}i}{8400} & 0 & -\frac{\sqrt{7}i}{1680} & 0 & -\frac{3\sqrt{35}i}{2800} & 0 \\[4pt] \frac{\sqrt{210}i}{280} & 0 & -\frac{\sqrt{21}i}{28} & 0 & \frac{\sqrt{42}i}{56} & 0 & 0 & \frac{3\sqrt{35}i}{2800} & 0 & \frac{\sqrt{7}i}{1680} & 0 & -\frac{11\sqrt{105}i}{8400} & 0 & \frac{\sqrt{5}i}{400} \\[4pt] 0 & -\frac{\sqrt{21}i}{56} & 0 & \frac{\sqrt{42}i}{56} & 0 & -\frac{\sqrt{105}i}{280} & -\frac{\sqrt{10}i}{160} & 0 & \frac{\sqrt{210}i}{5600} & 0 & -\frac{13\sqrt{14}i}{3360} & 0 & \frac{23\sqrt{70}i}{16800} & 0 \\[4pt] \frac{3\sqrt{21}i}{56} & 0 & \frac{\sqrt{210}i}{280} & 0 & -\frac{\sqrt{105}i}{280} & 0 & 0 & -\frac{\sqrt{14}i}{224} & 0 & -\frac{\sqrt{70}i}{1120} & 0 & \frac{\sqrt{42}i}{672} & 0 & -\frac{\sqrt{2}i}{480} \end{bmatrix}$ |
| 748 | symmetry | $-\dfrac{\sqrt{105}\,y(x-z)(x+z)\left(x^2-2y^2+z^2\right)}{4}$ |

*continued …*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_{5,2}^{(1,0;a)}(E_u,3)$

$$
\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{200} & 0 & -\frac{\sqrt{14}}{40} & 0 & -\frac{\sqrt{210}}{200} & 0 & \frac{3\sqrt{10}}{40} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{200} & 0 & \frac{3\sqrt{70}}{200} & 0 & \frac{\sqrt{42}}{40} & 0 & \frac{\sqrt{210}}{200} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{200} & 0 & -\frac{\sqrt{42}}{40} & 0 & -\frac{3\sqrt{70}}{200} & 0 & -\frac{\sqrt{30}}{200} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}}{40} & 0 & \frac{\sqrt{210}}{200} & 0 & \frac{\sqrt{14}}{40} & 0 & \frac{\sqrt{70}}{200} & 0 \\
0 & -\frac{\sqrt{105}}{280} & 0 & -\frac{\sqrt{210}}{280} & 0 & \frac{3\sqrt{21}}{56} & -\frac{\sqrt{2}}{480} & 0 & -\frac{\sqrt{42}}{672} & 0 & -\frac{\sqrt{70}}{1120} & 0 & \frac{\sqrt{14}}{224} & 0 \\
\frac{\sqrt{105}}{280} & 0 & \frac{\sqrt{42}}{56} & 0 & \frac{\sqrt{21}}{56} & 0 & 0 & \frac{23\sqrt{70}}{16800} & 0 & \frac{13\sqrt{14}}{3360} & 0 & \frac{\sqrt{210}}{5600} & 0 & \frac{\sqrt{10}}{160} \\
0 & -\frac{\sqrt{42}}{56} & 0 & -\frac{\sqrt{21}}{28} & 0 & -\frac{\sqrt{210}}{280} & -\frac{\sqrt{5}}{400} & 0 & -\frac{11\sqrt{105}}{8400} & 0 & -\frac{\sqrt{7}}{1680} & 0 & \frac{3\sqrt{35}}{2800} & 0 \\
\frac{\sqrt{210}}{280} & 0 & \frac{\sqrt{21}}{28} & 0 & \frac{\sqrt{42}}{56} & 0 & 0 & \frac{3\sqrt{35}}{2800} & 0 & -\frac{\sqrt{7}}{1680} & 0 & -\frac{11\sqrt{105}}{8400} & 0 & -\frac{\sqrt{5}}{400} \\
0 & -\frac{\sqrt{21}}{56} & 0 & -\frac{\sqrt{42}}{56} & 0 & -\frac{\sqrt{105}}{280} & \frac{\sqrt{10}}{160} & 0 & \frac{\sqrt{210}}{5600} & 0 & \frac{13\sqrt{14}}{3360} & 0 & \frac{23\sqrt{70}}{16800} & 0 \\
-\frac{3\sqrt{21}}{56} & 0 & \frac{\sqrt{210}}{280} & 0 & \frac{\sqrt{105}}{280} & 0 & 0 & \frac{\sqrt{14}}{224} & 0 & -\frac{\sqrt{70}}{1120} & 0 & -\frac{\sqrt{42}}{672} & 0 & -\frac{\sqrt{2}}{480}
\end{bmatrix}
$$

| 749 | symmetry | $z$ |
|---|---|---|

$\mathbb{T}_{1}^{(1,1;a)}(A_{2u})$

$$
\begin{bmatrix}
0 & -\frac{i}{5} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{6}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{6}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{i}{5} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{2i}{7} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{6i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{28} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{2i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{14} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{2i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{14} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{6i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{28} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{2i}{7} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{28} & 0
\end{bmatrix}
$$

| 750 | symmetry | $x$ |
|---|---|---|

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Table 9

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{T}_{1,1}^{(1,1;a)}(E_u)=\begin{pmatrix}
\frac{\sqrt{5}i}{10} & 0 & -\frac{\sqrt{2}i}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{3}i}{10} & 0 & -\frac{\sqrt{6}i}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{6}i}{20} & 0 & -\frac{\sqrt{3}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{2}i}{20} & 0 & -\frac{\sqrt{5}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{2\sqrt{5}i}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}i}{56} & 0 & \frac{\sqrt{2}i}{56} & 0 & 0 & 0 & 0 & 0 \\
-\frac{2\sqrt{5}i}{35} & 0 & -\frac{4\sqrt{2}i}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{56} & 0 & \frac{\sqrt{6}i}{56} & 0 & 0 & 0 & 0 \\
0 & -\frac{4\sqrt{2}i}{35} & 0 & -\frac{6i}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}i}{28} & 0 & \frac{\sqrt{3}i}{28} & 0 & 0 & 0 \\
0 & 0 & -\frac{6i}{35} & 0 & -\frac{4\sqrt{2}i}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{28} & 0 & \frac{\sqrt{5}i}{28} & 0 & 0 \\
0 & 0 & 0 & -\frac{4\sqrt{2}i}{35} & 0 & -\frac{2\sqrt{5}i}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{56} & 0 & \frac{\sqrt{30}i}{56} & 0 \\
0 & 0 & 0 & 0 & -\frac{2\sqrt{5}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{56} & 0 & \frac{\sqrt{42}i}{56}
\end{pmatrix}$$

| 751 | symmetry | $y$ |
|---|---|---|

$$\mathbb{T}_{1,2}^{(1,1;a)}(E_u)=\begin{pmatrix}
-\frac{\sqrt{5}}{10} & 0 & -\frac{\sqrt{2}}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{3}}{10} & 0 & -\frac{\sqrt{6}}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{6}}{20} & 0 & -\frac{\sqrt{3}}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{2}}{20} & 0 & -\frac{\sqrt{5}}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{2\sqrt{5}}{35} & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{56} & 0 & \frac{\sqrt{2}}{56} & 0 & 0 & 0 & 0 & 0 \\
\frac{2\sqrt{5}}{35} & 0 & -\frac{4\sqrt{2}}{35} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{56} & 0 & \frac{\sqrt{6}}{56} & 0 & 0 & 0 & 0 \\
0 & \frac{4\sqrt{2}}{35} & 0 & -\frac{6}{35} & 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{28} & 0 & \frac{\sqrt{3}}{28} & 0 & 0 & 0 \\
0 & 0 & \frac{6}{35} & 0 & -\frac{4\sqrt{2}}{35} & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{28} & 0 & \frac{\sqrt{5}}{28} & 0 & 0 \\
0 & 0 & 0 & \frac{4\sqrt{2}}{35} & 0 & -\frac{2\sqrt{5}}{35} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{56} & 0 & \frac{\sqrt{30}}{56} & 0 \\
0 & 0 & 0 & 0 & \frac{2\sqrt{5}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{56} & 0 & \frac{\sqrt{42}}{56}
\end{pmatrix}$$

| 752 | symmetry | $-\frac{z\left(3x^2+3y^2-2z^2\right)}{2}$ |
|---|---|---|

*continued ...*

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Table 9

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

$\mathbb{T}_3^{(1,1;a)}(A_{2u})$

$$\begin{bmatrix}
0 & \frac{9i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{28} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{3\sqrt{6}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{28} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{3\sqrt{6}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{28} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{9i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{28} & 0 & 0 \\
\frac{5i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{i}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{2i}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{28} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{2i}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{28} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{i}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{5i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{28} & 0 \\
\end{bmatrix}$$

| 753 | symmetry | $\sqrt{15}xyz$ |
|---|---|---|

$\mathbb{T}_3^{(1,1;a)}(B_{1u})$

$$\begin{bmatrix}
0 & 0 & 0 & \frac{3\sqrt{30}}{56} & 0 & 0 & \frac{\sqrt{14}}{56} & 0 & 0 & 0 & -\frac{\sqrt{10}}{56} & 0 & 0 & 0 \\
\frac{15}{56} & 0 & 0 & 0 & \frac{3\sqrt{5}}{56} & 0 & 0 & -\frac{\sqrt{6}}{56} & 0 & 0 & 0 & -\frac{3\sqrt{2}}{56} & 0 & 0 \\
0 & -\frac{3\sqrt{5}}{56} & 0 & 0 & 0 & -\frac{15}{56} & 0 & 0 & -\frac{3\sqrt{2}}{56} & 0 & 0 & 0 & -\frac{\sqrt{6}}{56} & 0 \\
0 & 0 & -\frac{3\sqrt{30}}{56} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{56} & 0 & 0 & 0 & \frac{\sqrt{14}}{56} \\
0 & 0 & \frac{5\sqrt{6}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{28} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{30}}{84} & 0 & 0 & -\frac{\sqrt{14}}{56} & 0 & 0 & 0 & -\frac{\sqrt{10}}{56} & 0 & 0 & 0 \\
-\frac{5\sqrt{6}}{84} & 0 & 0 & 0 & -\frac{\sqrt{30}}{84} & 0 & 0 & -\frac{1}{56} & 0 & 0 & 0 & -\frac{\sqrt{3}}{56} & 0 & 0 \\
0 & -\frac{\sqrt{30}}{84} & 0 & 0 & 0 & -\frac{5\sqrt{6}}{84} & 0 & 0 & \frac{\sqrt{3}}{56} & 0 & 0 & 0 & \frac{1}{56} & 0 \\
0 & 0 & \frac{\sqrt{30}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{56} & 0 & 0 & 0 & \frac{\sqrt{14}}{56} \\
0 & 0 & 0 & \frac{5\sqrt{6}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{28} & 0 & 0 & 0 \\
\end{bmatrix}$$

| 754 | symmetry | $\frac{\sqrt{15}z(x-y)(x+y)}{2}$ |
|---|---|---|

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_3^{(1,1;a)}(B_{2u})$

$$\begin{bmatrix}
0 & 0 & 0 & \frac{3\sqrt{30}i}{56} & 0 & 0 & -\frac{\sqrt{14}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{10}i}{56} & 0 & 0 & 0 \\
-\frac{15i}{56} & 0 & 0 & 0 & \frac{3\sqrt{5}i}{56} & 0 & 0 & \frac{\sqrt{6}i}{56} & 0 & 0 & 0 & -\frac{3\sqrt{2}i}{56} & 0 & 0 \\
0 & \frac{3\sqrt{5}i}{56} & 0 & 0 & 0 & -\frac{15i}{56} & 0 & 0 & \frac{3\sqrt{2}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{6}i}{56} & 0 \\
0 & 0 & \frac{3\sqrt{30}i}{56} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{56} & 0 & 0 & 0 & \frac{\sqrt{14}i}{56} \\
0 & 0 & \frac{5\sqrt{6}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{28} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{30}i}{84} & 0 & 0 & \frac{\sqrt{14}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{10}i}{56} & 0 & 0 & 0 \\
\frac{5\sqrt{6}i}{84} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{84} & 0 & 0 & \frac{i}{56} & 0 & 0 & 0 & -\frac{\sqrt{3}i}{56} & 0 & 0 \\
0 & \frac{\sqrt{30}i}{84} & 0 & 0 & 0 & -\frac{5\sqrt{6}i}{84} & 0 & 0 & -\frac{\sqrt{3}i}{56} & 0 & 0 & 0 & \frac{i}{56} & 0 \\
0 & 0 & -\frac{\sqrt{30}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{56} & 0 & 0 & 0 & \frac{\sqrt{14}i}{56} \\
0 & 0 & 0 & -\frac{5\sqrt{6}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{28} & 0 & 0 & 0
\end{bmatrix}$$

| 755 | symmetry | $\frac{x\left(2x^2-3y^2-3z^2\right)}{2}$ |
|---|---|---|

$\mathbb{T}_{3,1}^{(1,1;a)}(E_u,1)$

$$\begin{bmatrix}
\frac{9\sqrt{5}i}{224} & 0 & -\frac{27\sqrt{2}i}{224} & 0 & \frac{45i}{224} & 0 & 0 & -\frac{\sqrt{30}i}{112} & 0 & \frac{\sqrt{6}i}{56} & 0 & -\frac{\sqrt{10}i}{112} & 0 & 0 \\
0 & -\frac{3\sqrt{3}i}{32} & 0 & \frac{3\sqrt{6}i}{224} & 0 & \frac{15\sqrt{15}i}{224} & -\frac{\sqrt{70}i}{112} & 0 & 0 & 0 & \frac{3\sqrt{2}i}{112} & 0 & -\frac{\sqrt{10}i}{56} & 0 \\
-\frac{15\sqrt{15}i}{224} & 0 & -\frac{3\sqrt{6}i}{224} & 0 & \frac{3\sqrt{3}i}{32} & 0 & 0 & -\frac{\sqrt{10}i}{56} & 0 & \frac{3\sqrt{2}i}{112} & 0 & 0 & 0 & -\frac{\sqrt{70}i}{112} \\
0 & -\frac{45i}{224} & 0 & \frac{27\sqrt{2}i}{224} & 0 & -\frac{9\sqrt{5}i}{224} & 0 & 0 & -\frac{\sqrt{10}i}{112} & 0 & \frac{\sqrt{6}i}{56} & 0 & -\frac{\sqrt{30}i}{112} & 0 \\
0 & -\frac{\sqrt{5}i}{28} & 0 & \frac{5\sqrt{10}i}{168} & 0 & 0 & -\frac{\sqrt{42}i}{224} & 0 & \frac{3\sqrt{2}i}{112} & 0 & -\frac{\sqrt{30}i}{224} & 0 & 0 & 0 \\
-\frac{\sqrt{5}i}{28} & 0 & \frac{\sqrt{2}i}{56} & 0 & \frac{5i}{42} & 0 & 0 & \frac{\sqrt{30}i}{224} & 0 & \frac{\sqrt{6}i}{112} & 0 & -\frac{3\sqrt{10}i}{224} & 0 & 0 \\
0 & \frac{\sqrt{2}i}{56} & 0 & \frac{i}{14} & 0 & \frac{5\sqrt{10}i}{168} & \frac{\sqrt{105}i}{224} & 0 & \frac{3\sqrt{5}i}{224} & 0 & -\frac{\sqrt{3}i}{224} & 0 & -\frac{3\sqrt{15}i}{224} & 0 \\
\frac{5\sqrt{10}i}{168} & 0 & \frac{i}{14} & 0 & \frac{\sqrt{2}i}{56} & 0 & 0 & \frac{3\sqrt{15}i}{224} & 0 & \frac{\sqrt{3}i}{224} & 0 & -\frac{3\sqrt{5}i}{224} & 0 & -\frac{\sqrt{105}i}{224} \\
0 & \frac{5i}{42} & 0 & \frac{\sqrt{2}i}{56} & 0 & -\frac{\sqrt{5}i}{28} & 0 & 0 & \frac{3\sqrt{10}i}{224} & 0 & -\frac{\sqrt{6}i}{112} & 0 & -\frac{\sqrt{30}i}{224} & 0 \\
0 & 0 & \frac{5\sqrt{10}i}{168} & 0 & -\frac{\sqrt{5}i}{28} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{224} & 0 & -\frac{3\sqrt{2}i}{112} & 0 & \frac{\sqrt{42}i}{224}
\end{bmatrix}$$

| 756 | symmetry | $-\frac{y\left(3x^2-2y^2+3z^2\right)}{2}$ |
|---|---|---|

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_{3,2}^{(1,1;a)}(E_u,1)$

$$\begin{bmatrix}
-\frac{9\sqrt{5}}{224} & 0 & -\frac{27\sqrt{2}}{224} & 0 & -\frac{45}{224} & 0 & 0 & \frac{\sqrt{30}}{112} & 0 & \frac{\sqrt{6}}{56} & 0 & \frac{\sqrt{10}}{112} & 0 & 0 \\[4pt]
0 & \frac{3\sqrt{3}}{32} & 0 & \frac{3\sqrt{6}}{224} & 0 & -\frac{15\sqrt{15}}{224} & -\frac{\sqrt{70}}{112} & 0 & 0 & 0 & \frac{3\sqrt{2}}{112} & 0 & \frac{\sqrt{10}}{56} & 0 \\[4pt]
-\frac{15\sqrt{15}}{224} & 0 & \frac{3\sqrt{6}}{224} & 0 & \frac{3\sqrt{3}}{32} & 0 & 0 & -\frac{\sqrt{10}}{56} & 0 & -\frac{3\sqrt{2}}{112} & 0 & 0 & 0 & \frac{\sqrt{70}}{112} \\[4pt]
0 & -\frac{45}{224} & 0 & -\frac{27\sqrt{2}}{224} & 0 & -\frac{9\sqrt{5}}{224} & 0 & 0 & -\frac{\sqrt{10}}{112} & 0 & -\frac{\sqrt{6}}{56} & 0 & -\frac{\sqrt{30}}{112} & 0 \\[4pt]
0 & -\frac{\sqrt{5}}{28} & 0 & -\frac{5\sqrt{10}}{168} & 0 & 0 & \frac{\sqrt{42}}{224} & 0 & \frac{3\sqrt{2}}{112} & 0 & \frac{\sqrt{30}}{224} & 0 & 0 & 0 \\[4pt]
\frac{\sqrt{5}}{28} & 0 & \frac{\sqrt{2}}{56} & 0 & -\frac{5}{42} & 0 & 0 & -\frac{\sqrt{30}}{224} & 0 & \frac{\sqrt{6}}{112} & 0 & \frac{3\sqrt{10}}{224} & 0 & 0 \\[4pt]
0 & -\frac{\sqrt{2}}{56} & 0 & \frac{1}{14} & 0 & -\frac{5\sqrt{10}}{168} & \frac{\sqrt{105}}{224} & 0 & -\frac{3\sqrt{5}}{224} & 0 & -\frac{\sqrt{3}}{224} & 0 & \frac{3\sqrt{15}}{224} & 0 \\[4pt]
\frac{5\sqrt{10}}{168} & 0 & -\frac{1}{14} & 0 & \frac{\sqrt{2}}{56} & 0 & 0 & \frac{3\sqrt{15}}{224} & 0 & -\frac{\sqrt{3}}{224} & 0 & -\frac{3\sqrt{5}}{224} & 0 & \frac{\sqrt{105}}{224} \\[4pt]
0 & \frac{5}{42} & 0 & -\frac{\sqrt{2}}{56} & 0 & -\frac{\sqrt{5}}{28} & 0 & 0 & \frac{3\sqrt{10}}{224} & 0 & \frac{\sqrt{6}}{112} & 0 & -\frac{\sqrt{30}}{224} & 0 \\[4pt]
0 & 0 & \frac{5\sqrt{10}}{168} & 0 & \frac{\sqrt{5}}{28} & 0 & 0 & 0 & \frac{\sqrt{30}}{224} & 0 & \frac{3\sqrt{2}}{112} & 0 & \frac{\sqrt{42}}{224}
\end{bmatrix}$$

| 757 | symmetry | $\dfrac{\sqrt{15}x(y-z)(y+z)}{2}$ |

$\mathbb{T}_{3,1}^{(1,1;a)}(E_u,2)$

$$\begin{bmatrix}
\frac{15\sqrt{3}i}{224} & 0 & -\frac{9\sqrt{30}i}{224} & 0 & -\frac{9\sqrt{15}i}{224} & 0 & 0 & -\frac{5\sqrt{2}i}{112} & 0 & \frac{\sqrt{10}i}{56} & 0 & \frac{\sqrt{6}i}{112} & 0 & 0 \\[4pt]
0 & -\frac{3\sqrt{5}i}{32} & 0 & \frac{3\sqrt{10}i}{224} & 0 & -\frac{45i}{224} & \frac{\sqrt{42}i}{112} & 0 & 0 & 0 & \frac{\sqrt{30}i}{112} & 0 & \frac{\sqrt{6}i}{56} & 0 \\[4pt]
\frac{45i}{224} & 0 & -\frac{3\sqrt{10}i}{224} & 0 & \frac{3\sqrt{5}i}{32} & 0 & 0 & \frac{\sqrt{6}i}{56} & 0 & \frac{\sqrt{30}i}{112} & 0 & 0 & 0 & \frac{\sqrt{42}i}{112} \\[4pt]
0 & \frac{9\sqrt{15}i}{224} & 0 & \frac{9\sqrt{30}i}{224} & 0 & -\frac{15\sqrt{3}i}{224} & 0 & 0 & \frac{\sqrt{6}i}{112} & 0 & \frac{\sqrt{10}i}{56} & 0 & -\frac{5\sqrt{2}i}{112} & 0 \\[4pt]
0 & -\frac{5\sqrt{3}i}{84} & 0 & -\frac{5\sqrt{6}i}{168} & 0 & 0 & -\frac{\sqrt{70}i}{224} & 0 & \frac{\sqrt{30}i}{112} & 0 & \frac{3\sqrt{2}i}{224} & 0 & 0 & 0 \\[4pt]
-\frac{5\sqrt{3}i}{84} & 0 & \frac{\sqrt{30}i}{168} & 0 & -\frac{\sqrt{15}i}{42} & 0 & 0 & \frac{5\sqrt{2}i}{224} & 0 & \frac{\sqrt{10}i}{112} & 0 & \frac{3\sqrt{6}i}{224} & 0 & 0 \\[4pt]
0 & \frac{\sqrt{30}i}{168} & 0 & \frac{\sqrt{15}i}{42} & 0 & -\frac{5\sqrt{6}i}{168} & -\frac{3\sqrt{7}i}{224} & 0 & \frac{5\sqrt{3}i}{224} & 0 & -\frac{\sqrt{5}i}{224} & 0 & \frac{9i}{224} & 0 \\[4pt]
-\frac{5\sqrt{6}i}{168} & 0 & \frac{\sqrt{15}i}{42} & 0 & \frac{\sqrt{30}i}{168} & 0 & 0 & -\frac{9i}{224} & 0 & \frac{\sqrt{5}i}{224} & 0 & -\frac{5\sqrt{3}i}{224} & 0 & \frac{3\sqrt{7}i}{224} \\[4pt]
0 & -\frac{\sqrt{15}i}{42} & 0 & \frac{\sqrt{30}i}{168} & 0 & -\frac{5\sqrt{3}i}{84} & 0 & 0 & -\frac{3\sqrt{6}i}{224} & 0 & -\frac{\sqrt{10}i}{112} & 0 & -\frac{5\sqrt{2}i}{224} & 0 \\[4pt]
0 & 0 & -\frac{5\sqrt{6}i}{168} & 0 & -\frac{5\sqrt{3}i}{84} & 0 & 0 & 0 & -\frac{3\sqrt{2}i}{224} & 0 & -\frac{\sqrt{30}i}{112} & 0 & \frac{\sqrt{70}i}{224}
\end{bmatrix}$$

| 758 | symmetry | $\dfrac{\sqrt{15}y(x-z)(x+z)}{2}$ |

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_{3,2}^{(1,1;a)}(E_u, 2)$

$$\begin{bmatrix}
-\frac{15\sqrt{3}}{224} & 0 & -\frac{9\sqrt{30}}{224} & 0 & \frac{9\sqrt{15}}{224} & 0 & 0 & \frac{5\sqrt{2}}{112} & 0 & \frac{\sqrt{10}}{56} & 0 & -\frac{\sqrt{6}}{112} & 0 & 0 \\
0 & \frac{3\sqrt{5}}{32} & 0 & \frac{3\sqrt{10}}{224} & 0 & \frac{45}{224} & \frac{\sqrt{42}}{112} & 0 & 0 & 0 & \frac{\sqrt{30}}{112} & 0 & -\frac{\sqrt{6}}{56} & 0 \\
\frac{45}{224} & 0 & \frac{3\sqrt{10}}{224} & 0 & \frac{3\sqrt{5}}{32} & 0 & 0 & \frac{\sqrt{6}}{56} & 0 & -\frac{\sqrt{30}}{112} & 0 & 0 & 0 & -\frac{\sqrt{42}}{112} \\
0 & \frac{9\sqrt{15}}{224} & 0 & -\frac{9\sqrt{30}}{224} & 0 & -\frac{15\sqrt{3}}{224} & 0 & 0 & \frac{\sqrt{6}}{112} & 0 & -\frac{\sqrt{10}}{56} & 0 & -\frac{5\sqrt{2}}{112} & 0 \\
0 & -\frac{5\sqrt{3}}{84} & 0 & \frac{5\sqrt{6}}{168} & 0 & 0 & \frac{\sqrt{70}}{224} & 0 & \frac{\sqrt{30}}{112} & 0 & -\frac{3\sqrt{2}}{224} & 0 & 0 & 0 \\
\frac{5\sqrt{3}}{84} & 0 & \frac{\sqrt{30}}{168} & 0 & \frac{\sqrt{15}}{42} & 0 & 0 & -\frac{5\sqrt{2}}{224} & 0 & \frac{\sqrt{10}}{112} & 0 & -\frac{3\sqrt{6}}{224} & 0 & 0 \\
0 & -\frac{\sqrt{30}}{168} & 0 & \frac{\sqrt{15}}{42} & 0 & \frac{5\sqrt{6}}{168} & -\frac{3\sqrt{7}}{224} & 0 & -\frac{5\sqrt{3}}{224} & 0 & -\frac{\sqrt{5}}{224} & 0 & -\frac{9}{224} & 0 \\
-\frac{5\sqrt{6}}{168} & 0 & -\frac{\sqrt{15}}{42} & 0 & \frac{\sqrt{30}}{168} & 0 & 0 & -\frac{9}{224} & 0 & -\frac{\sqrt{5}}{224} & 0 & -\frac{5\sqrt{3}}{224} & 0 & -\frac{3\sqrt{7}}{224} \\
0 & -\frac{\sqrt{15}}{42} & 0 & -\frac{\sqrt{30}}{168} & 0 & -\frac{5\sqrt{3}}{84} & 0 & 0 & -\frac{3\sqrt{6}}{224} & 0 & \frac{\sqrt{10}}{112} & 0 & -\frac{5\sqrt{2}}{224} & 0 \\
0 & 0 & -\frac{5\sqrt{6}}{168} & 0 & \frac{5\sqrt{3}}{84} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{2}}{224} & 0 & \frac{\sqrt{30}}{112} & 0 & \frac{\sqrt{70}}{224}
\end{bmatrix}$$

| 759 | symmetry | $-\frac{x^2}{2} - \frac{y^2}{2} + z^2$ |
|---|---|---|

$\mathbb{M}_2^{(a)}(A_{1u})$

$$\begin{bmatrix}
0 & \frac{3\sqrt{10}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{14} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{15}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{5}}{70} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{15}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{5}}{70} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{3\sqrt{10}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{14} & 0 & 0 \\
-\frac{\sqrt{10}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{10}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3}{14} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{10}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{70} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{10}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{70} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{10}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3}{14} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{14} & 0
\end{bmatrix}$$

| 760 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |
|---|---|---|

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_2^{(a)}(B_{1u}) = \begin{bmatrix}
0 & 0 & 0 & \frac{\sqrt{15}}{35} & 0 & 0 & \frac{\sqrt{7}}{28} & 0 & 0 & 0 & \frac{\sqrt{5}}{140} & 0 & 0 & 0 \\
-\frac{\sqrt{2}}{7} & 0 & 0 & 0 & \frac{2\sqrt{10}}{35} & 0 & 0 & \frac{\sqrt{3}}{28} & 0 & 0 & 0 & \frac{1}{28} & 0 & 0 \\
0 & -\frac{2\sqrt{10}}{35} & 0 & 0 & 0 & \frac{\sqrt{2}}{7} & 0 & 0 & \frac{1}{28} & 0 & 0 & 0 & \frac{\sqrt{3}}{28} & 0 \\
0 & 0 & -\frac{\sqrt{15}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{140} & 0 & 0 & 0 & \frac{\sqrt{7}}{28} \\
0 & 0 & -\frac{\sqrt{3}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{14} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{3\sqrt{15}}{140} & 0 & 0 & -\frac{\sqrt{7}}{14} & 0 & 0 & 0 & \frac{2\sqrt{5}}{35} & 0 & 0 & 0 \\
-\frac{\sqrt{3}}{28} & 0 & 0 & 0 & -\frac{3\sqrt{15}}{140} & 0 & 0 & -\frac{\sqrt{2}}{7} & 0 & 0 & 0 & \frac{\sqrt{6}}{14} & 0 & 0 \\
0 & -\frac{3\sqrt{15}}{140} & 0 & 0 & 0 & -\frac{\sqrt{3}}{28} & 0 & 0 & -\frac{\sqrt{6}}{14} & 0 & 0 & 0 & \frac{\sqrt{2}}{7} & 0 \\
0 & 0 & -\frac{3\sqrt{15}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{5}}{35} & 0 & 0 & 0 & \frac{\sqrt{7}}{14} \\
0 & 0 & 0 & -\frac{\sqrt{3}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{14} & 0 & 0 & 0
\end{bmatrix}$$

| 761 | symmetry | $\sqrt{3}xy$ |
|---|---|---|

$$\mathbb{M}_2^{(a)}(B_{2u}) = \begin{bmatrix}
0 & 0 & 0 & -\frac{\sqrt{15}i}{35} & 0 & 0 & \frac{\sqrt{7}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{5}i}{140} & 0 & 0 & 0 \\
-\frac{\sqrt{2}i}{7} & 0 & 0 & 0 & -\frac{2\sqrt{10}i}{35} & 0 & 0 & \frac{\sqrt{3}i}{28} & 0 & 0 & 0 & -\frac{i}{28} & 0 & 0 \\
0 & -\frac{2\sqrt{10}i}{35} & 0 & 0 & 0 & -\frac{\sqrt{2}i}{7} & 0 & 0 & \frac{i}{28} & 0 & 0 & 0 & -\frac{\sqrt{3}i}{28} & 0 \\
0 & 0 & -\frac{\sqrt{15}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}i}{140} & 0 & 0 & 0 & -\frac{\sqrt{7}i}{28} \\
0 & 0 & \frac{\sqrt{3}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{i}{14} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{3\sqrt{15}i}{140} & 0 & 0 & -\frac{\sqrt{7}i}{14} & 0 & 0 & 0 & -\frac{2\sqrt{5}i}{35} & 0 & 0 & 0 \\
-\frac{\sqrt{3}i}{28} & 0 & 0 & 0 & \frac{3\sqrt{15}i}{140} & 0 & 0 & -\frac{\sqrt{2}i}{7} & 0 & 0 & 0 & -\frac{\sqrt{6}i}{14} & 0 & 0 \\
0 & -\frac{3\sqrt{15}i}{140} & 0 & 0 & 0 & \frac{\sqrt{3}i}{28} & 0 & 0 & -\frac{\sqrt{6}i}{14} & 0 & 0 & 0 & -\frac{\sqrt{2}i}{7} & 0 \\
0 & 0 & -\frac{3\sqrt{15}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{5}i}{35} & 0 & 0 & 0 & -\frac{\sqrt{7}i}{14} \\
0 & 0 & 0 & -\frac{\sqrt{3}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{i}{14} & 0 & 0 & 0
\end{bmatrix}$$

| 762 | symmetry | $\sqrt{3}yz$ |
|---|---|---|

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_{2,1}^{(a)}(E_u) = \begin{pmatrix}
-\frac{\sqrt{6}i}{14} & 0 & -\frac{3\sqrt{15}i}{70} & 0 & 0 & 0 & 0 & -\frac{i}{14} & 0 & -\frac{\sqrt{5}i}{70} & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{10}i}{70} & 0 & -\frac{\sqrt{5}i}{14} & 0 & 0 & 0 & 0 & -\frac{i}{14} & 0 & -\frac{\sqrt{15}i}{70} & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{5}i}{14} & 0 & -\frac{\sqrt{10}i}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{70} & 0 & -\frac{i}{14} & 0 & 0 \\
0 & 0 & 0 & \frac{3\sqrt{15}i}{70} & 0 & \frac{\sqrt{6}i}{14} & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}i}{70} & 0 & -\frac{i}{14} & 0 \\
0 & \frac{\sqrt{6}i}{28} & 0 & 0 & 0 & 0 & -\frac{\sqrt{35}i}{28} & 0 & -\frac{\sqrt{15}i}{28} & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{6}i}{28} & 0 & \frac{\sqrt{15}i}{70} & 0 & 0 & 0 & 0 & -\frac{i}{28} & 0 & -\frac{11\sqrt{5}i}{140} & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{15}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{28} & 0 & -\frac{\sqrt{10}i}{20} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{70} & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{20} & 0 & -\frac{\sqrt{6}i}{28} & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{15}i}{70} & 0 & -\frac{\sqrt{6}i}{28} & 0 & 0 & 0 & 0 & \frac{11\sqrt{5}i}{140} & 0 & \frac{i}{28} & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{28} & 0 & \frac{\sqrt{35}i}{28}
\end{pmatrix}$$

| 763 | symmetry | $-\sqrt{3}xz$ |

$$\mathbb{M}_{2,2}^{(a)}(E_u) = \begin{pmatrix}
\frac{\sqrt{6}}{14} & 0 & -\frac{3\sqrt{15}}{70} & 0 & 0 & 0 & 0 & \frac{1}{14} & 0 & -\frac{\sqrt{5}}{70} & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{10}}{70} & 0 & -\frac{\sqrt{5}}{14} & 0 & 0 & 0 & 0 & \frac{1}{14} & 0 & -\frac{\sqrt{15}}{70} & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{5}}{14} & 0 & -\frac{\sqrt{10}}{70} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{70} & 0 & -\frac{1}{14} & 0 & 0 \\
0 & 0 & 0 & -\frac{3\sqrt{15}}{70} & 0 & \frac{\sqrt{6}}{14} & 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{70} & 0 & -\frac{1}{14} & 0 \\
0 & \frac{\sqrt{6}}{28} & 0 & 0 & 0 & 0 & \frac{\sqrt{35}}{28} & 0 & -\frac{\sqrt{15}}{28} & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{6}}{28} & 0 & \frac{\sqrt{15}}{70} & 0 & 0 & 0 & 0 & \frac{1}{28} & 0 & -\frac{11\sqrt{5}}{140} & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{15}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{28} & 0 & -\frac{\sqrt{10}}{20} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{20} & 0 & -\frac{\sqrt{6}}{28} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{15}}{70} & 0 & -\frac{\sqrt{6}}{28} & 0 & 0 & 0 & 0 & -\frac{11\sqrt{5}}{140} & 0 & \frac{1}{28} & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{28} & 0 & \frac{\sqrt{35}}{28}
\end{pmatrix}$$

| 764 | symmetry | $\frac{\sqrt{21}\left(x^4-3x^2y^2-3x^2z^2+y^4-3y^2z^2+z^4\right)}{6}$ |

*continued ...*

254

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_4^{(a)}(A_{1u},1)$

$$\begin{bmatrix}
0 & -\frac{\sqrt{21}}{84} & 0 & 0 & 0 & -\frac{\sqrt{105}}{84} & 0 & 0 & -\frac{3\sqrt{210}}{280} & 0 & 0 & 0 & -\frac{3\sqrt{70}}{280} & 0 \\
0 & 0 & \frac{\sqrt{14}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{56} & 0 & 0 & 0 & -\frac{\sqrt{30}}{40} \\
0 & 0 & 0 & -\frac{\sqrt{14}}{28} & 0 & 0 & -\frac{\sqrt{30}}{40} & 0 & 0 & 0 & \frac{\sqrt{42}}{56} & 0 & 0 & 0 \\
\frac{\sqrt{105}}{84} & 0 & 0 & 0 & \frac{\sqrt{21}}{84} & 0 & 0 & -\frac{3\sqrt{70}}{280} & 0 & 0 & 0 & -\frac{3\sqrt{210}}{280} & 0 & 0 \\
\frac{\sqrt{21}}{84} & 0 & 0 & 0 & \frac{\sqrt{105}}{84} & 0 & 0 & -\frac{\sqrt{14}}{28} & 0 & 0 & 0 & -\frac{\sqrt{42}}{84} & 0 & 0 \\
0 & -\frac{\sqrt{21}}{28} & 0 & 0 & 0 & \frac{\sqrt{105}}{84} & 0 & 0 & \frac{\sqrt{210}}{105} & 0 & 0 & 0 & -\frac{\sqrt{70}}{70} & 0 \\
0 & 0 & \frac{\sqrt{21}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{28} & 0 & 0 & 0 & -\frac{\sqrt{5}}{20} \\
0 & 0 & 0 & \frac{\sqrt{21}}{42} & 0 & 0 & \frac{\sqrt{5}}{20} & 0 & 0 & 0 & -\frac{\sqrt{7}}{28} & 0 & 0 & 0 \\
\frac{\sqrt{105}}{84} & 0 & 0 & 0 & -\frac{\sqrt{21}}{28} & 0 & 0 & \frac{\sqrt{70}}{70} & 0 & 0 & 0 & -\frac{\sqrt{210}}{105} & 0 & 0 \\
0 & \frac{\sqrt{105}}{84} & 0 & 0 & 0 & \frac{\sqrt{21}}{84} & 0 & 0 & \frac{\sqrt{42}}{84} & 0 & 0 & 0 & \frac{\sqrt{14}}{28} & 0
\end{bmatrix}$$

| 765 | symmetry | $-\dfrac{\sqrt{15}\left(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4\right)}{12}$ |

$\mathbb{M}_4^{(a)}(A_{1u},2)$

$$\begin{bmatrix}
0 & -\frac{\sqrt{15}}{84} & 0 & 0 & 0 & \frac{\sqrt{3}}{12} & 0 & 0 & -\frac{3\sqrt{6}}{56} & 0 & 0 & 0 & \frac{3\sqrt{2}}{40} & 0 \\
0 & 0 & \frac{\sqrt{10}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{56} & 0 & 0 & 0 & \frac{\sqrt{42}}{40} \\
0 & 0 & 0 & -\frac{\sqrt{10}}{28} & 0 & 0 & \frac{\sqrt{42}}{40} & 0 & 0 & 0 & \frac{\sqrt{30}}{56} & 0 & 0 & 0 \\
-\frac{\sqrt{3}}{12} & 0 & 0 & 0 & \frac{\sqrt{15}}{84} & 0 & 0 & \frac{3\sqrt{2}}{40} & 0 & 0 & 0 & -\frac{3\sqrt{6}}{56} & 0 & 0 \\
\frac{\sqrt{15}}{84} & 0 & 0 & 0 & -\frac{\sqrt{3}}{12} & 0 & 0 & -\frac{\sqrt{10}}{28} & 0 & 0 & 0 & \frac{\sqrt{30}}{60} & 0 & 0 \\
0 & -\frac{\sqrt{15}}{28} & 0 & 0 & 0 & -\frac{\sqrt{3}}{12} & 0 & 0 & \frac{\sqrt{6}}{21} & 0 & 0 & 0 & \frac{\sqrt{2}}{10} & 0 \\
0 & 0 & \frac{\sqrt{15}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{28} & 0 & 0 & 0 & \frac{\sqrt{7}}{20} \\
0 & 0 & 0 & \frac{\sqrt{15}}{42} & 0 & 0 & -\frac{\sqrt{7}}{20} & 0 & 0 & 0 & -\frac{\sqrt{5}}{28} & 0 & 0 & 0 \\
-\frac{\sqrt{3}}{12} & 0 & 0 & 0 & -\frac{\sqrt{15}}{28} & 0 & 0 & -\frac{\sqrt{2}}{10} & 0 & 0 & 0 & -\frac{\sqrt{6}}{21} & 0 & 0 \\
0 & -\frac{\sqrt{3}}{12} & 0 & 0 & 0 & \frac{\sqrt{15}}{84} & 0 & 0 & -\frac{\sqrt{30}}{60} & 0 & 0 & 0 & \frac{\sqrt{10}}{28} & 0
\end{bmatrix}$$

| 766 | symmetry | $\dfrac{\sqrt{35}xy(x-y)(x+y)}{2}$ |

*continued …*

255

Table 9

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{M}_4^{(a)}(A_{2u})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{42}i}{140} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{2}i}{20} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{2}i}{20} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{7}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{42}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{70} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{35} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{10} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{7}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{7}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{70} & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

| No. | symmetry | |
|-----|----------|--|
| 767 | symmetry | $\dfrac{\sqrt{5}(x-y)(x+y)\left(x^2+y^2-6z^2\right)}{4}$ |

$\mathbb{M}_4^{(a)}(B_{1u})$

$$\begin{bmatrix}
0 & 0 & 0 & \frac{\sqrt{10}}{28} & 0 & 0 & \frac{3\sqrt{42}}{280} & 0 & 0 & 0 & \frac{9\sqrt{30}}{280} & 0 & 0 & 0 \\
-\frac{\sqrt{3}}{28} & 0 & 0 & 0 & -\frac{\sqrt{15}}{28} & 0 & 0 & -\frac{33\sqrt{2}}{280} & 0 & 0 & 0 & \frac{3\sqrt{6}}{280} & 0 & 0 \\
0 & \frac{\sqrt{15}}{28} & 0 & 0 & 0 & \frac{\sqrt{3}}{28} & 0 & 0 & \frac{3\sqrt{6}}{280} & 0 & 0 & 0 & -\frac{33\sqrt{2}}{280} & 0 \\
0 & 0 & -\frac{\sqrt{10}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{9\sqrt{30}}{280} & 0 & 0 & 0 & \frac{3\sqrt{42}}{280} \\
0 & 0 & -\frac{3\sqrt{2}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{14} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{10}}{28} & 0 & 0 & -\frac{3\sqrt{42}}{140} & 0 & 0 & 0 & \frac{\sqrt{30}}{140} & 0 & 0 & 0 \\
-\frac{3\sqrt{2}}{28} & 0 & 0 & 0 & \frac{\sqrt{10}}{28} & 0 & 0 & \frac{9\sqrt{3}}{140} & 0 & 0 & 0 & -\frac{17}{140} & 0 & 0 \\
0 & \frac{\sqrt{10}}{28} & 0 & 0 & 0 & -\frac{3\sqrt{2}}{28} & 0 & 0 & \frac{17}{140} & 0 & 0 & 0 & -\frac{9\sqrt{3}}{140} & 0 \\
0 & 0 & \frac{\sqrt{10}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{140} & 0 & 0 & 0 & \frac{3\sqrt{42}}{140} \\
0 & 0 & 0 & -\frac{3\sqrt{2}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{14} & 0 & 0 & 0
\end{bmatrix}$$

| No. | symmetry | |
|-----|----------|--|
| 768 | symmetry | $-\dfrac{\sqrt{5}xy\left(x^2+y^2-6z^2\right)}{2}$ |

Table 9

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_4^{(a)}(B_{2u})$$

$$\begin{bmatrix}
0 & 0 & 0 & \frac{\sqrt{10}i}{28} & 0 & 0 & -\frac{3\sqrt{42}i}{280} & 0 & 0 & 0 & \frac{9\sqrt{30}i}{280} & 0 & 0 & 0 \\
\frac{\sqrt{3}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{28} & 0 & 0 & \frac{33\sqrt{2}i}{280} & 0 & 0 & 0 & \frac{3\sqrt{6}i}{280} & 0 & 0 \\
0 & -\frac{\sqrt{15}i}{28} & 0 & 0 & 0 & \frac{\sqrt{3}i}{28} & 0 & 0 & -\frac{3\sqrt{6}i}{280} & 0 & 0 & 0 & -\frac{33\sqrt{2}i}{280} & 0 \\
0 & 0 & \frac{\sqrt{10}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{9\sqrt{30}i}{280} & 0 & 0 & 0 & \frac{3\sqrt{42}i}{280} \\
0 & 0 & -\frac{3\sqrt{2}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{14} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{10}i}{28} & 0 & 0 & \frac{3\sqrt{42}i}{140} & 0 & 0 & 0 & \frac{\sqrt{30}i}{140} & 0 & 0 & 0 \\
\frac{3\sqrt{2}i}{28} & 0 & 0 & 0 & \frac{\sqrt{10}i}{28} & 0 & 0 & -\frac{9\sqrt{3}i}{140} & 0 & 0 & 0 & -\frac{17i}{140} & 0 & 0 \\
0 & -\frac{\sqrt{10}i}{28} & 0 & 0 & 0 & -\frac{3\sqrt{2}i}{28} & 0 & 0 & -\frac{17i}{140} & 0 & 0 & 0 & -\frac{9\sqrt{3}i}{140} & 0 \\
0 & 0 & -\frac{\sqrt{10}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{140} & 0 & 0 & 0 & \frac{3\sqrt{42}i}{140} \\
0 & 0 & 0 & \frac{3\sqrt{2}i}{28} & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{14} & 0 & 0 & 0 & 0
\end{bmatrix}$$

| 769 | symmetry | $\frac{\sqrt{35}yz(y-z)(y+z)}{2}$ |
|---|---|---|

$$\mathbb{M}_{4,1}^{(a)}(E_u,1)$$

$$\begin{bmatrix}
-\frac{\sqrt{7}i}{112} & 0 & -\frac{\sqrt{70}i}{112} & 0 & -\frac{\sqrt{35}i}{112} & 0 & 0 & -\frac{9\sqrt{42}i}{560} & 0 & -\frac{3\sqrt{210}i}{280} & 0 & -\frac{9\sqrt{14}i}{560} & 0 & 0 \\
0 & \frac{\sqrt{105}i}{112} & 0 & \frac{\sqrt{210}i}{112} & 0 & \frac{\sqrt{21}i}{112} & \frac{3\sqrt{2}i}{80} & 0 & \frac{3\sqrt{42}i}{140} & 0 & \frac{3\sqrt{70}i}{560} & 0 & -\frac{3\sqrt{14}i}{280} & 0 \\
-\frac{\sqrt{21}i}{112} & 0 & -\frac{\sqrt{210}i}{112} & 0 & -\frac{\sqrt{105}i}{112} & 0 & 0 & -\frac{3\sqrt{14}i}{280} & 0 & \frac{3\sqrt{70}i}{560} & 0 & \frac{3\sqrt{42}i}{140} & 0 & \frac{3\sqrt{2}i}{80} \\
0 & \frac{\sqrt{35}i}{112} & 0 & \frac{\sqrt{70}i}{112} & 0 & \frac{\sqrt{7}i}{112} & 0 & 0 & -\frac{9\sqrt{14}i}{560} & 0 & -\frac{3\sqrt{210}i}{280} & 0 & -\frac{9\sqrt{42}i}{560} & 0 \\
0 & \frac{\sqrt{7}i}{28} & 0 & \frac{\sqrt{14}i}{56} & 0 & 0 & -\frac{\sqrt{30}i}{80} & 0 & -\frac{\sqrt{70}i}{56} & 0 & -\frac{\sqrt{42}i}{112} & 0 & 0 & 0 \\
-\frac{\sqrt{7}i}{28} & 0 & -\frac{\sqrt{70}i}{56} & 0 & 0 & 0 & 0 & \frac{13\sqrt{42}i}{560} & 0 & \frac{\sqrt{210}i}{280} & 0 & -\frac{\sqrt{14}i}{80} & 0 & 0 \\
0 & \frac{\sqrt{70}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{14}i}{56} & -\frac{3\sqrt{3}i}{80} & 0 & -\frac{\sqrt{7}i}{560} & 0 & \frac{\sqrt{105}i}{80} & 0 & \frac{\sqrt{21}i}{560} & 0 \\
-\frac{\sqrt{14}i}{56} & 0 & 0 & 0 & \frac{\sqrt{70}i}{56} & 0 & 0 & -\frac{\sqrt{21}i}{560} & 0 & -\frac{\sqrt{105}i}{80} & 0 & \frac{\sqrt{7}i}{560} & 0 & \frac{3\sqrt{3}i}{80} \\
0 & 0 & 0 & -\frac{\sqrt{70}i}{56} & 0 & -\frac{\sqrt{7}i}{28} & 0 & 0 & \frac{\sqrt{14}i}{80} & 0 & -\frac{\sqrt{210}i}{280} & 0 & -\frac{13\sqrt{42}i}{560} & 0 \\
0 & 0 & \frac{\sqrt{14}i}{56} & 0 & \frac{\sqrt{7}i}{28} & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{112} & 0 & \frac{\sqrt{70}i}{56} & 0 & \frac{\sqrt{30}i}{80}
\end{bmatrix}$$

| 770 | symmetry | $-\frac{\sqrt{35}xz(x-z)(x+z)}{2}$ |
|---|---|---|

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{M}_{4,2}^{(a)}(E_u,1)$ | $\begin{bmatrix} \frac{\sqrt{7}}{112} & 0 & -\frac{\sqrt{70}}{112} & 0 & \frac{\sqrt{35}}{112} & 0 & 0 & \frac{9\sqrt{42}}{560} & 0 & -\frac{3\sqrt{210}}{280} & 0 & \frac{9\sqrt{14}}{560} & 0 & 0 \\ 0 & -\frac{\sqrt{105}}{112} & 0 & \frac{\sqrt{210}}{112} & 0 & -\frac{\sqrt{21}}{112} & \frac{3\sqrt{2}}{80} & 0 & -\frac{3\sqrt{42}}{140} & 0 & \frac{3\sqrt{70}}{560} & 0 & \frac{3\sqrt{14}}{280} & 0 \\ -\frac{\sqrt{21}}{112} & 0 & \frac{\sqrt{210}}{112} & 0 & -\frac{\sqrt{105}}{112} & 0 & 0 & -\frac{3\sqrt{14}}{280} & 0 & -\frac{3\sqrt{70}}{560} & 0 & \frac{3\sqrt{42}}{140} & 0 & -\frac{3\sqrt{2}}{80} \\ 0 & \frac{\sqrt{35}}{112} & 0 & -\frac{\sqrt{70}}{112} & 0 & \frac{\sqrt{7}}{112} & 0 & 0 & -\frac{9\sqrt{14}}{560} & 0 & \frac{3\sqrt{210}}{280} & 0 & -\frac{9\sqrt{42}}{560} & 0 \\ 0 & \frac{\sqrt{7}}{28} & 0 & -\frac{\sqrt{14}}{56} & 0 & 0 & \frac{\sqrt{30}}{80} & 0 & -\frac{\sqrt{70}}{56} & 0 & \frac{\sqrt{42}}{112} & 0 & 0 & 0 \\ \frac{\sqrt{7}}{28} & 0 & -\frac{\sqrt{70}}{56} & 0 & 0 & 0 & 0 & -\frac{13\sqrt{42}}{560} & 0 & \frac{\sqrt{210}}{280} & 0 & \frac{\sqrt{14}}{80} & 0 & 0 \\ 0 & -\frac{\sqrt{70}}{56} & 0 & 0 & 0 & \frac{\sqrt{14}}{56} & -\frac{3\sqrt{3}}{80} & 0 & \frac{\sqrt{7}}{560} & 0 & \frac{\sqrt{105}}{80} & 0 & -\frac{\sqrt{21}}{560} & 0 \\ -\frac{\sqrt{14}}{56} & 0 & 0 & 0 & \frac{\sqrt{70}}{56} & 0 & 0 & -\frac{\sqrt{21}}{560} & 0 & \frac{\sqrt{105}}{80} & 0 & \frac{\sqrt{7}}{560} & 0 & -\frac{3\sqrt{3}}{80} \\ 0 & 0 & 0 & \frac{\sqrt{70}}{56} & 0 & -\frac{\sqrt{7}}{28} & 0 & 0 & \frac{\sqrt{14}}{80} & 0 & \frac{\sqrt{210}}{280} & 0 & -\frac{13\sqrt{42}}{560} & 0 \\ 0 & 0 & \frac{\sqrt{14}}{56} & 0 & -\frac{\sqrt{7}}{28} & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{112} & 0 & -\frac{\sqrt{70}}{56} & 0 & \frac{\sqrt{30}}{80} \end{bmatrix}$ |
| 771 | symmetry | $\dfrac{\sqrt{5}\,yz\left(6x^2-y^2-z^2\right)}{2}$ |
| | $\mathbb{M}_{4,1}^{(a)}(E_u,2)$ | $\begin{bmatrix} -\frac{i}{112} & 0 & -\frac{\sqrt{10}i}{112} & 0 & \frac{\sqrt{5}i}{16} & 0 & 0 & -\frac{9\sqrt{6}i}{560} & 0 & -\frac{3\sqrt{30}i}{280} & 0 & \frac{9\sqrt{2}i}{80} & 0 & 0 \\ 0 & \frac{\sqrt{15}i}{112} & 0 & \frac{\sqrt{30}i}{112} & 0 & -\frac{\sqrt{3}i}{16} & -\frac{3\sqrt{14}i}{80} & 0 & \frac{3\sqrt{6}i}{140} & 0 & \frac{3\sqrt{10}i}{560} & 0 & \frac{3\sqrt{2}i}{40} & 0 \\ \frac{\sqrt{3}i}{16} & 0 & -\frac{\sqrt{30}i}{112} & 0 & -\frac{\sqrt{15}i}{112} & 0 & 0 & \frac{3\sqrt{2}i}{40} & 0 & \frac{3\sqrt{10}i}{560} & 0 & \frac{3\sqrt{6}i}{140} & 0 & -\frac{3\sqrt{14}i}{80} \\ 0 & -\frac{\sqrt{5}i}{16} & 0 & \frac{\sqrt{10}i}{112} & 0 & \frac{i}{112} & 0 & 0 & \frac{9\sqrt{2}i}{80} & 0 & -\frac{3\sqrt{30}i}{280} & 0 & -\frac{9\sqrt{6}i}{560} & 0 \\ 0 & \frac{i}{28} & 0 & -\frac{\sqrt{2}i}{8} & 0 & 0 & -\frac{\sqrt{210}i}{560} & 0 & -\frac{\sqrt{10}i}{56} & 0 & \frac{\sqrt{6}i}{16} & 0 & 0 & 0 \\ -\frac{i}{28} & 0 & -\frac{\sqrt{10}i}{56} & 0 & 0 & 0 & 0 & \frac{13\sqrt{6}i}{560} & 0 & \frac{\sqrt{30}i}{280} & 0 & \frac{7\sqrt{2}i}{80} & 0 & 0 \\ 0 & \frac{\sqrt{10}i}{56} & 0 & 0 & 0 & \frac{\sqrt{2}i}{8} & \frac{3\sqrt{21}i}{80} & 0 & -\frac{i}{560} & 0 & \frac{\sqrt{15}i}{80} & 0 & -\frac{\sqrt{3}i}{80} & 0 \\ \frac{\sqrt{2}i}{8} & 0 & 0 & 0 & \frac{\sqrt{10}i}{56} & 0 & 0 & \frac{\sqrt{3}i}{80} & 0 & -\frac{\sqrt{15}i}{80} & 0 & \frac{i}{560} & 0 & -\frac{3\sqrt{21}i}{80} \\ 0 & 0 & 0 & -\frac{\sqrt{10}i}{56} & 0 & -\frac{i}{28} & 0 & 0 & -\frac{7\sqrt{2}i}{80} & 0 & -\frac{\sqrt{30}i}{280} & 0 & -\frac{13\sqrt{6}i}{560} & 0 \\ 0 & 0 & -\frac{\sqrt{2}i}{8} & 0 & \frac{i}{28} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{16} & 0 & \frac{\sqrt{10}i}{56} & 0 & \frac{\sqrt{210}i}{560} \end{bmatrix}$ |
| 772 | symmetry | $\dfrac{\sqrt{5}\,xz\left(x^2-6y^2+z^2\right)}{2}$ |

Table 9

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_{4,2}^{(a)}(E_u, 2)$$

$$\begin{pmatrix}
\frac{1}{112} & 0 & -\frac{\sqrt{10}}{112} & 0 & -\frac{\sqrt{5}}{16} & 0 & 0 & \frac{9\sqrt{6}}{560} & 0 & -\frac{3\sqrt{30}}{280} & 0 & -\frac{9\sqrt{2}}{80} & 0 & 0 \\
0 & -\frac{\sqrt{15}}{112} & 0 & \frac{\sqrt{30}}{112} & 0 & \frac{\sqrt{3}}{16} & -\frac{3\sqrt{14}}{80} & 0 & -\frac{3\sqrt{6}}{140} & 0 & \frac{3\sqrt{10}}{560} & 0 & -\frac{3\sqrt{2}}{40} & 0 \\
\frac{\sqrt{3}}{16} & 0 & \frac{\sqrt{30}}{112} & 0 & -\frac{\sqrt{15}}{112} & 0 & 0 & \frac{3\sqrt{2}}{40} & 0 & -\frac{3\sqrt{10}}{560} & 0 & \frac{3\sqrt{6}}{140} & 0 & \frac{3\sqrt{14}}{80} \\
0 & -\frac{\sqrt{5}}{16} & 0 & -\frac{\sqrt{10}}{112} & 0 & \frac{1}{112} & 0 & 0 & \frac{9\sqrt{2}}{80} & 0 & \frac{3\sqrt{30}}{280} & 0 & -\frac{9\sqrt{6}}{560} & 0 \\
0 & \frac{1}{28} & 0 & \frac{\sqrt{2}}{8} & 0 & 0 & \frac{\sqrt{210}}{560} & 0 & -\frac{\sqrt{10}}{56} & 0 & -\frac{\sqrt{6}}{16} & 0 & 0 & 0 \\
\frac{1}{28} & 0 & -\frac{\sqrt{10}}{56} & 0 & 0 & 0 & 0 & -\frac{13\sqrt{6}}{560} & 0 & \frac{\sqrt{30}}{280} & 0 & -\frac{7\sqrt{2}}{80} & 0 & 0 \\
0 & -\frac{\sqrt{10}}{56} & 0 & 0 & 0 & -\frac{\sqrt{2}}{8} & \frac{3\sqrt{21}}{80} & 0 & \frac{1}{560} & 0 & \frac{\sqrt{15}}{80} & 0 & \frac{\sqrt{3}}{80} & 0 \\
\frac{\sqrt{2}}{8} & 0 & 0 & 0 & \frac{\sqrt{10}}{56} & 0 & 0 & \frac{\sqrt{3}}{80} & 0 & \frac{\sqrt{15}}{80} & 0 & \frac{1}{560} & 0 & \frac{3\sqrt{21}}{80} \\
0 & 0 & 0 & \frac{\sqrt{10}}{56} & 0 & -\frac{1}{28} & 0 & 0 & -\frac{7\sqrt{2}}{80} & 0 & \frac{\sqrt{30}}{280} & 0 & -\frac{13\sqrt{6}}{560} & 0 \\
0 & 0 & -\frac{\sqrt{2}}{8} & 0 & -\frac{1}{28} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{16} & 0 & -\frac{\sqrt{10}}{56} & 0 & \frac{\sqrt{210}}{560}
\end{pmatrix}$$

| No. | | symmetry |
|---|---|---|
| 773 | | $-\frac{x^2}{2} - \frac{y^2}{2} + z^2$ |

$$\mathbb{M}_2^{(1,-1;a)}(A_{1u})$$

$$\begin{pmatrix}
0 & -\frac{3\sqrt{6}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{15}}{35} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{3}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{6\sqrt{3}}{35} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{3}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{6\sqrt{3}}{35} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{3\sqrt{6}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{15}}{35} & 0 & 0 \\
\frac{\sqrt{6}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{6}}{105} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{15}}{70} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{4\sqrt{6}}{105} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{2}}{70} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{4\sqrt{6}}{105} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{2}}{70} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{105} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{15}}{70} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3}{14} & 0
\end{pmatrix}$$

| No. | | symmetry |
|---|---|---|
| 774 | | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_2^{(1,-1;a)}(B_{1u})$

$$\begin{pmatrix}
0 & 0 & 0 & -\frac{3}{70} & 0 & 0 & -\frac{\sqrt{105}}{35} & 0 & 0 & 0 & -\frac{\sqrt{3}}{35} & 0 & 0 & 0 \\
\frac{\sqrt{30}}{70} & 0 & 0 & 0 & -\frac{\sqrt{6}}{35} & 0 & 0 & -\frac{3\sqrt{5}}{35} & 0 & 0 & 0 & -\frac{\sqrt{15}}{35} & 0 & 0 \\
0 & \frac{\sqrt{6}}{35} & 0 & 0 & 0 & -\frac{\sqrt{30}}{70} & 0 & 0 & -\frac{\sqrt{15}}{35} & 0 & 0 & 0 & -\frac{3\sqrt{5}}{35} & 0 \\
0 & 0 & \frac{3}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{35} & 0 & 0 & 0 & -\frac{\sqrt{105}}{35} \\
0 & 0 & \frac{\sqrt{5}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{70} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{3}{35} & 0 & 0 & -\frac{\sqrt{105}}{70} & 0 & 0 & 0 & \frac{2\sqrt{3}}{35} & 0 & 0 & 0 \\
\frac{\sqrt{5}}{35} & 0 & 0 & 0 & \frac{3}{35} & 0 & 0 & -\frac{\sqrt{30}}{35} & 0 & 0 & 0 & \frac{3\sqrt{10}}{70} & 0 & 0 \\
0 & \frac{3}{35} & 0 & 0 & 0 & \frac{\sqrt{5}}{35} & 0 & 0 & -\frac{3\sqrt{10}}{70} & 0 & 0 & 0 & \frac{\sqrt{30}}{35} & 0 \\
0 & 0 & \frac{3}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{3}}{35} & 0 & 0 & 0 & \frac{\sqrt{105}}{70} \\
0 & 0 & 0 & \frac{\sqrt{5}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{70} & 0 & 0 & 0 \\
\end{pmatrix}$$

| 775 | symmetry | $\sqrt{3}xy$ |

$\mathbb{M}_2^{(1,-1;a)}(B_{2u})$

$$\begin{pmatrix}
0 & 0 & 0 & \frac{3i}{70} & 0 & 0 & -\frac{\sqrt{105}i}{35} & 0 & 0 & 0 & \frac{\sqrt{3}i}{35} & 0 & 0 & 0 \\
\frac{\sqrt{30}i}{70} & 0 & 0 & 0 & \frac{\sqrt{6}i}{35} & 0 & 0 & -\frac{3\sqrt{5}i}{35} & 0 & 0 & 0 & \frac{\sqrt{15}i}{35} & 0 & 0 \\
0 & \frac{\sqrt{6}i}{35} & 0 & 0 & 0 & \frac{\sqrt{30}i}{70} & 0 & 0 & -\frac{\sqrt{15}i}{35} & 0 & 0 & 0 & \frac{3\sqrt{5}i}{35} & 0 \\
0 & 0 & \frac{3i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{35} & 0 & 0 & 0 & \frac{\sqrt{105}i}{35} \\
0 & 0 & -\frac{\sqrt{5}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{70} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{3i}{35} & 0 & 0 & -\frac{\sqrt{105}i}{70} & 0 & 0 & 0 & -\frac{2\sqrt{3}i}{35} & 0 & 0 & 0 \\
\frac{\sqrt{5}i}{35} & 0 & 0 & 0 & -\frac{3i}{35} & 0 & 0 & -\frac{\sqrt{30}i}{35} & 0 & 0 & 0 & -\frac{3\sqrt{10}i}{70} & 0 & 0 \\
0 & \frac{3i}{35} & 0 & 0 & 0 & -\frac{\sqrt{5}i}{35} & 0 & 0 & -\frac{3\sqrt{10}i}{70} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{35} & 0 \\
0 & 0 & \frac{3i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{3}i}{35} & 0 & 0 & 0 & -\frac{\sqrt{105}i}{70} \\
0 & 0 & 0 & \frac{\sqrt{5}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{70} & 0 & 0 & 0 \\
\end{pmatrix}$$

| 776 | symmetry | $\sqrt{3}yz$ |

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_{2,1}^{(1,-1;a)}(E_u)$:

$$\begin{bmatrix}
\frac{3\sqrt{10}i}{140} & 0 & \frac{9i}{140} & 0 & 0 & 0 & 0 & \frac{2\sqrt{15}i}{35} & 0 & \frac{2\sqrt{3}i}{35} & 0 & 0 & 0 \\
0 & -\frac{\sqrt{6}i}{140} & 0 & \frac{\sqrt{3}i}{28} & 0 & 0 & 0 & 0 & \frac{2\sqrt{15}i}{35} & 0 & \frac{6i}{35} & 0 & 0 \\
0 & 0 & -\frac{\sqrt{3}i}{28} & 0 & \frac{\sqrt{6}i}{140} & 0 & 0 & 0 & 0 & \frac{6i}{35} & 0 & \frac{2\sqrt{15}i}{35} & 0 \\
0 & 0 & 0 & -\frac{9i}{140} & 0 & -\frac{3\sqrt{10}i}{140} & 0 & 0 & 0 & 0 & \frac{2\sqrt{3}i}{35} & 0 & \frac{2\sqrt{15}i}{35} \\
0 & -\frac{\sqrt{10}i}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{28} & 0 & -\frac{3i}{28} & 0 & 0 & 0 & 0 \\
\frac{\sqrt{10}i}{35} & 0 & -\frac{2i}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{140} & 0 & -\frac{11\sqrt{3}i}{140} & 0 & 0 & 0 \\
0 & \frac{2i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{10}i}{140} & 0 & -\frac{\sqrt{6}i}{20} & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{2i}{35} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{20} & 0 & -\frac{3\sqrt{10}i}{140} & 0 \\
0 & 0 & 0 & -\frac{2i}{35} & 0 & \frac{\sqrt{10}i}{35} & 0 & 0 & 0 & 0 & \frac{11\sqrt{3}i}{140} & 0 & \frac{\sqrt{15}i}{140} \\
0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{35} & 0 & 0 & 0 & 0 & 0 & \frac{3i}{28} & 0 & \frac{\sqrt{21}i}{28}
\end{bmatrix}$$

| 777 | symmetry | $-\sqrt{3}xz$ |

$\mathbb{M}_{2,2}^{(1,-1;a)}(E_u)$:

$$\begin{bmatrix}
-\frac{3\sqrt{10}}{140} & 0 & \frac{9}{140} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{15}}{35} & 0 & \frac{2\sqrt{3}}{35} & 0 & 0 & 0 \\
0 & \frac{\sqrt{6}}{140} & 0 & \frac{\sqrt{3}}{28} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{15}}{35} & 0 & \frac{6}{35} & 0 & 0 \\
0 & 0 & \frac{\sqrt{3}}{28} & 0 & \frac{\sqrt{6}}{140} & 0 & 0 & 0 & 0 & -\frac{6}{35} & 0 & \frac{2\sqrt{15}}{35} & 0 \\
0 & 0 & 0 & \frac{9}{140} & 0 & -\frac{3\sqrt{10}}{140} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{3}}{35} & 0 & \frac{2\sqrt{15}}{35} \\
0 & -\frac{\sqrt{10}}{35} & 0 & 0 & 0 & 0 & \frac{\sqrt{21}}{28} & 0 & -\frac{3}{28} & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{10}}{35} & 0 & -\frac{2}{35} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{140} & 0 & -\frac{11\sqrt{3}}{140} & 0 & 0 & 0 \\
0 & -\frac{2}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}}{140} & 0 & -\frac{\sqrt{6}}{20} & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{2}{35} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{20} & 0 & -\frac{3\sqrt{10}}{140} & 0 \\
0 & 0 & 0 & \frac{2}{35} & 0 & \frac{\sqrt{10}}{35} & 0 & 0 & 0 & 0 & -\frac{11\sqrt{3}}{140} & 0 & \frac{\sqrt{15}}{140} \\
0 & 0 & 0 & 0 & \frac{\sqrt{10}}{35} & 0 & 0 & 0 & 0 & 0 & -\frac{3}{28} & 0 & \frac{\sqrt{21}}{28}
\end{bmatrix}$$

| 778 | symmetry | $\frac{\sqrt{21}\left(x^4-3x^2y^2-3x^2z^2+y^4-3y^2z^2+z^4\right)}{6}$ |

continued …

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_4^{(1,-1;a)}(A_{1u},1)$

$$\begin{bmatrix}
0 & \frac{\sqrt{7}}{168} & 0 & 0 & 0 & \frac{\sqrt{35}}{168} & 0 & 0 & \frac{\sqrt{70}}{56} & 0 & 0 & 0 & \frac{\sqrt{210}}{168} & 0 \\
0 & 0 & -\frac{\sqrt{42}}{168} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{14}}{168} & 0 & 0 & 0 & \frac{\sqrt{10}}{24} \\
0 & 0 & 0 & \frac{\sqrt{42}}{168} & 0 & 0 & \frac{\sqrt{10}}{24} & 0 & 0 & 0 & -\frac{5\sqrt{14}}{168} & 0 & 0 & 0 \\
-\frac{\sqrt{35}}{168} & 0 & 0 & 0 & -\frac{\sqrt{7}}{168} & 0 & 0 & \frac{\sqrt{210}}{168} & 0 & 0 & 0 & \frac{\sqrt{70}}{56} & 0 & 0 \\
-\frac{\sqrt{7}}{84} & 0 & 0 & 0 & -\frac{\sqrt{35}}{84} & 0 & 0 & -\frac{5\sqrt{42}}{168} & 0 & 0 & 0 & -\frac{5\sqrt{14}}{168} & 0 & 0 \\
0 & \frac{\sqrt{7}}{28} & 0 & 0 & 0 & -\frac{\sqrt{35}}{84} & 0 & 0 & \frac{\sqrt{70}}{42} & 0 & 0 & 0 & -\frac{\sqrt{210}}{84} & 0 \\
0 & 0 & -\frac{\sqrt{7}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{21}}{168} & 0 & 0 & 0 & -\frac{\sqrt{15}}{24} \\
0 & 0 & 0 & -\frac{\sqrt{7}}{42} & 0 & 0 & \frac{\sqrt{15}}{24} & 0 & 0 & 0 & -\frac{5\sqrt{21}}{168} & 0 & 0 & 0 \\
-\frac{\sqrt{35}}{84} & 0 & 0 & 0 & \frac{\sqrt{7}}{28} & 0 & 0 & \frac{\sqrt{210}}{168} & 0 & 0 & 0 & -\frac{\sqrt{70}}{42} & 0 & 0 \\
0 & -\frac{\sqrt{35}}{84} & 0 & 0 & 0 & -\frac{\sqrt{7}}{84} & 0 & 0 & \frac{5\sqrt{14}}{168} & 0 & 0 & 0 & \frac{5\sqrt{42}}{168} & 0
\end{bmatrix}$$

779   symmetry

$$-\frac{\sqrt{15}\left(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4\right)}{12}$$

$\mathbb{M}_4^{(1,-1;a)}(A_{1u},2)$

$$\begin{bmatrix}
0 & \frac{\sqrt{5}}{168} & 0 & 0 & 0 & -\frac{1}{24} & 0 & 0 & \frac{5\sqrt{2}}{56} & 0 & 0 & 0 & -\frac{\sqrt{6}}{24} & 0 \\
0 & 0 & -\frac{\sqrt{30}}{168} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{10}}{168} & 0 & 0 & 0 & -\frac{\sqrt{14}}{24} \\
0 & 0 & 0 & \frac{\sqrt{30}}{168} & 0 & 0 & -\frac{\sqrt{14}}{24} & 0 & 0 & 0 & -\frac{5\sqrt{10}}{168} & 0 & 0 & 0 \\
\frac{1}{24} & 0 & 0 & 0 & -\frac{\sqrt{5}}{168} & 0 & 0 & -\frac{\sqrt{6}}{24} & 0 & 0 & 0 & \frac{5\sqrt{2}}{56} & 0 & 0 \\
-\frac{\sqrt{5}}{84} & 0 & 0 & 0 & \frac{1}{12} & 0 & 0 & -\frac{5\sqrt{30}}{168} & 0 & 0 & 0 & \frac{\sqrt{10}}{24} & 0 & 0 \\
0 & \frac{\sqrt{5}}{28} & 0 & 0 & 0 & \frac{1}{12} & 0 & 0 & \frac{5\sqrt{2}}{42} & 0 & 0 & 0 & \frac{\sqrt{6}}{12} & 0 \\
0 & 0 & -\frac{\sqrt{5}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{15}}{168} & 0 & 0 & 0 & \frac{\sqrt{21}}{24} \\
0 & 0 & 0 & -\frac{\sqrt{5}}{42} & 0 & 0 & -\frac{\sqrt{21}}{24} & 0 & 0 & 0 & -\frac{5\sqrt{15}}{168} & 0 & 0 & 0 \\
\frac{1}{12} & 0 & 0 & 0 & \frac{\sqrt{5}}{28} & 0 & 0 & -\frac{\sqrt{6}}{12} & 0 & 0 & 0 & -\frac{5\sqrt{2}}{42} & 0 & 0 \\
0 & \frac{1}{12} & 0 & 0 & 0 & -\frac{\sqrt{5}}{84} & 0 & 0 & -\frac{\sqrt{10}}{24} & 0 & 0 & 0 & \frac{5\sqrt{30}}{168} & 0
\end{bmatrix}$$

780   symmetry

$$\frac{\sqrt{35}\,xy(x-y)(x+y)}{2}$$

Table 9

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_4^{(1,-1;a)}(A_{2u}) = \begin{bmatrix}
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}i}{28} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{12} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{21}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{21}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{84} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}i}{14} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{i}{4} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{i}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{21}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{21}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{84} & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

| 781 | symmetry | $\dfrac{\sqrt{5}(x-y)(x+y)\left(x^2+y^2-6z^2\right)}{4}$ |
|---|---|---|

$$\mathbb{M}_4^{(1,-1;a)}(B_{1u}) = \begin{bmatrix}
0 & 0 & 0 & -\frac{\sqrt{30}}{168} & 0 & 0 & -\frac{\sqrt{14}}{56} & 0 & 0 & 0 & -\frac{3\sqrt{10}}{56} & 0 & 0 & 0 \\
\frac{1}{56} & 0 & 0 & 0 & \frac{\sqrt{5}}{56} & 0 & 0 & \frac{11\sqrt{6}}{168} & 0 & 0 & 0 & -\frac{\sqrt{2}}{56} & 0 & 0 \\
0 & -\frac{\sqrt{5}}{56} & 0 & 0 & 0 & -\frac{1}{56} & 0 & 0 & -\frac{\sqrt{2}}{56} & 0 & 0 & 0 & \frac{11\sqrt{6}}{168} & 0 \\
0 & 0 & \frac{\sqrt{30}}{168} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}}{56} & 0 & 0 & 0 & -\frac{\sqrt{14}}{56} \\
0 & 0 & \frac{\sqrt{6}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{2}}{28} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{30}}{84} & 0 & 0 & -\frac{3\sqrt{14}}{56} & 0 & 0 & 0 & \frac{\sqrt{10}}{56} & 0 & 0 & 0 \\
\frac{\sqrt{6}}{28} & 0 & 0 & 0 & -\frac{\sqrt{30}}{84} & 0 & 0 & \frac{9}{56} & 0 & 0 & 0 & -\frac{17\sqrt{3}}{168} & 0 & 0 \\
0 & -\frac{\sqrt{30}}{84} & 0 & 0 & 0 & \frac{\sqrt{6}}{28} & 0 & 0 & \frac{17\sqrt{3}}{168} & 0 & 0 & 0 & -\frac{9}{56} & 0 \\
0 & 0 & -\frac{\sqrt{30}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{56} & 0 & 0 & 0 & \frac{3\sqrt{14}}{56} \\
0 & 0 & 0 & \frac{\sqrt{6}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{2}}{28} & 0 & 0 & 0
\end{bmatrix}$$

| 782 | symmetry | $-\dfrac{\sqrt{5}xy\left(x^2+y^2-6z^2\right)}{2}$ |
|---|---|---|

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|
|  | $\mathbb{M}_4^{(1,-1;a)}(B_{2u})$ | $\begin{bmatrix} 0 & 0 & 0 & -\frac{\sqrt{30}i}{168} & 0 & 0 & \frac{\sqrt{14}i}{56} & 0 & 0 & 0 & -\frac{3\sqrt{10}i}{56} & 0 & 0 & 0 \\ -\frac{i}{56} & 0 & 0 & 0 & \frac{\sqrt{5}i}{56} & 0 & 0 & -\frac{11\sqrt{6}i}{168} & 0 & 0 & 0 & -\frac{\sqrt{2}i}{56} & 0 & 0 \\ 0 & \frac{\sqrt{5}i}{56} & 0 & 0 & 0 & -\frac{i}{56} & 0 & 0 & \frac{\sqrt{2}i}{56} & 0 & 0 & 0 & \frac{11\sqrt{6}i}{168} & 0 \\ 0 & 0 & -\frac{\sqrt{30}i}{168} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{10}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{14}i}{56} \\ 0 & 0 & \frac{\sqrt{6}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{2}i}{28} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{30}i}{84} & 0 & 0 & \frac{3\sqrt{14}i}{56} & 0 & 0 & 0 & \frac{\sqrt{10}i}{56} & 0 & 0 & 0 \\ -\frac{\sqrt{6}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{84} & 0 & 0 & -\frac{9i}{56} & 0 & 0 & 0 & -\frac{17\sqrt{3}i}{168} & 0 & 0 \\ 0 & \frac{\sqrt{30}i}{84} & 0 & 0 & 0 & \frac{\sqrt{6}i}{28} & 0 & 0 & -\frac{17\sqrt{3}i}{168} & 0 & 0 & 0 & -\frac{9i}{56} & 0 \\ 0 & 0 & \frac{\sqrt{30}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{56} & 0 & 0 & 0 & \frac{3\sqrt{14}i}{56} \\ 0 & 0 & 0 & -\frac{\sqrt{6}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{2}i}{28} & 0 & 0 & 0 \end{bmatrix}$ |
| 783 | symmetry | $\frac{\sqrt{35}yz(y-z)(y+z)}{2}$ |
|  | $\mathbb{M}_{4,1}^{(1,-1;a)}(E_u,1)$ | $\begin{bmatrix} \frac{\sqrt{21}i}{672} & 0 & \frac{\sqrt{210}i}{672} & 0 & \frac{\sqrt{105}i}{672} & 0 & 0 & \frac{3\sqrt{14}i}{112} & 0 & \frac{\sqrt{70}i}{56} & 0 & \frac{\sqrt{42}i}{112} & 0 & 0 \\ 0 & -\frac{\sqrt{35}i}{224} & 0 & -\frac{\sqrt{70}i}{224} & 0 & -\frac{\sqrt{7}i}{224} & -\frac{\sqrt{6}i}{48} & 0 & -\frac{\sqrt{14}i}{28} & 0 & -\frac{\sqrt{210}i}{336} & 0 & \frac{\sqrt{42}i}{168} & 0 \\ \frac{\sqrt{7}i}{224} & 0 & \frac{\sqrt{70}i}{224} & 0 & \frac{\sqrt{35}i}{224} & 0 & 0 & \frac{\sqrt{42}i}{168} & 0 & -\frac{\sqrt{210}i}{336} & 0 & -\frac{\sqrt{14}i}{28} & 0 & -\frac{\sqrt{6}i}{48} \\ 0 & -\frac{\sqrt{105}i}{672} & 0 & -\frac{\sqrt{210}i}{672} & 0 & -\frac{\sqrt{21}i}{672} & 0 & 0 & \frac{\sqrt{42}i}{112} & 0 & \frac{\sqrt{70}i}{56} & 0 & \frac{3\sqrt{14}i}{112} & 0 \\ 0 & -\frac{\sqrt{21}i}{84} & 0 & -\frac{\sqrt{42}i}{168} & 0 & 0 & -\frac{\sqrt{10}i}{32} & 0 & -\frac{5\sqrt{210}i}{336} & 0 & -\frac{5\sqrt{14}i}{224} & 0 & 0 & 0 \\ \frac{\sqrt{21}i}{84} & 0 & \frac{\sqrt{210}i}{168} & 0 & 0 & 0 & 0 & \frac{13\sqrt{14}i}{224} & 0 & \frac{\sqrt{70}i}{112} & 0 & -\frac{\sqrt{42}i}{96} & 0 & 0 \\ 0 & -\frac{\sqrt{210}i}{168} & 0 & 0 & 0 & \frac{\sqrt{42}i}{168} & -\frac{3i}{32} & 0 & -\frac{\sqrt{21}i}{672} & 0 & \frac{\sqrt{35}i}{32} & 0 & \frac{\sqrt{7}i}{224} & 0 \\ \frac{\sqrt{42}i}{168} & 0 & 0 & 0 & -\frac{\sqrt{210}i}{168} & 0 & 0 & -\frac{\sqrt{7}i}{224} & 0 & -\frac{\sqrt{35}i}{32} & 0 & \frac{\sqrt{21}i}{672} & 0 & \frac{3i}{32} \\ 0 & 0 & 0 & \frac{\sqrt{210}i}{168} & 0 & \frac{\sqrt{21}i}{84} & 0 & 0 & \frac{\sqrt{42}i}{96} & 0 & -\frac{\sqrt{70}i}{112} & 0 & -\frac{13\sqrt{14}i}{224} & 0 \\ 0 & 0 & -\frac{\sqrt{42}i}{168} & 0 & -\frac{\sqrt{21}i}{84} & 0 & 0 & 0 & 0 & \frac{5\sqrt{14}i}{224} & 0 & \frac{5\sqrt{210}i}{336} & 0 & \frac{\sqrt{10}i}{32} \end{bmatrix}$ |
| 784 | symmetry | $-\frac{\sqrt{35}xz(x-z)(x+z)}{2}$ |

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_{4,2}^{(1,-1;a)}(E_u,1)$

$$\begin{pmatrix}
-\frac{\sqrt{21}}{672} & 0 & \frac{\sqrt{210}}{672} & 0 & -\frac{\sqrt{105}}{672} & 0 & 0 & -\frac{3\sqrt{14}}{112} & 0 & \frac{\sqrt{70}}{56} & 0 & -\frac{\sqrt{42}}{112} & 0 & 0 \\
0 & \frac{\sqrt{35}}{224} & 0 & -\frac{\sqrt{70}}{224} & 0 & \frac{\sqrt{7}}{224} & -\frac{\sqrt{6}}{48} & 0 & \frac{\sqrt{14}}{28} & 0 & -\frac{\sqrt{210}}{336} & 0 & -\frac{\sqrt{42}}{168} & 0 \\
\frac{\sqrt{7}}{224} & 0 & -\frac{\sqrt{70}}{224} & 0 & \frac{\sqrt{35}}{224} & 0 & 0 & \frac{\sqrt{42}}{168} & 0 & \frac{\sqrt{210}}{336} & 0 & -\frac{\sqrt{14}}{28} & 0 & \frac{\sqrt{6}}{48} \\
0 & -\frac{\sqrt{105}}{672} & 0 & \frac{\sqrt{210}}{672} & 0 & -\frac{\sqrt{21}}{672} & 0 & 0 & \frac{\sqrt{42}}{112} & 0 & -\frac{\sqrt{70}}{56} & 0 & \frac{3\sqrt{14}}{112} & 0 \\
0 & -\frac{\sqrt{21}}{84} & 0 & \frac{\sqrt{42}}{168} & 0 & 0 & \frac{\sqrt{10}}{32} & 0 & -\frac{5\sqrt{210}}{336} & 0 & \frac{5\sqrt{14}}{224} & 0 & 0 & 0 \\
-\frac{\sqrt{21}}{84} & 0 & \frac{\sqrt{210}}{168} & 0 & 0 & 0 & 0 & -\frac{13\sqrt{14}}{224} & 0 & \frac{\sqrt{70}}{112} & 0 & \frac{\sqrt{42}}{96} & 0 & 0 \\
0 & \frac{\sqrt{210}}{168} & 0 & 0 & 0 & -\frac{\sqrt{42}}{168} & -\frac{3}{32} & 0 & \frac{\sqrt{21}}{672} & 0 & \frac{\sqrt{35}}{32} & 0 & -\frac{\sqrt{7}}{224} & 0 \\
\frac{\sqrt{42}}{168} & 0 & 0 & 0 & -\frac{\sqrt{210}}{168} & 0 & 0 & -\frac{\sqrt{7}}{224} & 0 & \frac{\sqrt{35}}{32} & 0 & \frac{\sqrt{21}}{672} & 0 & -\frac{3}{32} \\
0 & 0 & 0 & -\frac{\sqrt{210}}{168} & 0 & \frac{\sqrt{21}}{84} & 0 & 0 & \frac{\sqrt{42}}{96} & 0 & \frac{\sqrt{70}}{112} & 0 & -\frac{13\sqrt{14}}{224} & 0 \\
0 & 0 & -\frac{\sqrt{42}}{168} & 0 & \frac{\sqrt{21}}{84} & 0 & 0 & 0 & 0 & \frac{5\sqrt{14}}{224} & 0 & -\frac{5\sqrt{210}}{336} & 0 & \frac{\sqrt{10}}{32}
\end{pmatrix}$$

| 785 | symmetry | $\dfrac{\sqrt{5}yz(6x^2-y^2-z^2)}{2}$ |
|---|---|---|

$\mathbb{M}_{4,1}^{(1,-1;a)}(E_u,2)$

$$\begin{pmatrix}
\frac{\sqrt{3}i}{672} & 0 & \frac{\sqrt{30}i}{672} & 0 & -\frac{\sqrt{15}i}{96} & 0 & 0 & \frac{3\sqrt{2}i}{112} & 0 & \frac{\sqrt{10}i}{56} & 0 & -\frac{\sqrt{6}i}{16} & 0 & 0 \\
0 & -\frac{\sqrt{5}i}{224} & 0 & -\frac{\sqrt{10}i}{224} & 0 & \frac{i}{32} & \frac{\sqrt{42}i}{48} & 0 & -\frac{\sqrt{2}i}{28} & 0 & -\frac{\sqrt{30}i}{336} & 0 & -\frac{\sqrt{6}i}{24} & 0 \\
-\frac{i}{32} & 0 & \frac{\sqrt{10}i}{224} & 0 & \frac{\sqrt{5}i}{224} & 0 & 0 & -\frac{\sqrt{6}i}{24} & 0 & -\frac{\sqrt{30}i}{336} & 0 & -\frac{\sqrt{2}i}{28} & 0 & \frac{\sqrt{42}i}{48} \\
0 & \frac{\sqrt{15}i}{96} & 0 & -\frac{\sqrt{30}i}{672} & 0 & -\frac{\sqrt{3}i}{672} & 0 & 0 & -\frac{\sqrt{6}i}{16} & 0 & \frac{\sqrt{10}i}{56} & 0 & \frac{3\sqrt{2}i}{112} & 0 \\
0 & -\frac{\sqrt{3}i}{84} & 0 & \frac{\sqrt{6}i}{24} & 0 & 0 & -\frac{\sqrt{70}i}{224} & 0 & -\frac{5\sqrt{30}i}{336} & 0 & \frac{5\sqrt{2}i}{32} & 0 & 0 & 0 \\
\frac{\sqrt{3}i}{84} & 0 & \frac{\sqrt{30}i}{168} & 0 & 0 & 0 & 0 & \frac{13\sqrt{2}i}{224} & 0 & \frac{\sqrt{10}i}{112} & 0 & \frac{7\sqrt{6}i}{96} & 0 & 0 \\
0 & -\frac{\sqrt{30}i}{168} & 0 & 0 & 0 & -\frac{\sqrt{6}i}{24} & \frac{3\sqrt{7}i}{32} & 0 & -\frac{\sqrt{3}i}{672} & 0 & \frac{\sqrt{5}i}{32} & 0 & -\frac{i}{32} & 0 \\
-\frac{\sqrt{6}i}{24} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{168} & 0 & 0 & \frac{i}{32} & 0 & -\frac{\sqrt{5}i}{32} & 0 & \frac{\sqrt{3}i}{672} & 0 & -\frac{3\sqrt{7}i}{32} \\
0 & 0 & 0 & \frac{\sqrt{30}i}{168} & 0 & \frac{\sqrt{3}i}{84} & 0 & 0 & -\frac{7\sqrt{6}i}{96} & 0 & -\frac{\sqrt{10}i}{112} & 0 & -\frac{13\sqrt{2}i}{224} & 0 \\
0 & 0 & \frac{\sqrt{6}i}{24} & 0 & -\frac{\sqrt{3}i}{84} & 0 & 0 & 0 & 0 & -\frac{5\sqrt{2}i}{32} & 0 & \frac{5\sqrt{30}i}{336} & 0 & \frac{\sqrt{70}i}{224}
\end{pmatrix}$$

| 786 | symmetry | $\dfrac{\sqrt{5}xz(x^2-6y^2+z^2)}{2}$ |
|---|---|---|

*continued ...*

**Table 9**

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_{4,2}^{(1,-1;a)}(E_u, 2)$

$$
\begin{bmatrix}
-\frac{\sqrt3}{672} & 0 & \frac{\sqrt{30}}{672} & 0 & \frac{\sqrt{15}}{96} & 0 & 0 & -\frac{3\sqrt2}{112} & 0 & \frac{\sqrt{10}}{56} & 0 & \frac{\sqrt6}{16} & 0 & 0 \\
0 & \frac{\sqrt5}{224} & 0 & -\frac{\sqrt{10}}{224} & 0 & -\frac{1}{32} & \frac{\sqrt{42}}{48} & 0 & \frac{\sqrt2}{28} & 0 & -\frac{\sqrt{30}}{336} & 0 & \frac{\sqrt6}{24} & 0 \\
-\frac{1}{32} & 0 & -\frac{\sqrt{10}}{224} & 0 & \frac{\sqrt5}{224} & 0 & 0 & -\frac{\sqrt6}{24} & 0 & \frac{\sqrt{30}}{336} & 0 & -\frac{\sqrt2}{28} & 0 & -\frac{\sqrt{42}}{48} \\
0 & \frac{\sqrt{15}}{96} & 0 & \frac{\sqrt{30}}{672} & 0 & -\frac{\sqrt3}{672} & 0 & 0 & -\frac{\sqrt6}{16} & 0 & -\frac{\sqrt{10}}{56} & 0 & \frac{3\sqrt2}{112} & 0 \\
0 & -\frac{\sqrt3}{84} & 0 & -\frac{\sqrt6}{24} & 0 & 0 & \frac{\sqrt{70}}{224} & 0 & -\frac{5\sqrt{30}}{336} & 0 & -\frac{5\sqrt2}{32} & 0 & 0 & 0 \\
-\frac{\sqrt3}{84} & 0 & \frac{\sqrt{30}}{168} & 0 & 0 & 0 & 0 & -\frac{13\sqrt2}{224} & 0 & \frac{\sqrt{10}}{112} & 0 & -\frac{7\sqrt6}{96} & 0 & 0 \\
0 & \frac{\sqrt{30}}{168} & 0 & 0 & 0 & \frac{\sqrt6}{24} & \frac{3\sqrt7}{32} & 0 & \frac{\sqrt3}{672} & 0 & \frac{\sqrt5}{32} & 0 & \frac{1}{32} & 0 \\
-\frac{\sqrt6}{24} & 0 & 0 & 0 & -\frac{\sqrt{30}}{168} & 0 & 0 & \frac{1}{32} & 0 & \frac{\sqrt5}{32} & 0 & \frac{\sqrt3}{672} & 0 & \frac{3\sqrt7}{32} \\
0 & 0 & 0 & -\frac{\sqrt{30}}{168} & 0 & \frac{\sqrt3}{84} & 0 & 0 & -\frac{7\sqrt6}{96} & 0 & \frac{\sqrt{10}}{112} & 0 & -\frac{13\sqrt2}{224} & 0 \\
0 & 0 & \frac{\sqrt6}{24} & 0 & \frac{\sqrt3}{84} & 0 & 0 & 0 & 0 & -\frac{5\sqrt2}{32} & 0 & -\frac{5\sqrt{30}}{336} & 0 & \frac{\sqrt{70}}{224}
\end{bmatrix}
$$

| 787 | symmetry | $\dfrac{\sqrt2\left(2x^6-15x^4y^2-15x^4z^2-15x^2y^4+180x^2y^2z^2-15x^2z^4+2y^6-15y^4z^2-15y^2z^4+2z^6\right)}{8}$ |

$\mathbb{M}_6^{(1,-1;a)}(A_{1u}, 1)$

$$
\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{33}}{264} & 0 & 0 & 0 & -\frac{7\sqrt{11}}{88} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{55}}{88} & 0 & 0 & 0 & \frac{7\sqrt{165}}{264} \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{66}}{264} & 0 & 0 & -\frac{\sqrt{2310}}{264} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2310}}{264} & 0 & 0 & 0 & -\frac{5\sqrt{66}}{264} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{7\sqrt{165}}{264} & 0 & 0 & 0 & \frac{\sqrt{55}}{88} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{7\sqrt{11}}{88} & 0 & 0 & 0 & -\frac{\sqrt{33}}{264}
\end{bmatrix}
$$

| 788 | symmetry | $-\dfrac{\sqrt{14}\left(x^6-15x^4z^2+15x^2z^4+y^6-15y^4z^2+15y^2z^4-2z^6\right)}{8}$ |

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_6^{(1,-1;a)}(A_{1u},2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{231}}{264} & 0 & 0 & 0 & \frac{\sqrt{77}}{88} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{385}}{88} & 0 & 0 & 0 & -\frac{\sqrt{1155}}{264} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{462}}{264} & 0 & 0 & 0 & \frac{\sqrt{330}}{264} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{330}}{264} & 0 & 0 & 0 & -\frac{5\sqrt{462}}{264} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{1155}}{264} & 0 & 0 & 0 & \frac{\sqrt{385}}{88} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{77}}{88} & 0 & 0 & 0 & -\frac{\sqrt{231}}{264} & 0
\end{bmatrix}$$

789    symmetry    $-\dfrac{3\sqrt{7}xy(x-y)(x+y)\left(x^2+y^2-10z^2\right)}{4}$

$\mathbb{M}_6^{(1,-1;a)}(A_{2u})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{154}i}{44} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2310}i}{132} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{165}i}{66} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{165}i}{66} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2310}i}{132} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{154}i}{44} & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

790    symmetry    $-\dfrac{\sqrt{2310}(x-y)(x+y)(x-z)(x+z)(y-z)(y+z)}{8}$

*continued ...*

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Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_6^{(1,-1;a)}(B_{1u},1)$

$$\begin{pmatrix}
0&0&0&0&0&0&0&0&0&0&0&0&0&0\\
0&0&0&0&0&0&0&0&0&0&0&0&0&0\\
0&0&0&0&0&0&0&0&0&0&0&0&0&0\\
0&0&0&0&0&0&0&0&0&0&0&0&0&0\\
0&0&0&0&0&0&0&0&0&-\frac{\sqrt{7}}{24}&0&0&0&\frac{\sqrt{5}}{8}\\
0&0&0&0&0&0&\frac{1}{24}&0&0&0&\frac{\sqrt{35}}{24}&0&0&0\\
0&0&0&0&0&0&0&-\frac{\sqrt{14}}{24}&0&0&0&-\frac{\sqrt{42}}{24}&0&0\\
0&0&0&0&0&0&0&0&\frac{\sqrt{42}}{24}&0&0&0&\frac{\sqrt{14}}{24}&0\\
0&0&0&0&0&0&0&0&0&-\frac{\sqrt{35}}{24}&0&0&0&-\frac{1}{24}\\
0&0&0&0&0&0&-\frac{\sqrt{5}}{8}&0&0&0&\frac{\sqrt{7}}{24}&0&0&0
\end{pmatrix}$$

**791**  symmetry

$$\frac{\sqrt{42}(x-y)(x+y)\left(x^4-9x^2y^2-5x^2z^2+y^4-5y^2z^2+5z^4\right)}{8}$$

$\mathbb{M}_6^{(1,-1;a)}(B_{1u},2)$

$$\begin{pmatrix}
0&0&0&0&0&0&0&0&0&0&0&0&0&0\\
0&0&0&0&0&0&0&0&0&0&0&0&0&0\\
0&0&0&0&0&0&0&0&0&0&0&0&0&0\\
0&0&0&0&0&0&0&0&0&0&0&0&0&0\\
0&0&0&0&0&0&0&0&0&\frac{\sqrt{385}}{264}&0&0&0&\frac{\sqrt{11}}{8}\\
0&0&0&0&0&0&-\frac{\sqrt{55}}{264}&0&0&0&-\frac{5\sqrt{77}}{264}&0&0&0\\
0&0&0&0&0&0&0&\frac{\sqrt{770}}{264}&0&0&0&\frac{\sqrt{2310}}{264}&0&0\\
0&0&0&0&0&0&0&0&-\frac{\sqrt{2310}}{264}&0&0&0&-\frac{\sqrt{770}}{264}&0\\
0&0&0&0&0&0&0&0&0&\frac{5\sqrt{77}}{264}&0&0&0&\frac{\sqrt{55}}{264}\\
0&0&0&0&0&0&-\frac{\sqrt{11}}{8}&0&0&0&-\frac{\sqrt{385}}{264}&0&0&0
\end{pmatrix}$$

**792**  symmetry

$$\frac{\sqrt{462}xy\left(x^2-3y^2\right)\left(3x^2-y^2\right)}{16}$$

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_6^{(1,-1;a)}(B_{2u}, 1)$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{i}{2} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{i}{2} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

| 793 | symmetry | $\dfrac{\sqrt{210}\,xy\left(x^4+2x^2y^2-16x^2z^2+y^4-16y^2z^2+16z^4\right)}{16}$ |

$\mathbb{M}_6^{(1,-1;a)}(B_{2u}, 2)$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{77}i}{66} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{11}i}{66} & 0 & 0 & 0 & \frac{\sqrt{385}i}{66} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{154}i}{66} & 0 & 0 & 0 & -\frac{\sqrt{462}i}{66} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{462}i}{66} & 0 & 0 & 0 & \frac{\sqrt{154}i}{66} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{385}i}{66} & 0 & 0 & 0 & -\frac{\sqrt{11}i}{66} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{77}i}{66} & 0 & 0 & 0 \end{bmatrix}$$

| 794 | symmetry | $\dfrac{3\sqrt{7}\,yz(y-z)(y+z)\left(10x^2-y^2-z^2\right)}{4}$ |

*continued ...*

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Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_{6,1}^{(1,-1;a)}(E_u,1)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{66}i}{1056} & 0 & -\frac{\sqrt{154}i}{352} & 0 & \frac{\sqrt{2310}i}{352} & 0 & \frac{\sqrt{462}i}{96} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2310}i}{1056} & 0 & \frac{5\sqrt{462}i}{1056} & 0 & -\frac{3\sqrt{770}i}{352} & 0 & -\frac{\sqrt{330}i}{96} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{165}i}{176} & 0 & -\frac{\sqrt{385}i}{176} & 0 & -\frac{5\sqrt{231}i}{528} & 0 & \frac{\sqrt{1155}i}{176} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{1155}i}{176} & 0 & \frac{5\sqrt{231}i}{528} & 0 & \frac{\sqrt{385}i}{176} & 0 & -\frac{\sqrt{165}i}{176} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{330}i}{96} & 0 & \frac{3\sqrt{770}i}{352} & 0 & -\frac{5\sqrt{462}i}{1056} & 0 & -\frac{\sqrt{2310}i}{1056} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{462}i}{96} & 0 & -\frac{\sqrt{2310}i}{352} & 0 & \frac{\sqrt{154}i}{352} & 0 & \frac{\sqrt{66}i}{1056}
\end{pmatrix}$$

| 795 | symmetry | $\dfrac{3\sqrt{7}xz(x-z)(x+z)\left(x^2-10y^2+z^2\right)}{4}$ |
|---|---|---|

$\mathbb{M}_{6,2}^{(1,-1;a)}(E_u,1)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{66}}{1056} & 0 & -\frac{\sqrt{154}}{352} & 0 & -\frac{\sqrt{2310}}{352} & 0 & \frac{\sqrt{462}}{96} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2310}}{1056} & 0 & \frac{5\sqrt{462}}{1056} & 0 & \frac{3\sqrt{770}}{352} & 0 & -\frac{\sqrt{330}}{96} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{165}}{176} & 0 & \frac{\sqrt{385}}{176} & 0 & -\frac{5\sqrt{231}}{528} & 0 & -\frac{\sqrt{1155}}{176} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{1155}}{176} & 0 & -\frac{5\sqrt{231}}{528} & 0 & \frac{\sqrt{385}}{176} & 0 & \frac{\sqrt{165}}{176} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{330}}{96} & 0 & \frac{3\sqrt{770}}{352} & 0 & \frac{5\sqrt{462}}{1056} & 0 & -\frac{\sqrt{2310}}{1056} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{462}}{96} & 0 & -\frac{\sqrt{2310}}{352} & 0 & -\frac{\sqrt{154}}{352} & 0 & \frac{\sqrt{66}}{1056}
\end{bmatrix}$$

| 796 | symmetry | $\dfrac{\sqrt{462}yz\left(y^2-3z^2\right)\left(3y^2-z^2\right)}{16}$ |
|---|---|---|

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_{6,1}^{(1,-1;a)}(E_u,2)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{i}{64} & 0 & -\frac{\sqrt{21}i}{64} & 0 & -\frac{\sqrt{35}i}{64} & 0 & -\frac{\sqrt{7}i}{64} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{35}i}{64} & 0 & \frac{5\sqrt{7}i}{64} & 0 & \frac{\sqrt{105}i}{64} & 0 & \frac{\sqrt{5}i}{64} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{64} & 0 & -\frac{\sqrt{210}i}{64} & 0 & -\frac{5\sqrt{14}i}{64} & 0 & -\frac{\sqrt{70}i}{64} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{64} & 0 & \frac{5\sqrt{14}i}{64} & 0 & \frac{\sqrt{210}i}{64} & 0 & \frac{\sqrt{10}i}{64} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}i}{64} & 0 & -\frac{\sqrt{105}i}{64} & 0 & -\frac{5\sqrt{7}i}{64} & 0 & -\frac{\sqrt{35}i}{64} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{64} & 0 & \frac{\sqrt{35}i}{64} & 0 & \frac{\sqrt{21}i}{64} & 0 & \frac{i}{64}
\end{pmatrix}$$

| 797 | symmetry | $-\dfrac{\sqrt{462}xz\left(x^2-3z^2\right)\left(3x^2-z^2\right)}{16}$ |
|---|---|---|

$\mathbb{M}_{6,2}^{(1,-1;a)}(E_u,2)$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{64} & 0 & -\frac{\sqrt{21}}{64} & 0 & \frac{\sqrt{35}}{64} & 0 & -\frac{\sqrt{7}}{64} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{35}}{64} & 0 & \frac{5\sqrt{7}}{64} & 0 & -\frac{\sqrt{105}}{64} & 0 & \frac{\sqrt{5}}{64} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{64} & 0 & \frac{\sqrt{210}}{64} & 0 & -\frac{5\sqrt{14}}{64} & 0 & \frac{\sqrt{70}}{64} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{64} & 0 & -\frac{5\sqrt{14}}{64} & 0 & \frac{\sqrt{210}}{64} & 0 & -\frac{\sqrt{10}}{64} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{64} & 0 & -\frac{\sqrt{105}}{64} & 0 & \frac{5\sqrt{7}}{64} & 0 & -\frac{\sqrt{35}}{64} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{64} & 0 & \frac{\sqrt{35}}{64} & 0 & -\frac{\sqrt{21}}{64} & 0 & \frac{1}{64}
\end{bmatrix}$$

| 798 | symmetry | $\dfrac{\sqrt{210}yz\left(16x^4-16x^2y^2-16x^2z^2+y^4+2y^2z^2+z^4\right)}{16}$ |
|---|---|---|

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_{6,1}^{(1,-1;a)}(E_u,3)$

$$
\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{55}\,i}{2112} & 0 & -\frac{\sqrt{1155}\,i}{2112} & 0 & \frac{9\sqrt{77}\,i}{704} & 0 & -\frac{\sqrt{385}\,i}{64} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{77}\,i}{2112} & 0 & \frac{5\sqrt{385}\,i}{2112} & 0 & -\frac{9\sqrt{231}\,i}{704} & 0 & \frac{5\sqrt{11}\,i}{64} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{9\sqrt{22}\,i}{704} & 0 & -\frac{5\sqrt{462}\,i}{2112} & 0 & -\frac{5\sqrt{770}\,i}{2112} & 0 & \frac{9\sqrt{154}\,i}{704} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{9\sqrt{154}\,i}{704} & 0 & \frac{5\sqrt{770}\,i}{2112} & 0 & \frac{5\sqrt{462}\,i}{2112} & 0 & -\frac{9\sqrt{22}\,i}{704} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{11}\,i}{64} & 0 & \frac{9\sqrt{231}\,i}{704} & 0 & -\frac{5\sqrt{385}\,i}{2112} & 0 & -\frac{5\sqrt{77}\,i}{2112} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{385}\,i}{64} & 0 & -\frac{9\sqrt{77}\,i}{704} & 0 & \frac{\sqrt{1155}\,i}{2112} & 0 & \frac{\sqrt{55}\,i}{2112}
\end{bmatrix}
$$

| 799 | symmetry | $-\dfrac{\sqrt{210}\,xz\left(x^4 - 16x^2y^2 + 2x^2z^2 + 16y^4 - 16y^2z^2 + z^4\right)}{16}$ |

$\mathbb{M}_{6,2}^{(1,-1;a)}(E_u,3)$

$$
\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{55}}{2112} & 0 & -\frac{\sqrt{1155}}{2112} & 0 & -\frac{9\sqrt{77}}{704} & 0 & -\frac{\sqrt{385}}{64} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{77}}{2112} & 0 & \frac{5\sqrt{385}}{2112} & 0 & \frac{9\sqrt{231}}{704} & 0 & \frac{5\sqrt{11}}{64} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{9\sqrt{22}}{704} & 0 & \frac{5\sqrt{462}}{2112} & 0 & -\frac{5\sqrt{770}}{2112} & 0 & -\frac{9\sqrt{154}}{704} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{9\sqrt{154}}{704} & 0 & -\frac{5\sqrt{770}}{2112} & 0 & \frac{5\sqrt{462}}{2112} & 0 & \frac{9\sqrt{22}}{704} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{11}}{64} & 0 & \frac{9\sqrt{231}}{704} & 0 & \frac{5\sqrt{385}}{2112} & 0 & -\frac{5\sqrt{77}}{2112} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{385}}{64} & 0 & -\frac{9\sqrt{77}}{704} & 0 & -\frac{\sqrt{1155}}{2112} & 0 & \frac{\sqrt{55}}{2112}
\end{bmatrix}
$$

| 800 | symmetry | $-\dfrac{x^2}{2} - \dfrac{y^2}{2} + z^2$ |

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_2^{(1,0;a)}(A_{1u})$$

$$\begin{bmatrix}
0 & -\frac{\sqrt{15}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{14} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{10}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{30}}{70} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{10}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{30}}{70} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{15}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{14} & 0 & 0 \\
\frac{\sqrt{15}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{28} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{15}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{28} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{2\sqrt{15}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{70} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{2\sqrt{15}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}}{70} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{28} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{28} & 0
\end{bmatrix}$$

| 801 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |
|---|---|---|

$$\mathbb{M}_2^{(1,0;a)}(B_{1u})$$

$$\begin{bmatrix}
0 & 0 & 0 & -\frac{\sqrt{10}}{70} & 0 & 0 & \frac{\sqrt{42}}{28} & 0 & 0 & 0 & \frac{\sqrt{30}}{140} & 0 & 0 & 0 \\
\frac{\sqrt{3}}{21} & 0 & 0 & 0 & -\frac{2\sqrt{15}}{105} & 0 & 0 & \frac{3\sqrt{2}}{28} & 0 & 0 & 0 & \frac{\sqrt{6}}{28} & 0 & 0 \\
0 & \frac{2\sqrt{15}}{105} & 0 & 0 & 0 & -\frac{\sqrt{3}}{21} & 0 & 0 & \frac{\sqrt{6}}{28} & 0 & 0 & 0 & \frac{3\sqrt{2}}{28} & 0 \\
0 & 0 & \frac{\sqrt{10}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{140} & 0 & 0 & 0 & \frac{\sqrt{42}}{28} \\
0 & 0 & \frac{3\sqrt{2}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{84} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{9\sqrt{10}}{140} & 0 & 0 & -\frac{\sqrt{42}}{84} & 0 & 0 & 0 & \frac{\sqrt{30}}{105} & 0 & 0 & 0 \\
\frac{3\sqrt{2}}{28} & 0 & 0 & 0 & \frac{9\sqrt{10}}{140} & 0 & 0 & -\frac{\sqrt{3}}{21} & 0 & 0 & 0 & \frac{1}{14} & 0 & 0 \\
0 & \frac{9\sqrt{10}}{140} & 0 & 0 & 0 & \frac{3\sqrt{2}}{28} & 0 & 0 & -\frac{1}{14} & 0 & 0 & 0 & \frac{\sqrt{3}}{21} & 0 \\
0 & 0 & \frac{9\sqrt{10}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{105} & 0 & 0 & 0 & \frac{\sqrt{42}}{84} \\
0 & 0 & 0 & \frac{3\sqrt{2}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{84} & 0 & 0 & 0
\end{bmatrix}$$

| 802 | symmetry | $\sqrt{3}xy$ |
|---|---|---|

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_2^{(1,0;a)}(B_{2u})$

$$\begin{bmatrix}
0 & 0 & 0 & \frac{\sqrt{10}i}{70} & 0 & 0 & \frac{\sqrt{42}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{140} & 0 & 0 & 0 \\
\frac{\sqrt{3}i}{21} & 0 & 0 & 0 & \frac{2\sqrt{15}i}{105} & 0 & 0 & \frac{3\sqrt{2}i}{28} & 0 & 0 & 0 & -\frac{\sqrt{6}i}{28} & 0 & 0 \\
0 & \frac{2\sqrt{15}i}{105} & 0 & 0 & 0 & \frac{\sqrt{3}i}{21} & 0 & 0 & \frac{\sqrt{6}i}{28} & 0 & 0 & 0 & -\frac{3\sqrt{2}i}{28} & 0 \\
0 & 0 & \frac{\sqrt{10}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{140} & 0 & 0 & 0 & -\frac{\sqrt{42}i}{28} \\
0 & 0 & -\frac{3\sqrt{2}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{84} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{9\sqrt{10}i}{140} & 0 & 0 & -\frac{\sqrt{42}i}{84} & 0 & 0 & 0 & -\frac{\sqrt{30}i}{105} & 0 & 0 & 0 \\
\frac{3\sqrt{2}i}{28} & 0 & 0 & 0 & -\frac{9\sqrt{10}i}{140} & 0 & 0 & -\frac{\sqrt{3}i}{21} & 0 & 0 & 0 & -\frac{i}{14} & 0 & 0 \\
0 & \frac{9\sqrt{10}i}{140} & 0 & 0 & 0 & -\frac{3\sqrt{2}i}{28} & 0 & 0 & -\frac{i}{14} & 0 & 0 & 0 & -\frac{\sqrt{3}i}{21} & 0 \\
0 & 0 & \frac{9\sqrt{10}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{105} & 0 & 0 & 0 & -\frac{\sqrt{42}i}{84} \\
0 & 0 & 0 & \frac{3\sqrt{2}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{84} & 0 & 0 & 0
\end{bmatrix}$$

| 803 | symmetry | $\sqrt{3}yz$ |
|---|---|---|

$\mathbb{M}_{2,1}^{(1,0;a)}(E_u)$

$$\begin{bmatrix}
\frac{i}{14} & 0 & \frac{3\sqrt{10}i}{140} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{14} & 0 & -\frac{\sqrt{30}i}{70} & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{15}i}{210} & 0 & \frac{\sqrt{30}i}{84} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{14} & 0 & -\frac{3\sqrt{10}i}{70} & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{30}i}{84} & 0 & \frac{\sqrt{15}i}{210} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}i}{70} & 0 & -\frac{\sqrt{6}i}{14} & 0 & 0 \\
0 & 0 & 0 & -\frac{3\sqrt{10}i}{140} & 0 & -\frac{i}{14} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{70} & 0 & -\frac{\sqrt{6}i}{14} & 0 \\
0 & -\frac{3i}{14} & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{168} & 0 & -\frac{\sqrt{10}i}{56} & 0 & 0 & 0 & 0 & 0 \\
\frac{3i}{14} & 0 & -\frac{3\sqrt{10}i}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{168} & 0 & -\frac{11\sqrt{30}i}{840} & 0 & 0 & 0 & 0 \\
0 & \frac{3\sqrt{10}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{i}{28} & 0 & -\frac{\sqrt{15}i}{60} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{3\sqrt{10}i}{70} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{60} & 0 & -\frac{i}{28} & 0 & 0 \\
0 & 0 & 0 & -\frac{3\sqrt{10}i}{70} & 0 & \frac{3i}{14} & 0 & 0 & 0 & 0 & \frac{11\sqrt{30}i}{840} & 0 & \frac{\sqrt{6}i}{168} & 0 \\
0 & 0 & 0 & 0 & -\frac{3i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{56} & 0 & \frac{\sqrt{210}i}{168}
\end{bmatrix}$$

| 804 | symmetry | $-\sqrt{3}xz$ |
|---|---|---|

*continued ...*

274

Table 9

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_{2,2}^{(1,0;a)}(E_u)$$

$$\begin{pmatrix}
-\frac{1}{14} & 0 & \frac{3\sqrt{10}}{140} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{14} & 0 & -\frac{\sqrt{30}}{70} & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{15}}{210} & 0 & \frac{\sqrt{30}}{84} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{14} & 0 & -\frac{3\sqrt{10}}{70} & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{30}}{84} & 0 & \frac{\sqrt{15}}{210} & 0 & 0 & 0 & 0 & \frac{3\sqrt{10}}{70} & 0 & -\frac{\sqrt{6}}{14} & 0 & 0 \\
0 & 0 & 0 & \frac{3\sqrt{10}}{140} & 0 & -\frac{1}{14} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{70} & 0 & -\frac{\sqrt{6}}{14} & 0 \\
0 & -\frac{3}{14} & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{168} & 0 & -\frac{\sqrt{10}}{56} & 0 & 0 & 0 & 0 & 0 \\
-\frac{3}{14} & 0 & -\frac{3\sqrt{10}}{70} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{168} & 0 & -\frac{11\sqrt{30}}{840} & 0 & 0 & 0 & 0 \\
0 & -\frac{3\sqrt{10}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{28} & 0 & -\frac{\sqrt{15}}{60} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{3\sqrt{10}}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{60} & 0 & -\frac{1}{28} & 0 & 0 \\
0 & 0 & 0 & \frac{3\sqrt{10}}{70} & 0 & \frac{3}{14} & 0 & 0 & 0 & 0 & -\frac{11\sqrt{30}}{840} & 0 & \frac{\sqrt{6}}{168} & 0 \\
0 & 0 & 0 & 0 & \frac{3}{14} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{56} & 0 & \frac{\sqrt{210}}{168}
\end{pmatrix}$$

| No. | multipole | matrix |
|---|---|---|
| 805 | symmetry | $\dfrac{\sqrt{21}\left(x^4-3x^2y^2-3x^2z^2+y^4-3y^2z^2+z^4\right)}{6}$ |

$$\mathbb{M}_{4}^{(1,0;a)}(A_{1u},1)$$

$$\begin{bmatrix}
0 & \frac{\sqrt{105}}{840} & 0 & 0 & 0 & \frac{\sqrt{21}}{168} & 0 & 0 & -\frac{9\sqrt{42}}{280} & 0 & 0 & 0 & -\frac{9\sqrt{14}}{280} & 0 \\
0 & 0 & -\frac{\sqrt{70}}{280} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{210}}{280} & 0 & 0 & 0 & -\frac{3\sqrt{6}}{40} \\
0 & 0 & 0 & \frac{\sqrt{70}}{280} & 0 & 0 & -\frac{3\sqrt{6}}{40} & 0 & 0 & 0 & \frac{3\sqrt{210}}{280} & 0 & 0 & 0 \\
-\frac{\sqrt{21}}{168} & 0 & 0 & 0 & -\frac{\sqrt{105}}{840} & 0 & 0 & -\frac{9\sqrt{14}}{280} & 0 & 0 & 0 & -\frac{9\sqrt{42}}{280} & 0 & 0 \\
-\frac{\sqrt{105}}{140} & 0 & 0 & 0 & -\frac{\sqrt{21}}{28} & 0 & 0 & -\frac{\sqrt{70}}{280} & 0 & 0 & 0 & -\frac{\sqrt{210}}{840} & 0 & 0 \\
0 & \frac{3\sqrt{105}}{140} & 0 & 0 & 0 & -\frac{\sqrt{21}}{28} & 0 & 0 & \frac{\sqrt{42}}{210} & 0 & 0 & 0 & -\frac{\sqrt{14}}{140} & 0 \\
0 & 0 & -\frac{\sqrt{105}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{35}}{280} & 0 & 0 & 0 & -\frac{1}{40} \\
0 & 0 & 0 & -\frac{\sqrt{105}}{70} & 0 & 0 & \frac{1}{40} & 0 & 0 & 0 & -\frac{\sqrt{35}}{280} & 0 & 0 & 0 \\
-\frac{\sqrt{21}}{28} & 0 & 0 & 0 & \frac{3\sqrt{105}}{140} & 0 & 0 & \frac{\sqrt{14}}{140} & 0 & 0 & 0 & -\frac{\sqrt{42}}{210} & 0 & 0 \\
0 & -\frac{\sqrt{21}}{28} & 0 & 0 & 0 & -\frac{\sqrt{105}}{140} & 0 & 0 & \frac{\sqrt{210}}{840} & 0 & 0 & 0 & \frac{\sqrt{70}}{280} & 0
\end{bmatrix}$$

| No. | multipole | matrix |
|---|---|---|
| 806 | symmetry | $-\dfrac{\sqrt{15}\left(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4\right)}{12}$ |

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_4^{(1,0;a)}(A_{1u}, 2)$

$$\begin{pmatrix}
0 & \frac{\sqrt{3}}{168} & 0 & 0 & 0 & -\frac{\sqrt{15}}{120} & 0 & 0 & -\frac{9\sqrt{30}}{280} & 0 & 0 & 0 & \frac{9\sqrt{10}}{200} & 0 \\
0 & 0 & -\frac{\sqrt{2}}{56} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{6}}{56} & 0 & 0 & 0 & \frac{3\sqrt{210}}{200} \\
0 & 0 & 0 & \frac{\sqrt{2}}{56} & 0 & 0 & \frac{3\sqrt{210}}{200} & 0 & 0 & 0 & \frac{3\sqrt{6}}{56} & 0 & 0 & 0 \\
\frac{\sqrt{15}}{120} & 0 & 0 & 0 & -\frac{\sqrt{3}}{168} & 0 & 0 & \frac{9\sqrt{10}}{200} & 0 & 0 & 0 & -\frac{9\sqrt{30}}{280} & 0 & 0 \\
-\frac{\sqrt{3}}{28} & 0 & 0 & 0 & \frac{\sqrt{15}}{20} & 0 & 0 & -\frac{\sqrt{2}}{56} & 0 & 0 & 0 & \frac{\sqrt{6}}{120} & 0 & 0 \\
0 & \frac{3\sqrt{3}}{28} & 0 & 0 & 0 & \frac{\sqrt{15}}{20} & 0 & 0 & \frac{\sqrt{30}}{210} & 0 & 0 & 0 & \frac{\sqrt{10}}{100} & 0 \\
0 & 0 & -\frac{\sqrt{3}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{56} & 0 & 0 & 0 & \frac{\sqrt{35}}{200} \\
0 & 0 & 0 & -\frac{\sqrt{3}}{14} & 0 & 0 & -\frac{\sqrt{35}}{200} & 0 & 0 & 0 & -\frac{1}{56} & 0 & 0 & 0 \\
\frac{\sqrt{15}}{20} & 0 & 0 & 0 & \frac{3\sqrt{3}}{28} & 0 & 0 & -\frac{\sqrt{10}}{100} & 0 & 0 & 0 & -\frac{\sqrt{30}}{210} & 0 & 0 \\
0 & \frac{\sqrt{15}}{20} & 0 & 0 & 0 & -\frac{\sqrt{3}}{28} & 0 & 0 & -\frac{\sqrt{6}}{120} & 0 & 0 & 0 & \frac{\sqrt{2}}{56} & 0
\end{pmatrix}$$

| 807 | symmetry | $\frac{\sqrt{35}xy(x-y)(x+y)}{2}$ |
|---|---|---|

$\mathbb{M}_4^{(1,0;a)}(A_{2u})$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{35}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{9\sqrt{210}i}{700} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{9\sqrt{10}i}{100} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{9\sqrt{10}i}{100} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{35}i}{140} & 0 & 0 & 0 & 0 & 0 & -\frac{9\sqrt{210}i}{700} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{3\sqrt{35}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}i}{140} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{35}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{350} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{100} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{100} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{3\sqrt{35}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{350} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{3\sqrt{35}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}i}{140} & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

| 808 | symmetry | $\frac{\sqrt{5}(x-y)(x+y)\left(x^2+y^2-6z^2\right)}{4}$ |
|---|---|---|

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# Table 9

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_4^{(1,0;a)}(B_{1u})$$

$$
\begin{bmatrix}
0 & 0 & 0 & -\frac{\sqrt{2}}{56} & 0 & 0 & \frac{9\sqrt{210}}{1400} & 0 & 0 & 0 & \frac{27\sqrt{6}}{280} & 0 & 0 & 0 \\
\frac{\sqrt{15}}{280} & 0 & 0 & 0 & \frac{\sqrt{3}}{56} & 0 & 0 & -\frac{99\sqrt{10}}{1400} & 0 & 0 & 0 & \frac{9\sqrt{30}}{1400} & 0 & 0 \\
0 & -\frac{\sqrt{3}}{56} & 0 & 0 & 0 & -\frac{\sqrt{15}}{280} & 0 & 0 & \frac{9\sqrt{30}}{1400} & 0 & 0 & 0 & -\frac{99\sqrt{10}}{1400} & 0 \\
0 & 0 & \frac{\sqrt{2}}{56} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{27\sqrt{6}}{280} & 0 & 0 & 0 & \frac{9\sqrt{210}}{1400} \\
0 & 0 & \frac{9\sqrt{10}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{140} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{3\sqrt{2}}{28} & 0 & 0 & -\frac{3\sqrt{210}}{1400} & 0 & 0 & 0 & \frac{\sqrt{6}}{280} & 0 & 0 & 0 \\
\frac{9\sqrt{10}}{140} & 0 & 0 & 0 & -\frac{3\sqrt{2}}{28} & 0 & 0 & \frac{9\sqrt{15}}{1400} & 0 & 0 & 0 & -\frac{17\sqrt{5}}{1400} & 0 & 0 \\
0 & -\frac{3\sqrt{2}}{28} & 0 & 0 & 0 & \frac{9\sqrt{10}}{140} & 0 & 0 & \frac{17\sqrt{5}}{1400} & 0 & 0 & 0 & -\frac{9\sqrt{15}}{1400} & 0 \\
0 & 0 & -\frac{3\sqrt{2}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{280} & 0 & 0 & 0 & \frac{3\sqrt{210}}{1400} \\
0 & 0 & 0 & \frac{9\sqrt{10}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{140} & 0 & 0 & 0 \\
\end{bmatrix}
$$

| 809 | symmetry | $-\dfrac{\sqrt{5}xy\left(x^2+y^2-6z^2\right)}{2}$ |
|---|---|---|

$$\mathbb{M}_4^{(1,0;a)}(B_{2u})$$

$$
\begin{bmatrix}
0 & 0 & 0 & -\frac{\sqrt{2}i}{56} & 0 & 0 & -\frac{9\sqrt{210}i}{1400} & 0 & 0 & 0 & \frac{27\sqrt{6}i}{280} & 0 & 0 & 0 \\
-\frac{\sqrt{15}i}{280} & 0 & 0 & 0 & \frac{\sqrt{3}i}{56} & 0 & 0 & \frac{99\sqrt{10}i}{1400} & 0 & 0 & 0 & \frac{9\sqrt{30}i}{1400} & 0 & 0 \\
0 & \frac{\sqrt{3}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{280} & 0 & 0 & -\frac{9\sqrt{30}i}{1400} & 0 & 0 & 0 & -\frac{99\sqrt{10}i}{1400} & 0 \\
0 & 0 & -\frac{\sqrt{2}i}{56} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{27\sqrt{6}i}{280} & 0 & 0 & 0 & \frac{9\sqrt{210}i}{1400} \\
0 & 0 & \frac{9\sqrt{10}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{140} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{3\sqrt{2}i}{28} & 0 & 0 & \frac{3\sqrt{210}i}{1400} & 0 & 0 & 0 & \frac{\sqrt{6}i}{280} & 0 & 0 & 0 \\
-\frac{9\sqrt{10}i}{140} & 0 & 0 & 0 & -\frac{3\sqrt{2}i}{28} & 0 & 0 & -\frac{9\sqrt{15}i}{1400} & 0 & 0 & 0 & -\frac{17\sqrt{5}i}{1400} & 0 & 0 \\
0 & \frac{3\sqrt{2}i}{28} & 0 & 0 & 0 & \frac{9\sqrt{10}i}{140} & 0 & 0 & -\frac{17\sqrt{5}i}{1400} & 0 & 0 & 0 & -\frac{9\sqrt{15}i}{1400} & 0 \\
0 & 0 & \frac{3\sqrt{2}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{280} & 0 & 0 & 0 & \frac{3\sqrt{210}i}{1400} \\
0 & 0 & 0 & -\frac{9\sqrt{10}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{140} & 0 & 0 & 0 \\
\end{bmatrix}
$$

| 810 | symmetry | $\dfrac{\sqrt{35}yz(y-z)(y+z)}{2}$ |
|---|---|---|

*continued …*

Table 9

| No. | multipole | matrix |
|-----|-----------|--------|

$$\mathbb{M}_{4,1}^{(1,0;a)}(E_u,1) = \begin{pmatrix}
\frac{\sqrt{35}i}{1120} & 0 & \frac{\sqrt{14}i}{224} & 0 & \frac{\sqrt{7}i}{224} & 0 & 0 & -\frac{27\sqrt{210}i}{2800} & 0 & -\frac{9\sqrt{42}i}{280} & 0 & -\frac{27\sqrt{70}i}{2800} & 0 & 0 \\
0 & -\frac{\sqrt{21}i}{224} & 0 & -\frac{\sqrt{42}i}{224} & 0 & -\frac{\sqrt{105}i}{1120} & \frac{9\sqrt{10}i}{400} & 0 & \frac{9\sqrt{210}i}{700} & 0 & \frac{9\sqrt{14}i}{560} & 0 & -\frac{9\sqrt{70}i}{1400} & 0 \\
\frac{\sqrt{105}i}{1120} & 0 & \frac{\sqrt{42}i}{224} & 0 & \frac{\sqrt{21}i}{224} & 0 & 0 & -\frac{9\sqrt{70}i}{1400} & 0 & \frac{9\sqrt{14}i}{560} & 0 & \frac{9\sqrt{210}i}{700} & 0 & \frac{9\sqrt{10}i}{400} \\
0 & -\frac{\sqrt{7}i}{224} & 0 & -\frac{\sqrt{14}i}{224} & 0 & -\frac{\sqrt{35}i}{1120} & 0 & 0 & -\frac{27\sqrt{70}i}{2800} & 0 & -\frac{9\sqrt{42}i}{280} & 0 & -\frac{27\sqrt{210}i}{2800} & 0 \\
0 & -\frac{3\sqrt{35}i}{140} & 0 & -\frac{3\sqrt{70}i}{280} & 0 & 0 & -\frac{\sqrt{6}i}{160} & 0 & -\frac{\sqrt{14}i}{112} & 0 & -\frac{\sqrt{210}i}{1120} & 0 & 0 & 0 \\
\frac{3\sqrt{35}i}{140} & 0 & \frac{3\sqrt{14}i}{56} & 0 & 0 & 0 & 0 & \frac{13\sqrt{210}i}{5600} & 0 & \frac{\sqrt{42}i}{560} & 0 & -\frac{\sqrt{70}i}{800} & 0 & 0 \\
0 & -\frac{3\sqrt{14}i}{56} & 0 & 0 & 0 & \frac{3\sqrt{70}i}{280} & -\frac{3\sqrt{15}i}{800} & 0 & -\frac{\sqrt{35}i}{5600} & 0 & \frac{\sqrt{21}i}{160} & 0 & \frac{\sqrt{105}i}{5600} & 0 \\
\frac{3\sqrt{70}i}{280} & 0 & 0 & 0 & -\frac{3\sqrt{14}i}{56} & 0 & 0 & -\frac{\sqrt{105}i}{5600} & 0 & -\frac{\sqrt{21}i}{160} & 0 & \frac{\sqrt{35}i}{5600} & 0 & \frac{3\sqrt{15}i}{800} \\
0 & 0 & 0 & \frac{3\sqrt{14}i}{56} & 0 & \frac{3\sqrt{35}i}{140} & 0 & 0 & \frac{\sqrt{70}i}{800} & 0 & -\frac{\sqrt{42}i}{560} & 0 & -\frac{13\sqrt{210}i}{5600} & 0 \\
0 & 0 & -\frac{3\sqrt{70}i}{280} & 0 & -\frac{3\sqrt{35}i}{140} & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{1120} & 0 & \frac{\sqrt{14}i}{112} & 0 & \frac{\sqrt{6}i}{160}
\end{pmatrix}$$

| 811 | symmetry | $-\dfrac{\sqrt{35}xz(x-z)(x+z)}{2}$ |
|-----|----------|--------|

$$\mathbb{M}_{4,2}^{(1,0;a)}(E_u,1) = \begin{pmatrix}
-\frac{\sqrt{35}}{1120} & 0 & \frac{\sqrt{14}}{224} & 0 & -\frac{\sqrt{7}}{224} & 0 & 0 & \frac{27\sqrt{210}}{2800} & 0 & -\frac{9\sqrt{42}}{280} & 0 & \frac{27\sqrt{70}}{2800} & 0 & 0 \\
0 & \frac{\sqrt{21}}{224} & 0 & -\frac{\sqrt{42}}{224} & 0 & \frac{\sqrt{105}}{1120} & \frac{9\sqrt{10}}{400} & 0 & -\frac{9\sqrt{210}}{700} & 0 & \frac{9\sqrt{14}}{560} & 0 & \frac{9\sqrt{70}}{1400} & 0 \\
\frac{\sqrt{105}}{1120} & 0 & -\frac{\sqrt{42}}{224} & 0 & \frac{\sqrt{21}}{224} & 0 & 0 & -\frac{9\sqrt{70}}{1400} & 0 & -\frac{9\sqrt{14}}{560} & 0 & \frac{9\sqrt{210}}{700} & 0 & -\frac{9\sqrt{10}}{400} \\
0 & -\frac{\sqrt{7}}{224} & 0 & \frac{\sqrt{14}}{224} & 0 & -\frac{\sqrt{35}}{1120} & 0 & 0 & -\frac{27\sqrt{70}}{2800} & 0 & \frac{9\sqrt{42}}{280} & 0 & -\frac{27\sqrt{210}}{2800} & 0 \\
0 & -\frac{3\sqrt{35}}{140} & 0 & \frac{3\sqrt{70}}{280} & 0 & 0 & \frac{\sqrt{6}}{160} & 0 & -\frac{\sqrt{14}}{112} & 0 & \frac{\sqrt{210}}{1120} & 0 & 0 & 0 \\
-\frac{3\sqrt{35}}{140} & 0 & \frac{3\sqrt{14}}{56} & 0 & 0 & 0 & 0 & -\frac{13\sqrt{210}}{5600} & 0 & \frac{\sqrt{42}}{560} & 0 & \frac{\sqrt{70}}{800} & 0 & 0 \\
0 & \frac{3\sqrt{14}}{56} & 0 & 0 & 0 & -\frac{3\sqrt{70}}{280} & -\frac{3\sqrt{15}}{800} & 0 & \frac{\sqrt{35}}{5600} & 0 & \frac{\sqrt{21}}{160} & 0 & -\frac{\sqrt{105}}{5600} & 0 \\
\frac{3\sqrt{70}}{280} & 0 & 0 & 0 & -\frac{3\sqrt{14}}{56} & 0 & 0 & -\frac{\sqrt{105}}{5600} & 0 & \frac{\sqrt{21}}{160} & 0 & \frac{\sqrt{35}}{5600} & 0 & -\frac{3\sqrt{15}}{800} \\
0 & 0 & 0 & -\frac{3\sqrt{14}}{56} & 0 & \frac{3\sqrt{35}}{140} & 0 & 0 & \frac{\sqrt{70}}{800} & 0 & \frac{\sqrt{42}}{560} & 0 & -\frac{13\sqrt{210}}{5600} & 0 \\
0 & 0 & -\frac{3\sqrt{70}}{280} & 0 & \frac{3\sqrt{35}}{140} & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{1120} & 0 & -\frac{\sqrt{14}}{112} & 0 & \frac{\sqrt{6}}{160}
\end{pmatrix}$$

| 812 | symmetry | $\dfrac{\sqrt{5}yz(6x^2-y^2-z^2)}{2}$ |
|-----|----------|--------|

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_{4,1}^{(1,0;a)}(E_u,2)$

$$\begin{bmatrix}
\frac{\sqrt{5}i}{1120} & 0 & \frac{\sqrt{2}i}{224} & 0 & -\frac{i}{32} & 0 & 0 & -\frac{27\sqrt{30}i}{2800} & 0 & -\frac{9\sqrt{6}i}{280} & 0 & \frac{27\sqrt{10}i}{400} & 0 & 0 \\[4pt]
0 & -\frac{\sqrt{3}i}{224} & 0 & -\frac{\sqrt{6}i}{224} & 0 & \frac{\sqrt{15}i}{160} & -\frac{9\sqrt{70}i}{400} & 0 & \frac{9\sqrt{30}i}{700} & 0 & \frac{9\sqrt{2}i}{560} & 0 & \frac{9\sqrt{10}i}{200} & 0 \\[4pt]
-\frac{\sqrt{15}i}{160} & 0 & \frac{\sqrt{6}i}{224} & 0 & \frac{\sqrt{3}i}{224} & 0 & 0 & \frac{9\sqrt{10}i}{200} & 0 & \frac{9\sqrt{2}i}{560} & 0 & \frac{9\sqrt{30}i}{700} & 0 & -\frac{9\sqrt{70}i}{400} \\[4pt]
0 & \frac{i}{32} & 0 & -\frac{\sqrt{2}i}{224} & 0 & -\frac{\sqrt{5}i}{1120} & 0 & 0 & \frac{27\sqrt{10}i}{400} & 0 & -\frac{9\sqrt{6}i}{280} & 0 & -\frac{27\sqrt{30}i}{2800} & 0 \\[4pt]
0 & -\frac{3\sqrt{5}i}{140} & 0 & \frac{3\sqrt{10}i}{40} & 0 & 0 & -\frac{\sqrt{42}i}{1120} & 0 & -\frac{\sqrt{2}i}{112} & 0 & \frac{\sqrt{30}i}{160} & 0 & 0 & 0 \\[4pt]
\frac{3\sqrt{5}i}{140} & 0 & \frac{3\sqrt{2}i}{56} & 0 & 0 & 0 & 0 & \frac{13\sqrt{30}i}{5600} & 0 & \frac{\sqrt{6}i}{560} & 0 & \frac{7\sqrt{10}i}{800} & 0 & 0 \\[4pt]
0 & -\frac{3\sqrt{2}i}{56} & 0 & 0 & 0 & -\frac{3\sqrt{10}i}{40} & \frac{3\sqrt{105}i}{800} & 0 & -\frac{\sqrt{5}i}{5600} & 0 & \frac{\sqrt{3}i}{160} & 0 & -\frac{\sqrt{15}i}{800} & 0 \\[4pt]
-\frac{3\sqrt{10}i}{40} & 0 & 0 & 0 & -\frac{3\sqrt{2}i}{56} & 0 & 0 & \frac{\sqrt{15}i}{800} & 0 & -\frac{\sqrt{3}i}{160} & 0 & \frac{\sqrt{5}i}{5600} & 0 & -\frac{3\sqrt{105}i}{800} \\[4pt]
0 & 0 & 0 & \frac{3\sqrt{2}i}{56} & 0 & \frac{3\sqrt{5}i}{140} & 0 & 0 & -\frac{7\sqrt{10}i}{800} & 0 & -\frac{\sqrt{6}i}{560} & 0 & -\frac{13\sqrt{30}i}{5600} & 0 \\[4pt]
0 & 0 & \frac{3\sqrt{10}i}{40} & 0 & -\frac{3\sqrt{5}i}{140} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{160} & 0 & \frac{\sqrt{2}i}{112} & 0 & \frac{\sqrt{42}i}{1120}
\end{bmatrix}$$

| 813 | symmetry | $\dfrac{\sqrt{5}xz(x^2-6y^2+z^2)}{2}$ |
|---|---|---|

$\mathbb{M}_{4,2}^{(1,0;a)}(E_u,2)$

$$\begin{bmatrix}
-\frac{\sqrt{5}}{1120} & 0 & \frac{\sqrt{2}}{224} & 0 & \frac{1}{32} & 0 & 0 & \frac{27\sqrt{30}}{2800} & 0 & -\frac{9\sqrt{6}}{280} & 0 & -\frac{27\sqrt{10}}{400} & 0 & 0 \\[4pt]
0 & \frac{\sqrt{3}}{224} & 0 & -\frac{\sqrt{6}}{224} & 0 & -\frac{\sqrt{15}}{160} & -\frac{9\sqrt{70}}{400} & 0 & -\frac{9\sqrt{30}}{700} & 0 & \frac{9\sqrt{2}}{560} & 0 & -\frac{9\sqrt{10}}{200} & 0 \\[4pt]
-\frac{\sqrt{15}}{160} & 0 & -\frac{\sqrt{6}}{224} & 0 & \frac{\sqrt{3}}{224} & 0 & 0 & \frac{9\sqrt{10}}{200} & 0 & -\frac{9\sqrt{2}}{560} & 0 & \frac{9\sqrt{30}}{700} & 0 & \frac{9\sqrt{70}}{400} \\[4pt]
0 & \frac{1}{32} & 0 & \frac{\sqrt{2}}{224} & 0 & -\frac{\sqrt{5}}{1120} & 0 & 0 & \frac{27\sqrt{10}}{400} & 0 & \frac{9\sqrt{6}}{280} & 0 & -\frac{27\sqrt{30}}{2800} & 0 \\[4pt]
0 & -\frac{3\sqrt{5}}{140} & 0 & -\frac{3\sqrt{10}}{40} & 0 & 0 & \frac{\sqrt{42}}{1120} & 0 & -\frac{\sqrt{2}}{112} & 0 & -\frac{\sqrt{30}}{160} & 0 & 0 & 0 \\[4pt]
-\frac{3\sqrt{5}}{140} & 0 & \frac{3\sqrt{2}}{56} & 0 & 0 & 0 & 0 & -\frac{13\sqrt{30}}{5600} & 0 & \frac{\sqrt{6}}{560} & 0 & -\frac{7\sqrt{10}}{800} & 0 & 0 \\[4pt]
0 & \frac{3\sqrt{2}}{56} & 0 & 0 & 0 & \frac{3\sqrt{10}}{40} & \frac{3\sqrt{105}}{800} & 0 & \frac{\sqrt{5}}{5600} & 0 & \frac{\sqrt{3}}{160} & 0 & \frac{\sqrt{15}}{800} & 0 \\[4pt]
-\frac{3\sqrt{10}}{40} & 0 & 0 & 0 & -\frac{3\sqrt{2}}{56} & 0 & 0 & \frac{\sqrt{15}}{800} & 0 & \frac{\sqrt{3}}{160} & 0 & \frac{\sqrt{5}}{5600} & 0 & \frac{3\sqrt{105}}{800} \\[4pt]
0 & 0 & 0 & -\frac{3\sqrt{2}}{56} & 0 & \frac{3\sqrt{5}}{140} & 0 & 0 & -\frac{7\sqrt{10}}{800} & 0 & \frac{\sqrt{6}}{560} & 0 & -\frac{13\sqrt{30}}{5600} & 0 \\[4pt]
0 & 0 & \frac{3\sqrt{10}}{40} & 0 & \frac{3\sqrt{5}}{140} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{160} & 0 & -\frac{\sqrt{2}}{112} & 0 & \frac{\sqrt{42}}{1120}
\end{bmatrix}$$

| 814 | symmetry | $1$ |
|---|---|---|

*continued ...*

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Table 9

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{M}_0^{(1,1;a)}(A_{1u})$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ -\frac{\sqrt{3}}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{3}}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{3}}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{3}}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$ |
| 815 | symmetry | $-\frac{x^2}{2} - \frac{y^2}{2} + z^2$ |
| | $\mathbb{M}_2^{(1,1;a)}(A_{1u})$ | $\begin{bmatrix} 0 & \frac{12}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}}{140} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{2\sqrt{6}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{9\sqrt{2}}{140} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{2\sqrt{6}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{9\sqrt{2}}{140} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{12}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}}{140} & 0 & 0 \\ \frac{3}{14} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{21} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{3}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{35} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{6}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{3}}{105} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{6}{35} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt{3}}{105} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{3}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{35} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{3}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{21} & 0 \end{bmatrix}$ |
| 816 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |

*continued ...*

Table 9

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{M}_2^{(1,1;a)}(B_{1u})$

$$\begin{bmatrix}
0 & 0 & 0 & \frac{2\sqrt{6}}{35} & 0 & 0 & -\frac{3\sqrt{70}}{280} & 0 & 0 & 0 & -\frac{3\sqrt{2}}{280} & 0 & 0 & 0 \\
-\frac{4\sqrt{5}}{35} & 0 & 0 & 0 & \frac{8}{35} & 0 & 0 & -\frac{3\sqrt{30}}{280} & 0 & 0 & 0 & -\frac{3\sqrt{10}}{280} & 0 & 0 \\
0 & -\frac{8}{35} & 0 & 0 & 0 & \frac{4\sqrt{5}}{35} & 0 & 0 & -\frac{3\sqrt{10}}{280} & 0 & 0 & 0 & -\frac{3\sqrt{30}}{280} & 0 \\
0 & 0 & -\frac{2\sqrt{6}}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{2}}{280} & 0 & 0 & 0 & -\frac{3\sqrt{70}}{280} \\
0 & 0 & \frac{3\sqrt{30}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{105} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{9\sqrt{6}}{140} & 0 & 0 & \frac{\sqrt{70}}{105} & 0 & 0 & 0 & -\frac{4\sqrt{2}}{105} & 0 & 0 & 0 \\
\frac{3\sqrt{30}}{140} & 0 & 0 & 0 & \frac{9\sqrt{6}}{140} & 0 & 0 & \frac{4\sqrt{5}}{105} & 0 & 0 & 0 & -\frac{2\sqrt{15}}{105} & 0 & 0 \\
0 & \frac{9\sqrt{6}}{140} & 0 & 0 & 0 & \frac{3\sqrt{30}}{140} & 0 & 0 & \frac{2\sqrt{15}}{105} & 0 & 0 & 0 & -\frac{4\sqrt{5}}{105} & 0 \\
0 & 0 & \frac{9\sqrt{6}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{4\sqrt{2}}{105} & 0 & 0 & 0 & -\frac{\sqrt{70}}{105} \\
0 & 0 & 0 & \frac{3\sqrt{30}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{105} & 0 & 0 & 0
\end{bmatrix}$$

| 817 | symmetry | $\sqrt{3}xy$ |
|-----|----------|--------------|

$\mathbb{M}_2^{(1,1;a)}(B_{2u})$

$$\begin{bmatrix}
0 & 0 & 0 & -\frac{2\sqrt{6}i}{35} & 0 & 0 & -\frac{3\sqrt{70}i}{280} & 0 & 0 & 0 & \frac{3\sqrt{2}i}{280} & 0 & 0 & 0 \\
-\frac{4\sqrt{5}i}{35} & 0 & 0 & 0 & -\frac{8i}{35} & 0 & 0 & -\frac{3\sqrt{30}i}{280} & 0 & 0 & 0 & \frac{3\sqrt{10}i}{280} & 0 & 0 \\
0 & -\frac{8i}{35} & 0 & 0 & 0 & -\frac{4\sqrt{5}i}{35} & 0 & 0 & -\frac{3\sqrt{10}i}{280} & 0 & 0 & 0 & \frac{3\sqrt{30}i}{280} & 0 \\
0 & 0 & -\frac{2\sqrt{6}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{2}i}{280} & 0 & 0 & 0 & \frac{3\sqrt{70}i}{280} \\
0 & 0 & -\frac{3\sqrt{30}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{105} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{9\sqrt{6}i}{140} & 0 & 0 & \frac{\sqrt{70}i}{105} & 0 & 0 & 0 & \frac{4\sqrt{2}i}{105} & 0 & 0 & 0 \\
\frac{3\sqrt{30}i}{140} & 0 & 0 & 0 & -\frac{9\sqrt{6}i}{140} & 0 & 0 & \frac{4\sqrt{5}i}{105} & 0 & 0 & 0 & \frac{2\sqrt{15}i}{105} & 0 & 0 \\
0 & \frac{9\sqrt{6}i}{140} & 0 & 0 & 0 & -\frac{3\sqrt{30}i}{140} & 0 & 0 & \frac{2\sqrt{15}i}{105} & 0 & 0 & 0 & \frac{4\sqrt{5}i}{105} & 0 \\
0 & 0 & \frac{9\sqrt{6}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{4\sqrt{2}i}{105} & 0 & 0 & 0 & \frac{\sqrt{70}i}{105} \\
0 & 0 & 0 & \frac{3\sqrt{30}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{105} & 0 & 0 & 0
\end{bmatrix}$$

| 818 | symmetry | $\sqrt{3}yz$ |
|-----|----------|--------------|

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{M}_{2,1}^{(1,1;a)}(E_u)$ | (matrix below) |

$$\mathbb{M}_{2,1}^{(1,1;a)}(E_u)=\begin{bmatrix}
-\frac{2\sqrt{15}i}{35} & 0 & -\frac{3\sqrt{6}i}{35} & 0 & 0 & 0 & 0 & \frac{3\sqrt{10}i}{140} & 0 & \frac{3\sqrt{2}i}{140} & 0 & 0 & 0 \\
0 & \frac{2i}{35} & 0 & -\frac{\sqrt{2}i}{7} & 0 & 0 & 0 & 0 & \frac{3\sqrt{10}i}{140} & 0 & \frac{3\sqrt{6}i}{140} & 0 & 0 \\
0 & 0 & \frac{\sqrt{2}i}{7} & 0 & -\frac{2i}{35} & 0 & 0 & 0 & 0 & \frac{3\sqrt{6}i}{140} & 0 & \frac{3\sqrt{10}i}{140} & 0 \\
0 & 0 & 0 & \frac{3\sqrt{6}i}{35} & 0 & \frac{2\sqrt{15}i}{35} & 0 & 0 & 0 & 0 & \frac{3\sqrt{2}i}{140} & 0 & \frac{3\sqrt{10}i}{140} \\
0 & -\frac{3\sqrt{15}i}{70} & 0 & 0 & 0 & 0 & \frac{\sqrt{14}i}{42} & 0 & \frac{\sqrt{6}i}{42} & 0 & 0 & 0 & 0 \\
\frac{3\sqrt{15}i}{70} & 0 & -\frac{3\sqrt{6}i}{70} & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{210} & 0 & \frac{11\sqrt{2}i}{210} & 0 & 0 & 0 \\
0 & \frac{3\sqrt{6}i}{70} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{105} & 0 & \frac{i}{15} & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{3\sqrt{6}i}{70} & 0 & 0 & 0 & 0 & -\frac{i}{15} & 0 & \frac{\sqrt{15}i}{105} & 0 \\
0 & 0 & 0 & -\frac{3\sqrt{6}i}{70} & 0 & \frac{3\sqrt{15}i}{70} & 0 & 0 & 0 & 0 & -\frac{11\sqrt{2}i}{210} & 0 & -\frac{\sqrt{10}i}{210} \\
0 & 0 & 0 & 0 & -\frac{3\sqrt{15}i}{70} & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{42} & 0 & -\frac{\sqrt{14}i}{42}
\end{bmatrix}$$

| No. | symmetry |
|---|---|
| 819 | $-\sqrt{3}xz$ |

| | multipole |
|---|---|
| | $\mathbb{M}_{2,2}^{(1,1;a)}(E_u)$ |

$$\mathbb{M}_{2,2}^{(1,1;a)}(E_u)=\begin{bmatrix}
\frac{2\sqrt{15}}{35} & 0 & -\frac{3\sqrt{6}}{35} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}}{140} & 0 & \frac{3\sqrt{2}}{140} & 0 & 0 & 0 \\
0 & -\frac{2}{35} & 0 & -\frac{\sqrt{2}}{7} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}}{140} & 0 & \frac{3\sqrt{6}}{140} & 0 & 0 \\
0 & 0 & -\frac{\sqrt{2}}{7} & 0 & -\frac{2}{35} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{6}}{140} & 0 & \frac{3\sqrt{10}}{140} & 0 \\
0 & 0 & 0 & -\frac{3\sqrt{6}}{35} & 0 & \frac{2\sqrt{15}}{35} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{2}}{140} & 0 & \frac{3\sqrt{10}}{140} \\
0 & -\frac{3\sqrt{15}}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{42} & 0 & \frac{\sqrt{6}}{42} & 0 & 0 & 0 & 0 \\
-\frac{3\sqrt{15}}{70} & 0 & -\frac{3\sqrt{6}}{70} & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{210} & 0 & \frac{11\sqrt{2}}{210} & 0 & 0 & 0 \\
0 & -\frac{3\sqrt{6}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{105} & 0 & \frac{1}{15} & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{3\sqrt{6}}{70} & 0 & 0 & 0 & 0 & \frac{1}{15} & 0 & \frac{\sqrt{15}}{105} & 0 \\
0 & 0 & 0 & \frac{3\sqrt{6}}{70} & 0 & \frac{3\sqrt{15}}{70} & 0 & 0 & 0 & 0 & \frac{11\sqrt{2}}{210} & 0 & -\frac{\sqrt{10}}{210} \\
0 & 0 & 0 & 0 & \frac{3\sqrt{15}}{70} & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{42} & 0 & -\frac{\sqrt{14}}{42}
\end{bmatrix}$$

| No. | symmetry |
|---|---|
| 820 | $\dfrac{\sqrt{21}\left(x^4-3x^2y^2-3x^2z^2+y^4-3y^2z^2+z^4\right)}{6}$ |

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_4^{(1,1;a)}(A_{1u},1)$

$$\begin{bmatrix}
0 & -\frac{\sqrt{770}}{210} & 0 & 0 & 0 & -\frac{\sqrt{154}}{42} & 0 & 0 & \frac{\sqrt{77}}{140} & 0 & 0 & 0 & \frac{\sqrt{231}}{420} & 0 \\
0 & 0 & \frac{\sqrt{1155}}{105} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{385}}{420} & 0 & 0 & 0 & \frac{\sqrt{11}}{60} \\
0 & 0 & 0 & -\frac{\sqrt{1155}}{105} & 0 & 0 & \frac{\sqrt{11}}{60} & 0 & 0 & 0 & -\frac{\sqrt{385}}{420} & 0 & 0 & 0 \\
\frac{\sqrt{154}}{42} & 0 & 0 & 0 & \frac{\sqrt{770}}{210} & 0 & 0 & \frac{\sqrt{231}}{420} & 0 & 0 & 0 & \frac{\sqrt{77}}{140} & 0 & 0 \\
-\frac{\sqrt{770}}{840} & 0 & 0 & 0 & -\frac{\sqrt{154}}{168} & 0 & 0 & \frac{\sqrt{1155}}{1155} & 0 & 0 & 0 & \frac{\sqrt{385}}{1155} & 0 & 0 \\
0 & \frac{\sqrt{770}}{280} & 0 & 0 & 0 & -\frac{\sqrt{154}}{168} & 0 & 0 & -\frac{4\sqrt{77}}{1155} & 0 & 0 & 0 & \frac{2\sqrt{231}}{1155} & 0 \\
0 & 0 & -\frac{\sqrt{770}}{420} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2310}}{2310} & 0 & 0 & 0 & \frac{\sqrt{66}}{330} \\
0 & 0 & 0 & -\frac{\sqrt{770}}{420} & 0 & 0 & -\frac{\sqrt{66}}{330} & 0 & 0 & 0 & \frac{\sqrt{2310}}{2310} & 0 & 0 & 0 \\
-\frac{\sqrt{154}}{168} & 0 & 0 & 0 & \frac{\sqrt{770}}{280} & 0 & 0 & -\frac{2\sqrt{231}}{1155} & 0 & 0 & 0 & \frac{4\sqrt{77}}{1155} & 0 & 0 \\
0 & -\frac{\sqrt{154}}{168} & 0 & 0 & 0 & -\frac{\sqrt{770}}{840} & 0 & 0 & -\frac{\sqrt{385}}{1155} & 0 & 0 & 0 & -\frac{\sqrt{1155}}{1155} & 0 \\
\end{bmatrix}$$

| 821 | symmetry | $-\dfrac{\sqrt{15}\left(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4\right)}{12}$ |
|---|---|---|

$\mathbb{M}_4^{(1,1;a)}(A_{1u},2)$

$$\begin{bmatrix}
0 & -\frac{\sqrt{22}}{42} & 0 & 0 & 0 & \frac{\sqrt{110}}{30} & 0 & 0 & \frac{\sqrt{55}}{140} & 0 & 0 & 0 & -\frac{\sqrt{165}}{300} & 0 \\
0 & 0 & \frac{\sqrt{33}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{11}}{84} & 0 & 0 & 0 & -\frac{\sqrt{385}}{300} \\
0 & 0 & 0 & -\frac{\sqrt{33}}{21} & 0 & 0 & -\frac{\sqrt{385}}{300} & 0 & 0 & 0 & -\frac{\sqrt{11}}{84} & 0 & 0 & 0 \\
-\frac{\sqrt{110}}{30} & 0 & 0 & 0 & \frac{\sqrt{22}}{42} & 0 & 0 & -\frac{\sqrt{165}}{300} & 0 & 0 & 0 & \frac{\sqrt{55}}{140} & 0 & 0 \\
-\frac{\sqrt{22}}{168} & 0 & 0 & 0 & \frac{\sqrt{110}}{120} & 0 & 0 & \frac{\sqrt{33}}{231} & 0 & 0 & 0 & -\frac{\sqrt{11}}{165} & 0 & 0 \\
0 & \frac{\sqrt{22}}{56} & 0 & 0 & 0 & \frac{\sqrt{110}}{120} & 0 & 0 & -\frac{4\sqrt{55}}{1155} & 0 & 0 & 0 & -\frac{2\sqrt{165}}{825} & 0 \\
0 & 0 & -\frac{\sqrt{22}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{66}}{462} & 0 & 0 & 0 & -\frac{\sqrt{2310}}{1650} \\
0 & 0 & 0 & -\frac{\sqrt{22}}{84} & 0 & 0 & \frac{\sqrt{2310}}{1650} & 0 & 0 & 0 & \frac{\sqrt{66}}{462} & 0 & 0 & 0 \\
\frac{\sqrt{110}}{120} & 0 & 0 & 0 & \frac{\sqrt{22}}{56} & 0 & 0 & \frac{2\sqrt{165}}{825} & 0 & 0 & 0 & \frac{4\sqrt{55}}{1155} & 0 & 0 \\
0 & \frac{\sqrt{110}}{120} & 0 & 0 & 0 & -\frac{\sqrt{22}}{168} & 0 & 0 & \frac{\sqrt{11}}{165} & 0 & 0 & 0 & -\frac{\sqrt{33}}{231} & 0 \\
\end{bmatrix}$$

| 822 | symmetry | $\dfrac{\sqrt{35}xy(x-y)(x+y)}{2}$ |
|---|---|---|

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_4^{(1,1;a)}(A_{2u})$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2310}i}{105} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{385}i}{350} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{165}i}{150} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{165}i}{150} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{2310}i}{105} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{385}i}{350} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{2310}i}{420} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{231}i}{1155} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2310}i}{420} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{4\sqrt{385}i}{1925} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{110}i}{275} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{110}i}{275} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{2310}i}{420} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{4\sqrt{385}i}{1925} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{2310}i}{420} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{231}i}{1155} & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

| No. | | |
|---|---|---|
| 823 | symmetry | $\dfrac{\sqrt{5}(x-y)(x+y)\left(x^2+y^2-6z^2\right)}{4}$ |

$\mathbb{M}_4^{(1,1;a)}(B_{1u})$

$$\begin{bmatrix}
0 & 0 & 0 & \frac{\sqrt{33}}{21} & 0 & 0 & -\frac{\sqrt{385}}{700} & 0 & 0 & 0 & -\frac{3\sqrt{11}}{140} & 0 & 0 & 0 \\
-\frac{\sqrt{110}}{70} & 0 & 0 & 0 & -\frac{\sqrt{22}}{14} & 0 & 0 & \frac{11\sqrt{165}}{2100} & 0 & 0 & 0 & -\frac{\sqrt{55}}{700} & 0 & 0 \\
0 & \frac{\sqrt{22}}{14} & 0 & 0 & 0 & \frac{\sqrt{110}}{70} & 0 & 0 & -\frac{\sqrt{55}}{700} & 0 & 0 & 0 & \frac{11\sqrt{165}}{2100} & 0 \\
0 & 0 & -\frac{\sqrt{33}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{11}}{140} & 0 & 0 & 0 & -\frac{\sqrt{385}}{700} \\
0 & 0 & \frac{\sqrt{165}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{55}}{385} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{33}}{84} & 0 & 0 & \frac{3\sqrt{385}}{1925} & 0 & 0 & 0 & -\frac{\sqrt{11}}{385} & 0 & 0 & 0 \\
\frac{\sqrt{165}}{140} & 0 & 0 & 0 & -\frac{\sqrt{33}}{84} & 0 & 0 & -\frac{9\sqrt{110}}{3850} & 0 & 0 & 0 & \frac{17\sqrt{330}}{11550} & 0 & 0 \\
0 & -\frac{\sqrt{33}}{84} & 0 & 0 & 0 & \frac{\sqrt{165}}{140} & 0 & 0 & -\frac{17\sqrt{330}}{11550} & 0 & 0 & 0 & \frac{9\sqrt{110}}{3850} & 0 \\
0 & 0 & -\frac{\sqrt{33}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{11}}{385} & 0 & 0 & 0 & -\frac{3\sqrt{385}}{1925} \\
0 & 0 & 0 & \frac{\sqrt{165}}{140} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt{55}}{385} & 0 & 0 & 0
\end{bmatrix}$$

| No. | | |
|---|---|---|
| 824 | symmetry | $-\dfrac{\sqrt{5}xy\left(x^2+y^2-6z^2\right)}{2}$ |

*continued ...*

284

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_4^{(1,1;a)}(B_{2u})$$

$$
\begin{bmatrix}
0 & 0 & 0 & \frac{\sqrt{33}i}{21} & 0 & 0 & \frac{\sqrt{385}i}{700} & 0 & 0 & 0 & -\frac{3\sqrt{11}i}{140} & 0 & 0 & 0 \\[4pt]
\frac{\sqrt{110}i}{70} & 0 & 0 & 0 & -\frac{\sqrt{22}i}{14} & 0 & 0 & -\frac{11\sqrt{165}i}{2100} & 0 & 0 & 0 & -\frac{\sqrt{55}i}{700} & 0 & 0 \\[4pt]
0 & -\frac{\sqrt{22}i}{14} & 0 & 0 & 0 & \frac{\sqrt{110}i}{70} & 0 & 0 & \frac{\sqrt{55}i}{700} & 0 & 0 & 0 & \frac{11\sqrt{165}i}{2100} & 0 \\[4pt]
0 & 0 & \frac{\sqrt{33}i}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{11}i}{140} & 0 & 0 & 0 & -\frac{\sqrt{385}i}{700} \\[4pt]
0 & 0 & \frac{\sqrt{165}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{55}i}{385} & 0 & 0 & 0 & 0 \\[4pt]
0 & 0 & 0 & -\frac{\sqrt{33}i}{84} & 0 & 0 & -\frac{3\sqrt{385}i}{1925} & 0 & 0 & 0 & -\frac{\sqrt{11}i}{385} & 0 & 0 & 0 \\[4pt]
-\frac{\sqrt{165}i}{140} & 0 & 0 & 0 & -\frac{\sqrt{33}i}{84} & 0 & 0 & \frac{9\sqrt{110}i}{3850} & 0 & 0 & 0 & \frac{17\sqrt{330}i}{11550} & 0 & 0 \\[4pt]
0 & \frac{\sqrt{33}i}{84} & 0 & 0 & 0 & \frac{\sqrt{165}i}{140} & 0 & 0 & \frac{17\sqrt{330}i}{11550} & 0 & 0 & 0 & \frac{9\sqrt{110}i}{3850} & 0 \\[4pt]
0 & 0 & \frac{\sqrt{33}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{11}i}{385} & 0 & 0 & 0 & -\frac{3\sqrt{385}i}{1925} \\[4pt]
0 & 0 & 0 & -\frac{\sqrt{165}i}{140} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{55}i}{385} & 0 & 0 & 0
\end{bmatrix}
$$

| 825 | symmetry | $\dfrac{\sqrt{35}yz(y-z)(y+z)}{2}$ |
|---|---|---|

$$\mathbb{M}_{4,1}^{(1,1;a)}(E_u,1)$$

$$
\begin{bmatrix}
-\frac{\sqrt{2310}i}{840} & 0 & -\frac{\sqrt{231}i}{84} & 0 & -\frac{\sqrt{462}i}{168} & 0 & 0 & \frac{3\sqrt{385}i}{1400} & 0 & \frac{\sqrt{77}i}{140} & 0 & \frac{\sqrt{1155}i}{1400} & 0 & 0 \\[4pt]
0 & \frac{\sqrt{154}i}{56} & 0 & \frac{\sqrt{77}i}{28} & 0 & \frac{\sqrt{770}i}{280} & -\frac{\sqrt{165}i}{600} & 0 & -\frac{\sqrt{385}i}{350} & 0 & -\frac{\sqrt{231}i}{840} & 0 & \frac{\sqrt{1155}i}{2100} & 0 \\[4pt]
-\frac{\sqrt{770}i}{280} & 0 & -\frac{\sqrt{77}i}{28} & 0 & -\frac{\sqrt{154}i}{56} & 0 & 0 & \frac{\sqrt{1155}i}{2100} & 0 & -\frac{\sqrt{231}i}{840} & 0 & -\frac{\sqrt{385}i}{350} & 0 & -\frac{\sqrt{165}i}{600} \\[4pt]
0 & \frac{\sqrt{462}i}{168} & 0 & \frac{\sqrt{231}i}{84} & 0 & \frac{\sqrt{2310}i}{840} & 0 & 0 & \frac{\sqrt{1155}i}{1400} & 0 & \frac{\sqrt{77}i}{140} & 0 & \frac{3\sqrt{385}i}{1400} & 0 \\[4pt]
0 & -\frac{\sqrt{2310}i}{840} & 0 & -\frac{\sqrt{1155}i}{840} & 0 & 0 & \frac{\sqrt{11}i}{220} & 0 & \frac{\sqrt{231}i}{462} & 0 & \frac{\sqrt{385}i}{1540} & 0 & 0 & 0 \\[4pt]
\frac{\sqrt{2310}i}{840} & 0 & \frac{\sqrt{231}i}{168} & 0 & 0 & 0 & 0 & -\frac{13\sqrt{385}i}{7700} & 0 & -\frac{\sqrt{77}i}{770} & 0 & \frac{\sqrt{1155}i}{3300} & 0 & 0 \\[4pt]
0 & -\frac{\sqrt{231}i}{168} & 0 & 0 & 0 & \frac{\sqrt{1155}i}{840} & \frac{3\sqrt{110}i}{2200} & 0 & \frac{\sqrt{2310}i}{46200} & 0 & -\frac{\sqrt{154}i}{440} & 0 & -\frac{\sqrt{770}i}{15400} & 0 \\[4pt]
\frac{\sqrt{1155}i}{840} & 0 & 0 & 0 & -\frac{\sqrt{231}i}{168} & 0 & 0 & \frac{\sqrt{770}i}{15400} & 0 & \frac{\sqrt{154}i}{440} & 0 & -\frac{\sqrt{2310}i}{46200} & 0 & -\frac{3\sqrt{110}i}{2200} \\[4pt]
0 & 0 & 0 & \frac{\sqrt{231}i}{168} & 0 & \frac{\sqrt{2310}i}{840} & 0 & 0 & -\frac{\sqrt{1155}i}{3300} & 0 & \frac{\sqrt{77}i}{770} & 0 & \frac{13\sqrt{385}i}{7700} & 0 \\[4pt]
0 & 0 & -\frac{\sqrt{1155}i}{840} & 0 & -\frac{\sqrt{2310}i}{840} & 0 & 0 & 0 & 0 & -\frac{\sqrt{385}i}{1540} & 0 & -\frac{\sqrt{231}i}{462} & 0 & -\frac{\sqrt{11}i}{220}
\end{bmatrix}
$$

| 826 | symmetry | $-\dfrac{\sqrt{35}xz(x-z)(x+z)}{2}$ |
|---|---|---|

*continued ...*

Table 9

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_{4,2}^{(1,1;a)}(E_u,1)$

$$\begin{bmatrix}
\frac{\sqrt{2310}}{840} & 0 & -\frac{\sqrt{231}}{84} & 0 & \frac{\sqrt{462}}{168} & 0 & 0 & -\frac{3\sqrt{385}}{1400} & 0 & \frac{\sqrt{77}}{140} & 0 & -\frac{\sqrt{1155}}{1400} & 0 & 0 \\
0 & -\frac{\sqrt{154}}{56} & 0 & \frac{\sqrt{77}}{28} & 0 & -\frac{\sqrt{770}}{280} & -\frac{\sqrt{165}}{600} & 0 & \frac{\sqrt{385}}{350} & 0 & -\frac{\sqrt{231}}{840} & 0 & -\frac{\sqrt{1155}}{2100} & 0 \\
-\frac{\sqrt{770}}{280} & 0 & \frac{\sqrt{77}}{28} & 0 & -\frac{\sqrt{154}}{56} & 0 & 0 & \frac{\sqrt{1155}}{2100} & 0 & \frac{\sqrt{231}}{840} & 0 & -\frac{\sqrt{385}}{350} & 0 & \frac{\sqrt{165}}{600} \\
0 & \frac{\sqrt{462}}{168} & 0 & -\frac{\sqrt{231}}{84} & 0 & \frac{\sqrt{2310}}{840} & 0 & 0 & \frac{\sqrt{1155}}{1400} & 0 & -\frac{\sqrt{77}}{140} & 0 & \frac{3\sqrt{385}}{1400} & 0 \\
0 & -\frac{\sqrt{2310}}{840} & 0 & \frac{\sqrt{1155}}{840} & 0 & 0 & -\frac{\sqrt{11}}{220} & 0 & \frac{\sqrt{231}}{462} & 0 & -\frac{\sqrt{385}}{1540} & 0 & 0 & 0 \\
-\frac{\sqrt{2310}}{840} & 0 & \frac{\sqrt{231}}{168} & 0 & 0 & 0 & 0 & \frac{13\sqrt{385}}{7700} & 0 & -\frac{\sqrt{77}}{770} & 0 & -\frac{\sqrt{1155}}{3300} & 0 & 0 \\
0 & \frac{\sqrt{231}}{168} & 0 & 0 & 0 & -\frac{\sqrt{1155}}{840} & \frac{3\sqrt{110}}{2200} & 0 & -\frac{\sqrt{2310}}{46200} & 0 & -\frac{\sqrt{154}}{440} & 0 & \frac{\sqrt{770}}{15400} & 0 \\
\frac{\sqrt{1155}}{840} & 0 & 0 & 0 & -\frac{\sqrt{231}}{168} & 0 & 0 & \frac{\sqrt{770}}{15400} & 0 & -\frac{\sqrt{154}}{440} & 0 & -\frac{\sqrt{2310}}{46200} & 0 & \frac{3\sqrt{110}}{2200} \\
0 & 0 & 0 & -\frac{\sqrt{231}}{168} & 0 & \frac{\sqrt{2310}}{840} & 0 & 0 & -\frac{\sqrt{1155}}{3300} & 0 & -\frac{\sqrt{77}}{770} & 0 & \frac{13\sqrt{385}}{7700} & 0 \\
0 & 0 & -\frac{\sqrt{1155}}{840} & 0 & \frac{\sqrt{2310}}{840} & 0 & 0 & 0 & 0 & -\frac{\sqrt{385}}{1540} & 0 & \frac{\sqrt{231}}{462} & 0 & -\frac{\sqrt{11}}{220}
\end{bmatrix}$$

| 827 | symmetry | $\dfrac{\sqrt{5}yz\left(6x^2-y^2-z^2\right)}{2}$ |

$\mathbb{M}_{4,1}^{(1,1;a)}(E_u,2)$

$$\begin{bmatrix}
-\frac{\sqrt{330}i}{840} & 0 & -\frac{\sqrt{33}i}{84} & 0 & \frac{\sqrt{66}i}{24} & 0 & 0 & \frac{3\sqrt{55}i}{1400} & 0 & \frac{\sqrt{11}i}{140} & 0 & -\frac{\sqrt{165}i}{200} & 0 & 0 \\
0 & \frac{\sqrt{22}i}{56} & 0 & \frac{\sqrt{11}i}{28} & 0 & -\frac{\sqrt{110}i}{40} & \frac{\sqrt{1155}i}{600} & 0 & -\frac{\sqrt{55}i}{350} & 0 & -\frac{\sqrt{33}i}{840} & 0 & -\frac{\sqrt{165}i}{300} & 0 \\
\frac{\sqrt{110}i}{40} & 0 & -\frac{\sqrt{11}i}{28} & 0 & -\frac{\sqrt{22}i}{56} & 0 & 0 & -\frac{\sqrt{165}i}{300} & 0 & -\frac{\sqrt{33}i}{840} & 0 & -\frac{\sqrt{55}i}{350} & 0 & \frac{\sqrt{1155}i}{600} \\
0 & -\frac{\sqrt{66}i}{24} & 0 & \frac{\sqrt{33}i}{84} & 0 & \frac{\sqrt{330}i}{840} & 0 & 0 & -\frac{\sqrt{165}i}{200} & 0 & \frac{\sqrt{11}i}{140} & 0 & \frac{3\sqrt{55}i}{1400} & 0 \\
0 & -\frac{\sqrt{330}i}{840} & 0 & \frac{\sqrt{165}i}{120} & 0 & 0 & \frac{\sqrt{77}i}{1540} & 0 & \frac{\sqrt{33}i}{462} & 0 & -\frac{\sqrt{55}i}{220} & 0 & 0 & 0 \\
\frac{\sqrt{330}i}{840} & 0 & \frac{\sqrt{33}i}{168} & 0 & 0 & 0 & 0 & -\frac{13\sqrt{55}i}{7700} & 0 & -\frac{\sqrt{11}i}{770} & 0 & -\frac{7\sqrt{165}i}{3300} & 0 & 0 \\
0 & -\frac{\sqrt{33}i}{168} & 0 & 0 & 0 & -\frac{\sqrt{165}i}{120} & -\frac{3\sqrt{770}i}{2200} & 0 & \frac{\sqrt{330}i}{46200} & 0 & -\frac{\sqrt{22}i}{440} & 0 & \frac{\sqrt{110}i}{2200} & 0 \\
-\frac{\sqrt{165}i}{120} & 0 & 0 & 0 & -\frac{\sqrt{33}i}{168} & 0 & 0 & -\frac{\sqrt{110}i}{2200} & 0 & \frac{\sqrt{22}i}{440} & 0 & -\frac{\sqrt{330}i}{46200} & 0 & \frac{3\sqrt{770}i}{2200} \\
0 & 0 & 0 & \frac{\sqrt{33}i}{168} & 0 & \frac{\sqrt{330}i}{840} & 0 & 0 & \frac{7\sqrt{165}i}{3300} & 0 & \frac{\sqrt{11}i}{770} & 0 & \frac{13\sqrt{55}i}{7700} & 0 \\
0 & 0 & \frac{\sqrt{165}i}{120} & 0 & -\frac{\sqrt{330}i}{840} & 0 & 0 & 0 & 0 & \frac{\sqrt{55}i}{220} & 0 & -\frac{\sqrt{33}i}{462} & 0 & -\frac{\sqrt{77}i}{1540}
\end{bmatrix}$$

| 828 | symmetry | $\dfrac{\sqrt{5}xz\left(x^2-6y^2+z^2\right)}{2}$ |

Table 9

| No. | multipole | matrix | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{M}_{4,2}^{(1,1;a)}(E_u,2)$ | $\frac{\sqrt{330}}{840}$ | $0$ | $-\frac{\sqrt{33}}{84}$ | $0$ | $-\frac{\sqrt{66}}{24}$ | $0$ | $0$ | $-\frac{3\sqrt{55}}{1400}$ | $0$ | $\frac{\sqrt{11}}{140}$ | $0$ | $\frac{\sqrt{165}}{200}$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{22}}{56}$ | $0$ | $\frac{\sqrt{11}}{28}$ | $0$ | $\frac{\sqrt{110}}{40}$ | $\frac{\sqrt{1155}}{600}$ | $0$ | $\frac{\sqrt{55}}{350}$ | $0$ | $-\frac{\sqrt{33}}{840}$ | $0$ | $\frac{\sqrt{165}}{300}$ | $0$ |
| | | $\frac{\sqrt{110}}{40}$ | $0$ | $\frac{\sqrt{11}}{28}$ | $0$ | $-\frac{\sqrt{22}}{56}$ | $0$ | $0$ | $-\frac{\sqrt{165}}{300}$ | $0$ | $\frac{\sqrt{33}}{840}$ | $0$ | $-\frac{\sqrt{55}}{350}$ | $0$ | $-\frac{\sqrt{1155}}{600}$ |
| | | $0$ | $-\frac{\sqrt{66}}{24}$ | $0$ | $-\frac{\sqrt{33}}{84}$ | $0$ | $\frac{\sqrt{330}}{840}$ | $0$ | $0$ | $-\frac{\sqrt{165}}{200}$ | $0$ | $-\frac{\sqrt{11}}{140}$ | $0$ | $\frac{3\sqrt{55}}{1400}$ | $0$ |
| | | $0$ | $-\frac{\sqrt{330}}{840}$ | $0$ | $-\frac{\sqrt{165}}{120}$ | $0$ | $0$ | $-\frac{\sqrt{77}}{1540}$ | $0$ | $\frac{\sqrt{33}}{462}$ | $0$ | $\frac{\sqrt{55}}{220}$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{330}}{840}$ | $0$ | $\frac{\sqrt{33}}{168}$ | $0$ | $0$ | $0$ | $0$ | $\frac{13\sqrt{55}}{7700}$ | $0$ | $-\frac{\sqrt{11}}{770}$ | $0$ | $\frac{7\sqrt{165}}{3300}$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{33}}{168}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{165}}{120}$ | $-\frac{3\sqrt{770}}{2200}$ | $0$ | $-\frac{\sqrt{330}}{46200}$ | $0$ | $-\frac{\sqrt{22}}{440}$ | $0$ | $-\frac{\sqrt{110}}{2200}$ | $0$ |
| | | $-\frac{\sqrt{165}}{120}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{33}}{168}$ | $0$ | $0$ | $-\frac{\sqrt{110}}{2200}$ | $0$ | $-\frac{\sqrt{22}}{440}$ | $0$ | $-\frac{\sqrt{330}}{46200}$ | $0$ | $-\frac{3\sqrt{770}}{2200}$ |
| | | $0$ | $0$ | $0$ | $-\frac{\sqrt{33}}{168}$ | $0$ | $\frac{\sqrt{330}}{840}$ | $0$ | $0$ | $\frac{7\sqrt{165}}{3300}$ | $0$ | $-\frac{\sqrt{11}}{770}$ | $0$ | $\frac{13\sqrt{55}}{7700}$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{165}}{120}$ | $0$ | $\frac{\sqrt{330}}{840}$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{55}}{220}$ | $0$ | $\frac{\sqrt{33}}{462}$ | $0$ | $-\frac{\sqrt{77}}{1540}$ |

bra: $= \langle\frac{5}{2},\frac{5}{2};f|,\langle\frac{5}{2},\frac{3}{2};f|,\langle\frac{5}{2},\frac{1}{2};f|,\langle\frac{5}{2},-\frac{1}{2};f|,\langle\frac{5}{2},-\frac{3}{2};f|,\langle\frac{5}{2},-\frac{5}{2};f|,\langle\frac{7}{2},\frac{7}{2};f|,\langle\frac{7}{2},\frac{5}{2};f|,\langle\frac{7}{2},\frac{3}{2};f|,\langle\frac{7}{2},\frac{1}{2};f|,\langle\frac{7}{2},-\frac{1}{2};f|,\langle\frac{7}{2},-\frac{3}{2};f|,\langle\frac{7}{2},-\frac{5}{2};f|,\langle\frac{7}{2},-\frac{7}{2};f|$

ket: $= |\frac{5}{2},\frac{5}{2};f\rangle,|\frac{5}{2},\frac{3}{2};f\rangle,|\frac{5}{2},\frac{1}{2};f\rangle,|\frac{5}{2},-\frac{1}{2};f\rangle,|\frac{5}{2},-\frac{3}{2};f\rangle,|\frac{5}{2},-\frac{5}{2};f\rangle,|\frac{7}{2},\frac{7}{2};f\rangle,|\frac{7}{2},\frac{5}{2};f\rangle,|\frac{7}{2},\frac{3}{2};f\rangle,|\frac{7}{2},\frac{1}{2};f\rangle,|\frac{7}{2},-\frac{1}{2};f\rangle,|\frac{7}{2},-\frac{3}{2};f\rangle,|\frac{7}{2},-\frac{5}{2};f\rangle,|\frac{7}{2},-\frac{7}{2};f\rangle$

Table 10: (f,f) block.

| No. | multipole | matrix |
|---|---|---|
| 829 | symmetry | 1 |

*continued ...*

Table 10

| No. | multipole | matrix |
|-----|-----------|--------|
| | $\mathbb{Q}_0^{(a)}(A_{1g})$ | $\begin{pmatrix} \frac{\sqrt{14}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{14}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{14}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{14}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{14} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{14} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{14} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{14} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{14} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{14} \end{pmatrix}$ |
| 830 | symmetry | $-\frac{x^2}{2} - \frac{y^2}{2} + z^2$ |

Table 10

| No. | multipole | matrix |
|---|---|---|

$$\begin{pmatrix}
-\frac{5\sqrt{42}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{7}}{98} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{42}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}}{98} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{2\sqrt{42}}{49} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{98} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{2\sqrt{42}}{49} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{98} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{42}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}}{98} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{42}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{7}}{98} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{42}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{5\sqrt{7}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{42}}{588} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{105}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{42}}{196} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{14}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{25\sqrt{42}}{588} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{14}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{25\sqrt{42}}{588} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{105}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{42}}{196} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{7}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{42}}{588} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{42}}{84}
\end{pmatrix}$$

with multipole $\mathbb{Q}_2^{(a)}(A_{1g})$

| 831 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |
|---|---|---|

*continued …*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{Q}_2^{(a)}(B_{1g})$ | $0$ | $0$ | $-\frac{3\sqrt{35}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{105}}{294}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{9\sqrt{7}}{98}$ | $0$ | $0$ | $\frac{\sqrt{15}}{42}$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{21}}{147}$ | $0$ | $0$ | $0$ |
| | | $-\frac{3\sqrt{35}}{98}$ | $0$ | $0$ | $0$ | $-\frac{9\sqrt{7}}{98}$ | $0$ | $0$ | $\frac{\sqrt{210}}{147}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{70}}{98}$ | $0$ | $0$ |
| | | $0$ | $-\frac{9\sqrt{7}}{98}$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{35}}{98}$ | $0$ | $0$ | $\frac{\sqrt{70}}{98}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{210}}{147}$ | $0$ |
| | | $0$ | $0$ | $-\frac{9\sqrt{7}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{2\sqrt{21}}{147}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{15}}{42}$ |
| | | $0$ | $0$ | $0$ | $-\frac{3\sqrt{35}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{105}}{294}$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{15}}{42}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{6}}{84}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{210}}{147}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{70}}{196}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{70}}{98}$ | $0$ | $0$ | $-\frac{5\sqrt{6}}{84}$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{210}}{294}$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{105}}{294}$ | $0$ | $0$ | $0$ | $\frac{2\sqrt{21}}{147}$ | $0$ | $0$ | $-\frac{5\sqrt{70}}{196}$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{210}}{294}$ | $0$ | $0$ |
| | | $0$ | $-\frac{2\sqrt{21}}{147}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{105}}{294}$ | $0$ | $0$ | $-\frac{5\sqrt{210}}{294}$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{70}}{196}$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{70}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{210}}{294}$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{6}}{84}$ |
| | | $0$ | $0$ | $0$ | $-\frac{\sqrt{210}}{147}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{70}}{196}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{15}}{42}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{6}}{84}$ | $0$ | $0$ |

| 832 | symmetry | $\sqrt{3}xy$ |

*continued ...*

Table 10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{Q}_2^{(a)}(B_{2g})$$

$$\begin{pmatrix}
0 & 0 & \frac{3\sqrt{35}i}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}i}{294} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{9\sqrt{7}i}{98} & 0 & 0 & \frac{\sqrt{15}i}{42} & 0 & 0 & 0 & \frac{2\sqrt{21}i}{147} & 0 & 0 & 0 \\
-\frac{3\sqrt{35}i}{98} & 0 & 0 & 0 & \frac{9\sqrt{7}i}{98} & 0 & 0 & \frac{\sqrt{210}i}{147} & 0 & 0 & 0 & \frac{\sqrt{70}i}{98} & 0 & 0 \\
0 & -\frac{9\sqrt{7}i}{98} & 0 & 0 & 0 & \frac{3\sqrt{35}i}{98} & 0 & 0 & \frac{\sqrt{70}i}{98} & 0 & 0 & 0 & \frac{\sqrt{210}i}{147} & 0 \\
0 & 0 & -\frac{9\sqrt{7}i}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt{21}i}{147} & 0 & 0 & 0 & \frac{\sqrt{15}i}{42} \\
0 & 0 & 0 & -\frac{3\sqrt{35}i}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}i}{294} & 0 & 0 & 0 \\
0 & -\frac{\sqrt{15}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{6}i}{84} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{210}i}{147} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{70}i}{196} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{70}i}{98} & 0 & 0 & -\frac{5\sqrt{6}i}{84} & 0 & 0 & 0 & \frac{5\sqrt{210}i}{294} & 0 & 0 & 0 \\
-\frac{\sqrt{105}i}{294} & 0 & 0 & 0 & -\frac{2\sqrt{21}i}{147} & 0 & 0 & -\frac{5\sqrt{70}i}{196} & 0 & 0 & 0 & \frac{5\sqrt{210}i}{294} & 0 & 0 \\
0 & -\frac{2\sqrt{21}i}{147} & 0 & 0 & 0 & -\frac{\sqrt{105}i}{294} & 0 & 0 & -\frac{5\sqrt{210}i}{294} & 0 & 0 & 0 & \frac{5\sqrt{70}i}{196} & 0 \\
0 & 0 & -\frac{\sqrt{70}i}{98} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{210}i}{294} & 0 & 0 & 0 & \frac{5\sqrt{6}i}{84} \\
0 & 0 & 0 & -\frac{\sqrt{210}i}{147} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{70}i}{196} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{6}i}{84} & 0 & 0
\end{pmatrix}$$

| 833 | symmetry | $\sqrt{3}yz$ |

*continued ...*

Table 10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{Q}_{2,1}^{(a)}(E_g)$$

$$
\begin{pmatrix}
0 & \frac{3\sqrt{70}i}{98} & 0 & 0 & 0 & 0 & \frac{5\sqrt{3}i}{84} & 0 & \frac{5\sqrt{7}i}{196} & 0 & 0 & 0 & 0 & 0 \\
-\frac{3\sqrt{70}i}{98} & 0 & \frac{3\sqrt{7}i}{49} & 0 & 0 & 0 & 0 & \frac{\sqrt{105}i}{588} & 0 & \frac{11\sqrt{21}i}{588} & 0 & 0 & 0 & 0 \\
0 & -\frac{3\sqrt{7}i}{49} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{196} & 0 & \frac{\sqrt{42}i}{84} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{3\sqrt{7}i}{49} & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}i}{84} & 0 & \frac{\sqrt{70}i}{196} & 0 & 0 \\
0 & 0 & 0 & \frac{3\sqrt{7}i}{49} & 0 & -\frac{3\sqrt{70}i}{98} & 0 & 0 & 0 & 0 & -\frac{11\sqrt{21}i}{588} & 0 & -\frac{\sqrt{105}i}{588} & 0 \\
0 & 0 & 0 & 0 & \frac{3\sqrt{70}i}{98} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{7}i}{196} & 0 & -\frac{5\sqrt{3}i}{84} \\
-\frac{5\sqrt{3}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{2}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{105}i}{588} & 0 & 0 & 0 & 0 & -\frac{5\sqrt{2}i}{28} & 0 & \frac{5\sqrt{42}i}{147} & 0 & 0 & 0 & 0 & 0 \\
-\frac{5\sqrt{7}i}{196} & 0 & \frac{\sqrt{70}i}{196} & 0 & 0 & 0 & 0 & -\frac{5\sqrt{42}i}{147} & 0 & \frac{5\sqrt{210}i}{588} & 0 & 0 & 0 & 0 \\
0 & -\frac{11\sqrt{21}i}{588} & 0 & \frac{\sqrt{42}i}{84} & 0 & 0 & 0 & 0 & -\frac{5\sqrt{210}i}{588} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{42}i}{84} & 0 & \frac{11\sqrt{21}i}{588} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{210}i}{588} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{70}i}{196} & 0 & \frac{5\sqrt{7}i}{196} & 0 & 0 & 0 & 0 & \frac{5\sqrt{210}i}{588} & 0 & -\frac{5\sqrt{42}i}{147} & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{105}i}{588} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{42}i}{147} & 0 & -\frac{5\sqrt{2}i}{28} \\
0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{3}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{2}i}{28} & 0
\end{pmatrix}
$$

| 834 | symmetry | $\sqrt{3}xz$ |
|---|---|---|

*continued ...*

292

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|-----|-----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{Q}^{(a)}_{2,2}(E_g)$ | $0$ | $-\frac{3\sqrt{70}}{98}$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{3}}{84}$ | $0$ | $-\frac{5\sqrt{7}}{196}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $-\frac{3\sqrt{70}}{98}$ | $0$ | $-\frac{3\sqrt{7}}{49}$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{105}}{588}$ | $0$ | $-\frac{11\sqrt{21}}{588}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{3\sqrt{7}}{49}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{70}}{196}$ | $0$ | $-\frac{\sqrt{42}}{84}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{7}}{49}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{42}}{84}$ | $0$ | $-\frac{\sqrt{70}}{196}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{3\sqrt{7}}{49}$ | $0$ | $\frac{3\sqrt{70}}{98}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{11\sqrt{21}}{588}$ | $0$ | $\frac{\sqrt{105}}{588}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{70}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{7}}{196}$ | $0$ | $\frac{5\sqrt{3}}{84}$ |
| | | $\frac{5\sqrt{3}}{84}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{2}}{28}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{105}}{588}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{2}}{28}$ | $0$ | $-\frac{5\sqrt{42}}{147}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $-\frac{5\sqrt{7}}{196}$ | $0$ | $-\frac{\sqrt{70}}{196}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{42}}{147}$ | $0$ | $-\frac{5\sqrt{210}}{588}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{11\sqrt{21}}{588}$ | $0$ | $-\frac{\sqrt{42}}{84}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{210}}{588}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{42}}{84}$ | $0$ | $-\frac{11\sqrt{21}}{588}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{210}}{588}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{\sqrt{70}}{196}$ | $0$ | $-\frac{5\sqrt{7}}{196}$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{210}}{588}$ | $0$ | $\frac{5\sqrt{42}}{147}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{105}}{588}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{42}}{147}$ | $0$ | $\frac{5\sqrt{2}}{28}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{3}}{84}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{2}}{28}$ | $0$ |
| 835 | symmetry | $\frac{\sqrt{21}\left(x^4-3x^2y^2-3x^2z^2+y^4-3y^2z^2+z^4\right)}{6}$ | | | | | | | | | | | | | |

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{Q}_4^{(a)}(A_{1g},1)$ | $\frac{\sqrt{33}}{84}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{165}}{84}$ | $0$ | $0$ | $\frac{5\sqrt{22}}{154}$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{66}}{462}$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{33}}{28}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{165}}{84}$ | $0$ | $0$ | $-\frac{2\sqrt{330}}{231}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{110}}{77}$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{33}}{42}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{11}}{154}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{385}}{154}$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{33}}{42}$ | $0$ | $0$ | $-\frac{\sqrt{385}}{154}$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{11}}{154}$ | $0$ | $0$ | $0$ |
| | | $\frac{\sqrt{165}}{84}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{33}}{28}$ | $0$ | $0$ | $-\frac{\sqrt{110}}{77}$ | $0$ | $0$ | $0$ | $\frac{2\sqrt{330}}{231}$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{165}}{84}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{33}}{84}$ | $0$ | $0$ | $-\frac{5\sqrt{66}}{462}$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{22}}{154}$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{\sqrt{385}}{154}$ | $0$ | $0$ | $\frac{\sqrt{33}}{44}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{1155}}{308}$ | $0$ | $0$ | $0$ |
| | | $\frac{5\sqrt{22}}{154}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{110}}{77}$ | $0$ | $0$ | $-\frac{13\sqrt{33}}{308}$ | $0$ | $0$ | $0$ | $\frac{15\sqrt{11}}{308}$ | $0$ | $0$ |
| | | $0$ | $-\frac{2\sqrt{330}}{231}$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{66}}{462}$ | $0$ | $0$ | $-\frac{3\sqrt{33}}{308}$ | $0$ | $0$ | $0$ | $\frac{15\sqrt{11}}{308}$ | $0$ |
| | | $0$ | $0$ | $-\frac{5\sqrt{11}}{154}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{9\sqrt{33}}{308}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{1155}}{308}$ |
| | | $0$ | $0$ | $0$ | $\frac{5\sqrt{11}}{154}$ | $0$ | $0$ | $\frac{\sqrt{1155}}{308}$ | $0$ | $0$ | $0$ | $\frac{9\sqrt{33}}{308}$ | $0$ | $0$ | $0$ |
| | | $\frac{5\sqrt{66}}{462}$ | $0$ | $0$ | $0$ | $\frac{2\sqrt{330}}{231}$ | $0$ | $0$ | $\frac{15\sqrt{11}}{308}$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{33}}{308}$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{110}}{77}$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{22}}{154}$ | $0$ | $0$ | $\frac{15\sqrt{11}}{308}$ | $0$ | $0$ | $0$ | $-\frac{13\sqrt{33}}{308}$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{385}}{154}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{1155}}{308}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{33}}{44}$ |
| 836 | symmetry | $-\frac{\sqrt{15}\left(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4\right)}{12}$ | | | | | | | | | | | | | | |

*continued …*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{Q}_4^{(a)}(A_{1g},2)$ | $\frac{\sqrt{1155}}{588}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{231}}{84}$ | $0$ | $0$ | $\frac{5\sqrt{770}}{1078}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2310}}{462}$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{1155}}{196}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{231}}{84}$ | $0$ | $0$ | $-\frac{10\sqrt{462}}{1617}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{154}}{77}$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{1155}}{294}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{385}}{1078}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{11}}{22}$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{1155}}{294}$ | $0$ | $0$ | $\frac{\sqrt{11}}{22}$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{385}}{1078}$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{231}}{84}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{1155}}{196}$ | $0$ | $0$ | $\frac{\sqrt{154}}{77}$ | $0$ | $0$ | $0$ | $\frac{10\sqrt{462}}{1617}$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{231}}{84}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{1155}}{588}$ | $0$ | $0$ | $\frac{\sqrt{2310}}{462}$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{770}}{1078}$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{11}}{22}$ | $0$ | $0$ | $\frac{\sqrt{1155}}{308}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{33}}{44}$ | $0$ | $0$ | $0$ |
| | | $\frac{5\sqrt{770}}{1078}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{154}}{77}$ | $0$ | $0$ | $-\frac{13\sqrt{1155}}{2156}$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{385}}{308}$ | $0$ | $0$ |
| | | $0$ | $-\frac{10\sqrt{462}}{1617}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{2310}}{462}$ | $0$ | $0$ | $-\frac{3\sqrt{1155}}{2156}$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{385}}{308}$ | $0$ |
| | | $0$ | $0$ | $-\frac{5\sqrt{385}}{1078}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{9\sqrt{1155}}{2156}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{33}}{44}$ |
| | | $0$ | $0$ | $0$ | $\frac{5\sqrt{385}}{1078}$ | $0$ | $0$ | $-\frac{\sqrt{33}}{44}$ | $0$ | $0$ | $0$ | $\frac{9\sqrt{1155}}{2156}$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{2310}}{462}$ | $0$ | $0$ | $0$ | $\frac{10\sqrt{462}}{1617}$ | $0$ | $0$ | $-\frac{3\sqrt{385}}{308}$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{1155}}{2156}$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{154}}{77}$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{770}}{1078}$ | $0$ | $0$ | $-\frac{3\sqrt{385}}{308}$ | $0$ | $0$ | $0$ | $-\frac{13\sqrt{1155}}{2156}$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{11}}{22}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{33}}{44}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{1155}}{308}$ |
| 837 | symmetry | $\frac{\sqrt{35}xy(x-y)(x+y)}{2}$ | | | | | | | | | | | | | |

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{Q}_4^{(a)}(A_{2g})$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{11}i}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{110}i}{77}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{11}i}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{66}i}{77}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{231}i}{77}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{231}i}{77}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $\frac{\sqrt{11}i}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{66}i}{77}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{11}i}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{110}i}{77}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{231}i}{77}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{77}i}{154}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $\frac{2\sqrt{66}i}{77}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{165}i}{154}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{110}i}{77}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{165}i}{154}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{77}i}{154}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{77}i}{154}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $\frac{\sqrt{110}i}{77}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{165}i}{154}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{2\sqrt{66}i}{77}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{165}i}{154}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{231}i}{77}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{77}i}{154}$ | $0$ | $0$ | $0$ | $0$ |

| 838 | symmetry | $\frac{\sqrt{5}(x-y)(x+y)\left(x^2+y^2-6z^2\right)}{4}$ |

*continued …*

Table 10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{Q}_4^{(a)}(B_{1g})$$

$$\begin{pmatrix}
0 & 0 & -\frac{3\sqrt{154}}{196} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{462}}{539} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{770}}{196} & 0 & 0 & \frac{3\sqrt{66}}{154} & 0 & 0 & 0 & -\frac{\sqrt{2310}}{1078} & 0 & 0 & 0 \\
-\frac{3\sqrt{154}}{196} & 0 & 0 & 0 & \frac{\sqrt{770}}{196} & 0 & 0 & -\frac{9\sqrt{231}}{1078} & 0 & 0 & 0 & \frac{17\sqrt{77}}{1078} & 0 & 0 \\
0 & \frac{\sqrt{770}}{196} & 0 & 0 & 0 & -\frac{3\sqrt{154}}{196} & 0 & 0 & -\frac{17\sqrt{77}}{1078} & 0 & 0 & 0 & \frac{9\sqrt{231}}{1078} & 0 \\
0 & 0 & \frac{\sqrt{770}}{196} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2310}}{1078} & 0 & 0 & 0 & -\frac{3\sqrt{66}}{154} \\
0 & 0 & 0 & -\frac{3\sqrt{154}}{196} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{462}}{539} & 0 & 0 & 0 \\
0 & \frac{3\sqrt{66}}{154} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{165}}{154} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{9\sqrt{231}}{1078} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{77}}{1078} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{17\sqrt{77}}{1078} & 0 & 0 & -\frac{3\sqrt{165}}{154} & 0 & 0 & 0 & \frac{6\sqrt{231}}{539} & 0 & 0 & 0 \\
-\frac{5\sqrt{462}}{539} & 0 & 0 & 0 & \frac{\sqrt{2310}}{1078} & 0 & 0 & -\frac{3\sqrt{77}}{1078} & 0 & 0 & 0 & \frac{6\sqrt{231}}{539} & 0 & 0 \\
0 & -\frac{\sqrt{2310}}{1078} & 0 & 0 & 0 & \frac{5\sqrt{462}}{539} & 0 & 0 & \frac{6\sqrt{231}}{539} & 0 & 0 & 0 & -\frac{3\sqrt{77}}{1078} & 0 \\
0 & 0 & \frac{17\sqrt{77}}{1078} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{6\sqrt{231}}{539} & 0 & 0 & 0 & -\frac{3\sqrt{165}}{154} \\
0 & 0 & 0 & \frac{9\sqrt{231}}{1078} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{77}}{1078} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{3\sqrt{66}}{154} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{165}}{154} & 0 & 0
\end{pmatrix}$$

| No. | | matrix |
|---|---|---|
| 839 | symmetry | $-\frac{\sqrt{5}xy\left(x^2+y^2-6z^2\right)}{2}$ |

*continued …*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{Q}_4^{(a)}(B_{2g})$ | $0$ | $0$ | $-\frac{3\sqrt{154}i}{196}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{462}i}{539}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{770}i}{196}$ | $0$ | $0$ | $-\frac{3\sqrt{66}i}{154}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2310}i}{1078}$ | $0$ | $0$ | $0$ |
| | | $\frac{3\sqrt{154}i}{196}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{770}i}{196}$ | $0$ | $0$ | $\frac{9\sqrt{231}i}{1078}$ | $0$ | $0$ | $0$ | $\frac{17\sqrt{77}i}{1078}$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{770}i}{196}$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{154}i}{196}$ | $0$ | $0$ | $\frac{17\sqrt{77}i}{1078}$ | $0$ | $0$ | $0$ | $\frac{9\sqrt{231}i}{1078}$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{770}i}{196}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2310}i}{1078}$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{66}i}{154}$ |
| | | $0$ | $0$ | $0$ | $\frac{3\sqrt{154}i}{196}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{462}i}{539}$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{3\sqrt{66}i}{154}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{165}i}{154}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $-\frac{9\sqrt{231}i}{1078}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{77}i}{1078}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{17\sqrt{77}i}{1078}$ | $0$ | $0$ | $\frac{3\sqrt{165}i}{154}$ | $0$ | $0$ | $0$ | $\frac{6\sqrt{231}i}{539}$ | $0$ | $0$ | $0$ |
| | | $\frac{5\sqrt{462}i}{539}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{2310}i}{1078}$ | $0$ | $0$ | $\frac{3\sqrt{77}i}{1078}$ | $0$ | $0$ | $0$ | $\frac{6\sqrt{231}i}{539}$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{2310}i}{1078}$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{462}i}{539}$ | $0$ | $0$ | $-\frac{6\sqrt{231}i}{539}$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{77}i}{1078}$ | $0$ |
| | | $0$ | $0$ | $-\frac{17\sqrt{77}i}{1078}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{6\sqrt{231}i}{539}$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{165}i}{154}$ |
| | | $0$ | $0$ | $0$ | $-\frac{9\sqrt{231}i}{1078}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{77}i}{1078}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{66}i}{154}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{165}i}{154}$ | $0$ | $0$ |

| 840 | symmetry | $\frac{\sqrt{35}yz(y-z)(y+z)}{2}$ |

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{Q}_{4,1}^{(a)}(E_g,1)$ | $0$ | $\frac{\sqrt{11}i}{28}$ | $0$ | $\frac{\sqrt{22}i}{56}$ | $0$ | $0$ | $\frac{\sqrt{2310}i}{616}$ | $0$ | $\frac{5\sqrt{110}i}{308}$ | $0$ | $\frac{5\sqrt{66}i}{616}$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{11}i}{28}$ | $0$ | $-\frac{\sqrt{110}i}{56}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{13\sqrt{66}i}{616}$ | $0$ | $-\frac{\sqrt{330}i}{308}$ | $0$ | $\frac{\sqrt{22}i}{88}$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{110}i}{56}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{22}i}{56}$ | $\frac{3\sqrt{231}i}{616}$ | $0$ | $\frac{\sqrt{11}i}{616}$ | $0$ | $-\frac{\sqrt{165}i}{88}$ | $0$ | $-\frac{\sqrt{33}i}{616}$ | $0$ |
| | | $-\frac{\sqrt{22}i}{56}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{110}i}{56}$ | $0$ | $0$ | $\frac{\sqrt{33}i}{616}$ | $0$ | $\frac{\sqrt{165}i}{88}$ | $0$ | $-\frac{\sqrt{11}i}{616}$ | $0$ | $-\frac{3\sqrt{231}i}{616}$ |
| | | $0$ | $0$ | $0$ | $-\frac{\sqrt{110}i}{56}$ | $0$ | $-\frac{\sqrt{11}i}{28}$ | $0$ | $0$ | $-\frac{\sqrt{22}i}{88}$ | $0$ | $\frac{\sqrt{330}i}{308}$ | $0$ | $\frac{13\sqrt{66}i}{616}$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{22}i}{56}$ | $0$ | $\frac{\sqrt{11}i}{28}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{66}i}{616}$ | $0$ | $-\frac{5\sqrt{110}i}{308}$ | $0$ | $-\frac{\sqrt{2310}i}{616}$ |
| | | $-\frac{\sqrt{2310}i}{616}$ | $0$ | $-\frac{3\sqrt{231}i}{616}$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{385}i}{308}$ | $0$ | $\frac{3\sqrt{77}i}{308}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{13\sqrt{66}i}{616}$ | $0$ | $-\frac{\sqrt{33}i}{616}$ | $0$ | $0$ | $-\frac{3\sqrt{385}i}{308}$ | $0$ | $-\frac{3\sqrt{165}i}{308}$ | $0$ | $\frac{3\sqrt{11}i}{154}$ | $0$ | $0$ | $0$ |
| | | $-\frac{5\sqrt{110}i}{308}$ | $0$ | $-\frac{\sqrt{11}i}{616}$ | $0$ | $\frac{\sqrt{22}i}{88}$ | $0$ | $0$ | $\frac{3\sqrt{165}i}{308}$ | $0$ | $-\frac{9\sqrt{33}i}{308}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{330}i}{308}$ | $0$ | $-\frac{\sqrt{165}i}{88}$ | $0$ | $\frac{5\sqrt{66}i}{616}$ | $-\frac{3\sqrt{77}i}{308}$ | $0$ | $\frac{9\sqrt{33}i}{308}$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{11}i}{154}$ | $0$ |
| | | $-\frac{5\sqrt{66}i}{616}$ | $0$ | $\frac{\sqrt{165}i}{88}$ | $0$ | $-\frac{\sqrt{330}i}{308}$ | $0$ | $0$ | $-\frac{3\sqrt{11}i}{154}$ | $0$ | $0$ | $0$ | $\frac{9\sqrt{33}i}{308}$ | $0$ | $-\frac{3\sqrt{77}i}{308}$ |
| | | $0$ | $-\frac{\sqrt{22}i}{88}$ | $0$ | $\frac{\sqrt{11}i}{616}$ | $0$ | $\frac{5\sqrt{110}i}{308}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{9\sqrt{33}i}{308}$ | $0$ | $\frac{3\sqrt{165}i}{308}$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{33}i}{616}$ | $0$ | $-\frac{13\sqrt{66}i}{616}$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{11}i}{154}$ | $0$ | $-\frac{3\sqrt{165}i}{308}$ | $0$ | $-\frac{3\sqrt{385}i}{308}$ |
| | | $0$ | $0$ | $0$ | $\frac{3\sqrt{231}i}{616}$ | $0$ | $\frac{\sqrt{2310}i}{616}$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{77}i}{308}$ | $0$ | $\frac{3\sqrt{385}i}{308}$ | $0$ |

| 841 | symmetry | $\frac{\sqrt{35}xz(x-z)(x+z)}{2}$ |

*continued ...*

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Table 10

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{4,2}^{(a)}(E_g,1)$

$$\begin{pmatrix}
0 & -\frac{\sqrt{11}}{28} & 0 & \frac{\sqrt{22}}{56} & 0 & 0 & \frac{\sqrt{2310}}{616} & 0 & -\frac{5\sqrt{110}}{308} & 0 & \frac{5\sqrt{66}}{616} & 0 & 0 & 0 \\
-\frac{\sqrt{11}}{28} & 0 & \frac{\sqrt{110}}{56} & 0 & 0 & 0 & 0 & -\frac{13\sqrt{66}}{616} & 0 & \frac{\sqrt{330}}{308} & 0 & \frac{\sqrt{22}}{88} & 0 & 0 \\
0 & \frac{\sqrt{110}}{56} & 0 & 0 & 0 & -\frac{\sqrt{22}}{56} & -\frac{3\sqrt{231}}{616} & 0 & \frac{\sqrt{11}}{616} & 0 & \frac{\sqrt{165}}{88} & 0 & -\frac{\sqrt{33}}{616} & 0 \\
\frac{\sqrt{22}}{56} & 0 & 0 & 0 & -\frac{\sqrt{110}}{56} & 0 & 0 & -\frac{\sqrt{33}}{616} & 0 & \frac{\sqrt{165}}{88} & 0 & \frac{\sqrt{11}}{616} & 0 & -\frac{3\sqrt{231}}{616} \\
0 & 0 & 0 & -\frac{\sqrt{110}}{56} & 0 & \frac{\sqrt{11}}{28} & 0 & 0 & \frac{\sqrt{22}}{88} & 0 & \frac{\sqrt{330}}{308} & 0 & -\frac{13\sqrt{66}}{616} & 0 \\
0 & 0 & -\frac{\sqrt{22}}{56} & 0 & \frac{\sqrt{11}}{28} & 0 & 0 & 0 & 0 & \frac{5\sqrt{66}}{616} & 0 & -\frac{5\sqrt{110}}{308} & 0 & \frac{\sqrt{2310}}{616} \\
\frac{\sqrt{2310}}{616} & 0 & -\frac{3\sqrt{231}}{616} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{385}}{308} & 0 & \frac{3\sqrt{77}}{308} & 0 & 0 & 0 & 0 \\
0 & -\frac{13\sqrt{66}}{616} & 0 & -\frac{\sqrt{33}}{616} & 0 & 0 & -\frac{3\sqrt{385}}{308} & 0 & \frac{3\sqrt{165}}{308} & 0 & \frac{3\sqrt{11}}{154} & 0 & 0 & 0 \\
-\frac{5\sqrt{110}}{308} & 0 & \frac{\sqrt{11}}{616} & 0 & \frac{\sqrt{22}}{88} & 0 & 0 & \frac{3\sqrt{165}}{308} & 0 & \frac{9\sqrt{33}}{308} & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{330}}{308} & 0 & \frac{\sqrt{165}}{88} & 0 & \frac{5\sqrt{66}}{616} & \frac{3\sqrt{77}}{308} & 0 & \frac{9\sqrt{33}}{308} & 0 & 0 & 0 & -\frac{3\sqrt{11}}{154} & 0 \\
\frac{5\sqrt{66}}{616} & 0 & \frac{\sqrt{165}}{88} & 0 & \frac{\sqrt{330}}{308} & 0 & 0 & \frac{3\sqrt{11}}{154} & 0 & 0 & 0 & -\frac{9\sqrt{33}}{308} & 0 & -\frac{3\sqrt{77}}{308} \\
0 & \frac{\sqrt{22}}{88} & 0 & \frac{\sqrt{11}}{616} & 0 & -\frac{5\sqrt{110}}{308} & 0 & 0 & 0 & 0 & -\frac{9\sqrt{33}}{308} & 0 & -\frac{3\sqrt{165}}{308} & 0 \\
0 & 0 & -\frac{\sqrt{33}}{616} & 0 & -\frac{13\sqrt{66}}{616} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{11}}{154} & 0 & -\frac{3\sqrt{165}}{308} & 0 & \frac{3\sqrt{385}}{308} \\
0 & 0 & 0 & -\frac{3\sqrt{231}}{616} & 0 & \frac{\sqrt{2310}}{616} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{77}}{308} & 0 & \frac{3\sqrt{385}}{308} & 0
\end{pmatrix}$$

| 842 | symmetry | $\frac{\sqrt{5}yz(6x^2-y^2-z^2)}{2}$ |
|---|---|---|

Table 10

| No. | multipole | matrix | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

$\mathbb{Q}_{4,1}^{(a)}(E_g, 2)$

$$
\begin{pmatrix}
0 & \frac{\sqrt{77}i}{196} & 0 & -\frac{\sqrt{154}i}{56} & 0 & 0 & \frac{\sqrt{330}i}{616} & 0 & \frac{5\sqrt{770}i}{2156} & 0 & -\frac{5\sqrt{462}i}{616} & 0 & 0 & 0 \\
-\frac{\sqrt{77}i}{196} & 0 & -\frac{\sqrt{770}i}{392} & 0 & 0 & 0 & 0 & -\frac{13\sqrt{462}i}{4312} & 0 & -\frac{\sqrt{2310}i}{2156} & 0 & -\frac{\sqrt{154}i}{88} & 0 & 0 \\
0 & \frac{\sqrt{770}i}{392} & 0 & 0 & 0 & \frac{\sqrt{154}i}{56} & -\frac{3\sqrt{33}i}{88} & 0 & \frac{\sqrt{77}i}{4312} & 0 & -\frac{\sqrt{1155}i}{616} & 0 & \frac{\sqrt{231}i}{616} & 0 \\
\frac{\sqrt{154}i}{56} & 0 & 0 & 0 & \frac{\sqrt{770}i}{392} & 0 & 0 & -\frac{\sqrt{231}i}{616} & 0 & \frac{\sqrt{1155}i}{616} & 0 & -\frac{\sqrt{77}i}{4312} & 0 & \frac{3\sqrt{33}i}{88} \\
0 & 0 & 0 & -\frac{\sqrt{770}i}{392} & 0 & -\frac{\sqrt{77}i}{196} & 0 & 0 & \frac{\sqrt{154}i}{88} & 0 & \frac{\sqrt{2310}i}{2156} & 0 & \frac{13\sqrt{462}i}{4312} & 0 \\
0 & 0 & -\frac{\sqrt{154}i}{56} & 0 & \frac{\sqrt{77}i}{196} & 0 & 0 & 0 & 0 & \frac{5\sqrt{462}i}{616} & 0 & -\frac{5\sqrt{770}i}{2156} & 0 & -\frac{\sqrt{330}i}{616} \\
-\frac{\sqrt{330}i}{616} & 0 & \frac{3\sqrt{33}i}{88} & 0 & 0 & 0 & 0 & \frac{3\sqrt{55}i}{308} & 0 & -\frac{3\sqrt{11}i}{44} & 0 & 0 & 0 & 0 \\
0 & \frac{13\sqrt{462}i}{4312} & 0 & \frac{\sqrt{231}i}{616} & 0 & 0 & -\frac{3\sqrt{55}i}{308} & 0 & -\frac{3\sqrt{1155}i}{2156} & 0 & -\frac{3\sqrt{77}i}{154} & 0 & 0 & 0 \\
-\frac{5\sqrt{770}i}{2156} & 0 & -\frac{\sqrt{77}i}{4312} & 0 & -\frac{\sqrt{154}i}{88} & 0 & 0 & \frac{3\sqrt{1155}i}{2156} & 0 & -\frac{9\sqrt{231}i}{2156} & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{2310}i}{2156} & 0 & -\frac{\sqrt{1155}i}{616} & 0 & -\frac{5\sqrt{462}i}{616} & \frac{3\sqrt{11}i}{44} & 0 & \frac{9\sqrt{231}i}{2156} & 0 & 0 & 0 & \frac{3\sqrt{77}i}{154} & 0 \\
\frac{5\sqrt{462}i}{616} & 0 & \frac{\sqrt{1155}i}{616} & 0 & -\frac{\sqrt{2310}i}{2156} & 0 & 0 & \frac{3\sqrt{77}i}{154} & 0 & 0 & 0 & \frac{9\sqrt{231}i}{2156} & 0 & \frac{3\sqrt{11}i}{44} \\
0 & \frac{\sqrt{154}i}{88} & 0 & \frac{\sqrt{77}i}{4312} & 0 & \frac{5\sqrt{770}i}{2156} & 0 & 0 & 0 & 0 & -\frac{9\sqrt{231}i}{2156} & 0 & \frac{3\sqrt{1155}i}{2156} & 0 \\
0 & 0 & -\frac{\sqrt{231}i}{616} & 0 & -\frac{13\sqrt{462}i}{4312} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{77}i}{154} & 0 & -\frac{3\sqrt{1155}i}{2156} & 0 & -\frac{3\sqrt{55}i}{308} \\
0 & 0 & 0 & -\frac{3\sqrt{33}i}{88} & 0 & \frac{\sqrt{330}i}{616} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{11}i}{44} & 0 & \frac{3\sqrt{55}i}{308} & 0 \\
\end{pmatrix}
$$

| 843 | symmetry | $-\frac{\sqrt5\,xz\left(x^2-6y^2+z^2\right)}{2}$ |

Table 10

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{Q}_{4,2}^{(a)}(E_g, 2)$

$$
\begin{pmatrix}
0 & -\frac{\sqrt{77}}{196} & 0 & -\frac{\sqrt{154}}{56} & 0 & 0 & \frac{\sqrt{330}}{616} & 0 & -\frac{5\sqrt{770}}{2156} & 0 & -\frac{5\sqrt{462}}{616} & 0 & 0 & 0 \\
-\frac{\sqrt{77}}{196} & 0 & \frac{\sqrt{770}}{392} & 0 & 0 & 0 & 0 & -\frac{13\sqrt{462}}{4312} & 0 & \frac{\sqrt{2310}}{2156} & 0 & -\frac{\sqrt{154}}{88} & 0 & 0 \\
0 & \frac{\sqrt{770}}{392} & 0 & 0 & 0 & \frac{\sqrt{154}}{56} & \frac{3\sqrt{33}}{88} & 0 & \frac{\sqrt{77}}{4312} & 0 & \frac{\sqrt{1155}}{616} & 0 & \frac{\sqrt{231}}{616} & 0 \\
-\frac{\sqrt{154}}{56} & 0 & 0 & 0 & -\frac{\sqrt{770}}{392} & 0 & 0 & \frac{\sqrt{231}}{616} & 0 & \frac{\sqrt{1155}}{616} & 0 & \frac{\sqrt{77}}{4312} & 0 & \frac{3\sqrt{33}}{88} \\
0 & 0 & 0 & -\frac{\sqrt{770}}{392} & 0 & \frac{\sqrt{77}}{196} & 0 & 0 & -\frac{\sqrt{154}}{88} & 0 & \frac{\sqrt{2310}}{2156} & 0 & -\frac{13\sqrt{462}}{4312} & 0 \\
0 & 0 & \frac{\sqrt{154}}{56} & 0 & \frac{\sqrt{77}}{196} & 0 & 0 & 0 & 0 & -\frac{5\sqrt{462}}{616} & 0 & -\frac{5\sqrt{770}}{2156} & 0 & \frac{\sqrt{330}}{616} \\
\frac{\sqrt{330}}{616} & 0 & \frac{3\sqrt{33}}{88} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{55}}{308} & 0 & -\frac{3\sqrt{11}}{44} & 0 & 0 & 0 & 0 \\
0 & -\frac{13\sqrt{462}}{4312} & 0 & \frac{\sqrt{231}}{616} & 0 & 0 & -\frac{3\sqrt{55}}{308} & 0 & \frac{3\sqrt{1155}}{2156} & 0 & -\frac{3\sqrt{77}}{154} & 0 & 0 & 0 \\
-\frac{5\sqrt{770}}{2156} & 0 & \frac{\sqrt{77}}{4312} & 0 & -\frac{\sqrt{154}}{88} & 0 & 0 & \frac{3\sqrt{1155}}{2156} & 0 & \frac{9\sqrt{231}}{2156} & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{2310}}{2156} & 0 & \frac{\sqrt{1155}}{616} & 0 & -\frac{5\sqrt{462}}{616} & -\frac{3\sqrt{11}}{44} & 0 & \frac{9\sqrt{231}}{2156} & 0 & 0 & 0 & \frac{3\sqrt{77}}{154} & 0 \\
-\frac{5\sqrt{462}}{616} & 0 & \frac{\sqrt{1155}}{616} & 0 & \frac{\sqrt{2310}}{2156} & 0 & 0 & -\frac{3\sqrt{77}}{154} & 0 & 0 & 0 & -\frac{9\sqrt{231}}{2156} & 0 & \frac{3\sqrt{11}}{44} \\
0 & -\frac{\sqrt{154}}{88} & 0 & \frac{\sqrt{77}}{4312} & 0 & -\frac{5\sqrt{770}}{2156} & 0 & 0 & 0 & 0 & -\frac{9\sqrt{231}}{2156} & 0 & -\frac{3\sqrt{1155}}{2156} & 0 \\
0 & 0 & \frac{\sqrt{231}}{616} & 0 & -\frac{13\sqrt{462}}{4312} & 0 & 0 & 0 & 0 & \frac{3\sqrt{77}}{154} & 0 & -\frac{3\sqrt{1155}}{2156} & 0 & \frac{3\sqrt{55}}{308} \\
0 & 0 & 0 & \frac{3\sqrt{33}}{88} & 0 & \frac{\sqrt{330}}{616} & 0 & 0 & 0 & 0 & \frac{3\sqrt{11}}{44} & 0 & \frac{3\sqrt{55}}{308} & 0
\end{pmatrix}
$$

| 844 | symmetry | $\dfrac{\sqrt{2}\left(2x^6-15x^4y^2-15x^4z^2-15x^2y^4+180x^2y^2z^2-15x^2z^4+2y^6-15y^4z^2-15y^2z^4+2z^6\right)}{8}$ |

*continued …*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{Q}_6^{(a)}(A_{1g},1)$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{154}}{616}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{462}}{88}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{2310}}{616}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{770}}{88}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{77}}{308}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{55}}{44}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{55}}{44}$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{77}}{308}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{770}}{88}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2310}}{616}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{462}}{88}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{154}}{616}$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{\sqrt{55}}{44}$ | $0$ | $0$ | $-\frac{\sqrt{231}}{1848}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{165}}{88}$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{154}}{616}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{770}}{88}$ | $0$ | $0$ | $\frac{5\sqrt{231}}{1848}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{77}}{88}$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{2310}}{616}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{462}}{88}$ | $0$ | $0$ | $-\frac{3\sqrt{231}}{616}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{77}}{88}$ | $0$ |
| | | $0$ | $0$ | $-\frac{5\sqrt{77}}{308}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{231}}{1848}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{165}}{88}$ |
| | | $0$ | $0$ | $0$ | $\frac{5\sqrt{77}}{308}$ | $0$ | $0$ | $\frac{\sqrt{165}}{88}$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{231}}{1848}$ | $0$ | $0$ | $0$ |
| | | $\frac{\sqrt{462}}{88}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2310}}{616}$ | $0$ | $0$ | $-\frac{\sqrt{77}}{88}$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{231}}{616}$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{770}}{88}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{154}}{616}$ | $0$ | $0$ | $-\frac{\sqrt{77}}{88}$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{231}}{1848}$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{55}}{44}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{165}}{88}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{231}}{1848}$ |
| 845 | symmetry | $-\frac{\sqrt{14}\left(x^6-15x^4z^2+15x^2z^4+y^6-15y^4z^2+15y^2z^4-2z^6\right)}{8}$ | | | | | | | | | | | | | |

*continued ...*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{Q}_6^{(a)}(A_{1g},2)$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{22}}{88}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{66}}{88}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{330}}{88}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{110}}{88}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{11}}{44}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{385}}{308}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{385}}{308}$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{11}}{44}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{110}}{88}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{330}}{88}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{66}}{88}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{22}}{88}$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{385}}{308}$ | $0$ | $0$ | $-\frac{\sqrt{33}}{264}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{1155}}{616}$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{22}}{88}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{110}}{88}$ | $0$ | $0$ | $\frac{5\sqrt{33}}{264}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{11}}{88}$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{330}}{88}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{66}}{88}$ | $0$ | $0$ | $-\frac{3\sqrt{33}}{88}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{11}}{88}$ | $0$ |
| | | $0$ | $0$ | $-\frac{5\sqrt{11}}{44}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{33}}{264}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{1155}}{616}$ |
| | | $0$ | $0$ | $0$ | $\frac{5\sqrt{11}}{44}$ | $0$ | $0$ | $-\frac{\sqrt{1155}}{616}$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{33}}{264}$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{66}}{88}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{330}}{88}$ | $0$ | $0$ | $\frac{\sqrt{11}}{88}$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{33}}{88}$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{110}}{88}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{22}}{88}$ | $0$ | $0$ | $\frac{\sqrt{11}}{88}$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{33}}{264}$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{385}}{308}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{1155}}{616}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{33}}{264}$ |

| 846 | symmetry | $-\frac{3\sqrt{7}xy(x-y)(x+y)\left(x^2+y^2-10z^2\right)}{4}$ |

*continued …*

Table 10

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{Q}_6^{(a)}(A_{2g})$

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{33}i}{22}$ | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{55}i}{22}$ | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{770}i}{154}$ |
| 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{770}i}{154}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{55}i}{22}$ | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{33}i}{22}$ | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | $-\frac{\sqrt{770}i}{154}$ | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{2310}i}{308}$ | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | $\frac{\sqrt{55}i}{22}$ | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{22}i}{44}$ | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{33}i}{22}$ | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{22}i}{44}$ | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{2310}i}{308}$ |
| 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{2310}i}{308}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $-\frac{\sqrt{33}i}{22}$ | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{22}i}{44}$ | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | $\frac{\sqrt{55}i}{22}$ | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{22}i}{44}$ | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | $-\frac{\sqrt{770}i}{154}$ | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{2310}i}{308}$ | 0 | 0 | 0 | 0 |

| 847 | symmetry | $-\frac{\sqrt{2310}(x-y)(x+y)(x-z)(x+z)(y-z)(y+z)}{8}$ |
|-----|----------|--------|

*continued ...*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{Q}_6^{(a)}(B_{1g},1)$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{6}}{24}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{210}}{56}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{42}}{168}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{30}}{24}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{3}}{12}$ | $0$ | $0$ | $0$ | $\frac{1}{4}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{1}{4}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{3}}{12}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{30}}{24}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{42}}{168}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{210}}{56}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{6}}{24}$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{42}}{168}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{210}}{56}$ | $0$ | $0$ | $\frac{\sqrt{105}}{168}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{35}}{56}$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{3}}{12}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{1}{8}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{35}}{56}$ |
| | | $0$ | $0$ | $0$ | $-\frac{1}{4}$ | $0$ | $0$ | $\frac{\sqrt{105}}{168}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{3}}{24}$ | $0$ | $0$ | $0$ |
| | | $\frac{\sqrt{6}}{24}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{30}}{24}$ | $0$ | $0$ | $-\frac{1}{8}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{3}}{24}$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{30}}{24}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{6}}{24}$ | $0$ | $0$ | $\frac{\sqrt{3}}{24}$ | $0$ | $0$ | $0$ | $-\frac{1}{8}$ | $0$ |
| | | $0$ | $0$ | $\frac{1}{4}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{3}}{24}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{105}}{168}$ |
| | | $0$ | $0$ | $0$ | $-\frac{\sqrt{3}}{12}$ | $0$ | $0$ | $-\frac{\sqrt{35}}{56}$ | $0$ | $0$ | $0$ | $-\frac{1}{8}$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{210}}{56}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{42}}{168}$ | $0$ | $0$ | $-\frac{\sqrt{35}}{56}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{105}}{168}$ | $0$ | $0$ |

| 848 | symmetry | $\frac{\sqrt{42}(x-y)(x+y)\left(x^4-9x^2y^2-5x^2z^2+y^4-5y^2z^2+5z^4\right)}{8}$ |

*continued ...*

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Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{Q}_6^{(a)}(B_{1g},2)$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{330}}{264}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{462}}{56}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{2310}}{1848}$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{66}}{264}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{165}}{132}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{55}}{44}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{55}}{44}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{165}}{132}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{66}}{264}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2310}}{1848}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{462}}{56}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{330}}{264}$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{2310}}{1848}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{462}}{56}$ | $0$ | $0$ | $-\frac{5\sqrt{231}}{1848}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{77}}{56}$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{165}}{132}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{55}}{88}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{77}}{56}$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{55}}{44}$ | $0$ | $0$ | $-\frac{5\sqrt{231}}{1848}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{165}}{264}$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{330}}{264}$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{66}}{264}$ | $0$ | $0$ | $\frac{\sqrt{55}}{88}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{165}}{264}$ | $0$ | $0$ |
| | | $0$ | $\frac{5\sqrt{66}}{264}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{330}}{264}$ | $0$ | $0$ | $-\frac{\sqrt{165}}{264}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{55}}{88}$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{55}}{44}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{165}}{264}$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{231}}{1848}$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{165}}{132}$ | $0$ | $0$ | $-\frac{\sqrt{77}}{56}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{55}}{88}$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{462}}{56}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2310}}{1848}$ | $0$ | $0$ | $-\frac{\sqrt{77}}{56}$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{231}}{1848}$ | $0$ | $0$ |
| 849 | symmetry | $\frac{\sqrt{462}xy\left(x^2-3y^2\right)\left(3x^2-y^2\right)}{16}$ | | | | | | | | | | | | | |

Table 10

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{Q}_6^{(a)}(B_{2g},1)$ | $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{14} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{14} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{14} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ -\frac{\sqrt{42}i}{14} & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$ |
| 850 | symmetry | $\dfrac{\sqrt{210}\,xy\left(x^4+2x^2y^2-16x^2z^2+y^4-16y^2z^2+16z^4\right)}{16}$ |

*continued ...*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{Q}_6^{(a)}(B_{2g}, 2)$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{66}i}{66}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{462}i}{462}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{330}i}{66}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{33}i}{33}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{11}i}{11}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{11}i}{11}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{33}i}{33}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{330}i}{66}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{462}i}{462}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{66}i}{66}$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{462}i}{462}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{1155}i}{462}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{33}i}{33}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{11}i}{22}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{\sqrt{11}i}{11}$ | $0$ | $0$ | $-\frac{\sqrt{1155}i}{462}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{33}i}{66}$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{66}i}{66}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{330}i}{66}$ | $0$ | $0$ | $\frac{\sqrt{11}i}{22}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{33}i}{66}$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{330}i}{66}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{66}i}{66}$ | $0$ | $0$ | $-\frac{\sqrt{33}i}{66}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{11}i}{22}$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{11}i}{11}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{33}i}{66}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{1155}i}{462}$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{33}i}{33}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{11}i}{22}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{462}i}{462}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{1155}i}{462}$ | $0$ | $0$ |
| 851 | symmetry | $\frac{3\sqrt{7}yz(y-z)(y+z)\left(10x^2-y^2-z^2\right)}{4}$ | | | | | | | | | | | | | | |

Table 10

| | $\mathbb{Q}_{6,1}^{(a)}(E_g,1)$ | |

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{77}i}{1232} & 0 & \frac{\sqrt{33}i}{176} & 0 & -\frac{3\sqrt{55}i}{176} & 0 & -\frac{\sqrt{11}i}{16} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{55}i}{176} & 0 & -\frac{5\sqrt{11}i}{176} & 0 & \frac{3\sqrt{165}i}{176} & 0 & \frac{\sqrt{385}i}{112} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{770}i}{1232} & 0 & \frac{\sqrt{330}i}{176} & 0 & \frac{5\sqrt{22}i}{176} & 0 & -\frac{3\sqrt{110}i}{176} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{110}i}{176} & 0 & -\frac{5\sqrt{22}i}{176} & 0 & -\frac{\sqrt{330}i}{176} & 0 & \frac{3\sqrt{770}i}{1232} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{385}i}{112} & 0 & -\frac{3\sqrt{165}i}{176} & 0 & \frac{5\sqrt{11}i}{176} & 0 & \frac{\sqrt{55}i}{176} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{11}i}{16} & 0 & \frac{3\sqrt{55}i}{176} & 0 & -\frac{\sqrt{33}i}{176} & 0 & -\frac{\sqrt{77}i}{1232} \\
-\frac{\sqrt{77}i}{1232} & 0 & \frac{3\sqrt{770}i}{1232} & 0 & \frac{\sqrt{385}i}{112} & 0 & 0 & \frac{\sqrt{462}i}{1232} & 0 & -\frac{\sqrt{2310}i}{616} & 0 & -\frac{\sqrt{154}i}{112} & 0 & 0 \\
0 & \frac{\sqrt{55}i}{176} & 0 & -\frac{3\sqrt{110}i}{176} & 0 & -\frac{\sqrt{11}i}{16} & -\frac{\sqrt{462}i}{1232} & 0 & -\frac{\sqrt{22}i}{88} & 0 & \frac{\sqrt{330}i}{176} & 0 & 0 & 0 \\
-\frac{\sqrt{33}i}{176} & 0 & -\frac{\sqrt{330}i}{176} & 0 & \frac{3\sqrt{165}i}{176} & 0 & 0 & \frac{\sqrt{22}i}{88} & 0 & \frac{\sqrt{110}i}{176} & 0 & 0 & 0 & \frac{\sqrt{154}i}{112} \\
0 & \frac{5\sqrt{11}i}{176} & 0 & \frac{5\sqrt{22}i}{176} & 0 & -\frac{3\sqrt{55}i}{176} & \frac{\sqrt{2310}i}{616} & 0 & -\frac{\sqrt{110}i}{176} & 0 & 0 & 0 & -\frac{\sqrt{330}i}{176} & 0 \\
\frac{3\sqrt{55}i}{176} & 0 & -\frac{5\sqrt{22}i}{176} & 0 & -\frac{5\sqrt{11}i}{176} & 0 & 0 & -\frac{\sqrt{330}i}{176} & 0 & 0 & 0 & -\frac{\sqrt{110}i}{176} & 0 & \frac{\sqrt{2310}i}{616} \\
0 & -\frac{3\sqrt{165}i}{176} & 0 & \frac{\sqrt{330}i}{176} & 0 & \frac{\sqrt{33}i}{176} & \frac{\sqrt{154}i}{112} & 0 & 0 & 0 & \frac{\sqrt{110}i}{176} & 0 & \frac{\sqrt{22}i}{88} & 0 \\
\frac{\sqrt{11}i}{16} & 0 & \frac{3\sqrt{110}i}{176} & 0 & -\frac{\sqrt{55}i}{176} & 0 & 0 & 0 & 0 & \frac{\sqrt{330}i}{176} & 0 & -\frac{\sqrt{22}i}{88} & 0 & -\frac{\sqrt{462}i}{1232} \\
0 & -\frac{\sqrt{385}i}{112} & 0 & -\frac{3\sqrt{770}i}{1232} & 0 & \frac{\sqrt{77}i}{1232} & 0 & 0 & -\frac{\sqrt{154}i}{112} & 0 & -\frac{\sqrt{2310}i}{616} & 0 & \frac{\sqrt{462}i}{1232} & 0
\end{pmatrix}$$

| 852 | symmetry | $-\frac{3\sqrt{7}xz(x-z)(x+z)\left(x^2-10y^2+z^2\right)}{4}$ |

*continued ...*

Table 10

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{6,2}^{(a)}(E_g,1)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{77}}{1232} & 0 & -\frac{\sqrt{33}}{176} & 0 & -\frac{3\sqrt{55}}{176} & 0 & \frac{\sqrt{11}}{16} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{55}}{176} & 0 & \frac{5\sqrt{11}}{176} & 0 & \frac{3\sqrt{165}}{176} & 0 & -\frac{\sqrt{385}}{112} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{770}}{1232} & 0 & \frac{\sqrt{330}}{176} & 0 & -\frac{5\sqrt{22}}{176} & 0 & -\frac{3\sqrt{110}}{176} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{110}}{176} & 0 & -\frac{5\sqrt{22}}{176} & 0 & \frac{\sqrt{330}}{176} & 0 & \frac{3\sqrt{770}}{1232} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{385}}{112} & 0 & \frac{3\sqrt{165}}{176} & 0 & \frac{5\sqrt{11}}{176} & 0 & -\frac{\sqrt{55}}{176} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{11}}{16} & 0 & -\frac{3\sqrt{55}}{176} & 0 & -\frac{\sqrt{33}}{176} & 0 & \frac{\sqrt{77}}{1232} \\
\frac{\sqrt{77}}{1232} & 0 & \frac{3\sqrt{770}}{1232} & 0 & -\frac{\sqrt{385}}{112} & 0 & 0 & -\frac{\sqrt{462}}{1232} & 0 & -\frac{\sqrt{2310}}{616} & 0 & \frac{\sqrt{154}}{112} & 0 & 0 \\
0 & -\frac{\sqrt{55}}{176} & 0 & -\frac{3\sqrt{110}}{176} & 0 & \frac{\sqrt{11}}{16} & -\frac{\sqrt{462}}{1232} & 0 & \frac{\sqrt{22}}{88} & 0 & \frac{\sqrt{330}}{176} & 0 & 0 & 0 \\
-\frac{\sqrt{33}}{176} & 0 & \frac{\sqrt{330}}{176} & 0 & \frac{3\sqrt{165}}{176} & 0 & 0 & \frac{\sqrt{22}}{88} & 0 & -\frac{\sqrt{110}}{176} & 0 & 0 & 0 & -\frac{\sqrt{154}}{112} \\
0 & \frac{5\sqrt{11}}{176} & 0 & -\frac{5\sqrt{22}}{176} & 0 & -\frac{3\sqrt{55}}{176} & -\frac{\sqrt{2310}}{616} & 0 & -\frac{\sqrt{110}}{176} & 0 & 0 & 0 & -\frac{\sqrt{330}}{176} & 0 \\
-\frac{3\sqrt{55}}{176} & 0 & -\frac{5\sqrt{22}}{176} & 0 & \frac{5\sqrt{11}}{176} & 0 & 0 & \frac{\sqrt{330}}{176} & 0 & 0 & 0 & \frac{\sqrt{110}}{176} & 0 & \frac{\sqrt{2310}}{616} \\
0 & \frac{3\sqrt{165}}{176} & 0 & \frac{\sqrt{330}}{176} & 0 & -\frac{\sqrt{33}}{176} & \frac{\sqrt{154}}{112} & 0 & 0 & 0 & \frac{\sqrt{110}}{176} & 0 & -\frac{\sqrt{22}}{88} & 0 \\
\frac{\sqrt{11}}{16} & 0 & -\frac{3\sqrt{110}}{176} & 0 & -\frac{\sqrt{55}}{176} & 0 & 0 & 0 & 0 & -\frac{\sqrt{330}}{176} & 0 & -\frac{\sqrt{22}}{88} & 0 & \frac{\sqrt{462}}{1232} \\
0 & -\frac{\sqrt{385}}{112} & 0 & \frac{3\sqrt{770}}{1232} & 0 & \frac{\sqrt{77}}{1232} & 0 & 0 & -\frac{\sqrt{154}}{112} & 0 & \frac{\sqrt{2310}}{616} & 0 & \frac{\sqrt{462}}{1232} & 0
\end{pmatrix}$$

| 853 | symmetry | $\dfrac{\sqrt{462}\,yz(y^2-3z^2)(3y^2-z^2)}{16}$ |
|---|---|---|

*continued …*

Table 10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{Q}_{6,1}^{(a)}(E_g,2)$$

$$
\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{448} & 0 & \frac{3\sqrt{2}i}{64} & 0 & \frac{\sqrt{30}i}{64} & 0 & \frac{\sqrt{6}i}{64} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{64} & 0 & -\frac{5\sqrt{6}i}{64} & 0 & -\frac{3\sqrt{10}i}{64} & 0 & -\frac{\sqrt{210}i}{448} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}i}{224} & 0 & \frac{3\sqrt{5}i}{32} & 0 & \frac{5\sqrt{3}i}{32} & 0 & \frac{\sqrt{15}i}{32} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{32} & 0 & -\frac{5\sqrt{3}i}{32} & 0 & -\frac{3\sqrt{5}i}{32} & 0 & -\frac{\sqrt{105}i}{224} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{448} & 0 & \frac{3\sqrt{10}i}{64} & 0 & \frac{5\sqrt{6}i}{64} & 0 & \frac{\sqrt{30}i}{64} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{64} & 0 & -\frac{\sqrt{30}i}{64} & 0 & -\frac{3\sqrt{2}i}{64} & 0 & -\frac{\sqrt{42}i}{448} \\
-\frac{\sqrt{42}i}{448} & 0 & -\frac{\sqrt{105}i}{224} & 0 & -\frac{\sqrt{210}i}{448} & 0 & 0 & \frac{3\sqrt{7}i}{224} & 0 & \frac{\sqrt{35}i}{112} & 0 & \frac{\sqrt{21}i}{224} & 0 & 0 \\
0 & \frac{\sqrt{30}i}{64} & 0 & \frac{\sqrt{15}i}{32} & 0 & \frac{\sqrt{6}i}{64} & -\frac{3\sqrt{7}i}{224} & 0 & -\frac{\sqrt{3}i}{16} & 0 & -\frac{\sqrt{5}i}{32} & 0 & 0 & 0 \\
-\frac{3\sqrt{2}i}{64} & 0 & -\frac{3\sqrt{5}i}{32} & 0 & -\frac{3\sqrt{10}i}{64} & 0 & 0 & \frac{\sqrt{3}i}{16} & 0 & \frac{\sqrt{15}i}{32} & 0 & 0 & 0 & -\frac{\sqrt{21}i}{224} \\
0 & \frac{5\sqrt{6}i}{64} & 0 & \frac{5\sqrt{3}i}{32} & 0 & \frac{\sqrt{30}i}{64} & -\frac{\sqrt{35}i}{112} & 0 & -\frac{\sqrt{15}i}{32} & 0 & 0 & 0 & \frac{\sqrt{5}i}{32} & 0 \\
-\frac{\sqrt{30}i}{64} & 0 & -\frac{5\sqrt{3}i}{32} & 0 & -\frac{5\sqrt{6}i}{64} & 0 & 0 & \frac{\sqrt{5}i}{32} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{32} & 0 & -\frac{\sqrt{35}i}{112} \\
0 & \frac{3\sqrt{10}i}{64} & 0 & \frac{3\sqrt{5}i}{32} & 0 & \frac{3\sqrt{2}i}{64} & -\frac{\sqrt{21}i}{224} & 0 & 0 & 0 & \frac{\sqrt{15}i}{32} & 0 & \frac{\sqrt{3}i}{16} & 0 \\
-\frac{\sqrt{6}i}{64} & 0 & -\frac{\sqrt{15}i}{32} & 0 & -\frac{\sqrt{30}i}{64} & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}i}{32} & 0 & -\frac{\sqrt{3}i}{16} & 0 & -\frac{3\sqrt{7}i}{224} \\
0 & \frac{\sqrt{210}i}{448} & 0 & \frac{\sqrt{105}i}{224} & 0 & \frac{\sqrt{42}i}{448} & 0 & 0 & \frac{\sqrt{21}i}{224} & 0 & \frac{\sqrt{35}i}{112} & 0 & \frac{3\sqrt{7}i}{224} & 0
\end{pmatrix}
$$

| 854 | symmetry | $\frac{\sqrt{462}\,xz\left(x^2-3z^2\right)\left(3x^2-z^2\right)}{16}$ |

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{42}}{448}$ | $0$ | $-\frac{3\sqrt{2}}{64}$ | $0$ | $\frac{\sqrt{30}}{64}$ | $0$ | $-\frac{\sqrt{6}}{64}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{30}}{64}$ | $0$ | $\frac{5\sqrt{6}}{64}$ | $0$ | $-\frac{3\sqrt{10}}{64}$ | $0$ | $\frac{\sqrt{210}}{448}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{105}}{224}$ | $0$ | $\frac{3\sqrt{5}}{32}$ | $0$ | $-\frac{5\sqrt{3}}{32}$ | $0$ | $\frac{\sqrt{15}}{32}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{15}}{32}$ | $0$ | $-\frac{5\sqrt{3}}{32}$ | $0$ | $\frac{3\sqrt{5}}{32}$ | $0$ | $-\frac{\sqrt{105}}{224}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{210}}{448}$ | $0$ | $-\frac{3\sqrt{10}}{64}$ | $0$ | $\frac{5\sqrt{6}}{64}$ | $0$ | $-\frac{\sqrt{30}}{64}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{6}}{64}$ | $0$ | $\frac{\sqrt{30}}{64}$ | $0$ | $-\frac{3\sqrt{2}}{64}$ | $0$ | $\frac{\sqrt{42}}{448}$ |
| | $\mathbb{Q}_{6,2}^{(a)}(E_g,2)$ | $\frac{\sqrt{42}}{448}$ | $0$ | $-\frac{\sqrt{105}}{224}$ | $0$ | $\frac{\sqrt{210}}{448}$ | $0$ | $0$ | $-\frac{3\sqrt{7}}{224}$ | $0$ | $\frac{\sqrt{35}}{112}$ | $0$ | $-\frac{\sqrt{21}}{224}$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{30}}{64}$ | $0$ | $\frac{\sqrt{15}}{32}$ | $0$ | $-\frac{\sqrt{6}}{64}$ | $-\frac{3\sqrt{7}}{224}$ | $0$ | $\frac{\sqrt{3}}{16}$ | $0$ | $-\frac{\sqrt{5}}{32}$ | $0$ | $0$ | $0$ |
| | | $-\frac{3\sqrt{2}}{64}$ | $0$ | $\frac{3\sqrt{5}}{32}$ | $0$ | $-\frac{3\sqrt{10}}{64}$ | $0$ | $0$ | $\frac{\sqrt{3}}{16}$ | $0$ | $-\frac{\sqrt{15}}{32}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{21}}{224}$ |
| | | $0$ | $\frac{5\sqrt{6}}{64}$ | $0$ | $-\frac{5\sqrt{3}}{32}$ | $0$ | $\frac{\sqrt{30}}{64}$ | $\frac{\sqrt{35}}{112}$ | $0$ | $-\frac{\sqrt{15}}{32}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{5}}{32}$ | $0$ |
| | | $\frac{\sqrt{30}}{64}$ | $0$ | $-\frac{5\sqrt{3}}{32}$ | $0$ | $\frac{5\sqrt{6}}{64}$ | $0$ | $0$ | $-\frac{\sqrt{5}}{32}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{15}}{32}$ | $0$ | $-\frac{\sqrt{35}}{112}$ |
| | | $0$ | $-\frac{3\sqrt{10}}{64}$ | $0$ | $\frac{3\sqrt{5}}{32}$ | $0$ | $-\frac{3\sqrt{2}}{64}$ | $-\frac{\sqrt{21}}{224}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{15}}{32}$ | $0$ | $-\frac{\sqrt{3}}{16}$ | $0$ |
| | | $-\frac{\sqrt{6}}{64}$ | $0$ | $\frac{\sqrt{15}}{32}$ | $0$ | $-\frac{\sqrt{30}}{64}$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{5}}{32}$ | $0$ | $-\frac{\sqrt{3}}{16}$ | $0$ | $\frac{3\sqrt{7}}{224}$ |
| | | $0$ | $\frac{\sqrt{210}}{448}$ | $0$ | $-\frac{\sqrt{105}}{224}$ | $0$ | $\frac{\sqrt{42}}{448}$ | $0$ | $0$ | $\frac{\sqrt{21}}{224}$ | $0$ | $-\frac{\sqrt{35}}{112}$ | $0$ | $\frac{3\sqrt{7}}{224}$ | $0$ |

| 855 | symmetry | $\frac{\sqrt{210}yz\left(16x^4-16x^2y^2-16x^2z^2+y^4+2y^2z^2+z^4\right)}{16}$ |

Table  10

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{Q}_{6,1}^{(a)}(E_g,3)$

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{2310}i}{14784}$ | $0$ | $\frac{\sqrt{110}i}{704}$ | $0$ | $-\frac{9\sqrt{66}i}{704}$ | $0$ | $\frac{\sqrt{330}i}{64}$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{66}i}{2112}$ | $0$ | $-\frac{5\sqrt{330}i}{2112}$ | $0$ | $\frac{27\sqrt{22}i}{704}$ | $0$ | $-\frac{5\sqrt{462}i}{448}$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{9\sqrt{231}i}{2464}$ | $0$ | $\frac{5\sqrt{11}i}{352}$ | $0$ | $\frac{5\sqrt{165}i}{1056}$ | $0$ | $-\frac{9\sqrt{33}i}{352}$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{9\sqrt{33}i}{352}$ | $0$ | $-\frac{5\sqrt{165}i}{1056}$ | $0$ | $-\frac{5\sqrt{11}i}{352}$ | $0$ | $\frac{9\sqrt{231}i}{2464}$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{462}i}{448}$ | $0$ | $-\frac{27\sqrt{22}i}{704}$ | $0$ | $\frac{5\sqrt{330}i}{2112}$ | $0$ | $\frac{5\sqrt{66}i}{2112}$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{330}i}{64}$ | $0$ | $\frac{9\sqrt{66}i}{704}$ | $0$ | $-\frac{\sqrt{110}i}{704}$ | $0$ | $-\frac{\sqrt{2310}i}{14784}$ |
| $-\frac{\sqrt{2310}i}{14784}$ | $0$ | $\frac{9\sqrt{231}i}{2464}$ | $0$ | $-\frac{5\sqrt{462}i}{448}$ | $0$ | $0$ | $\frac{\sqrt{385}i}{2464}$ | $0$ | $-\frac{9\sqrt{77}i}{1232}$ | $0$ | $\frac{\sqrt{1155}i}{224}$ | $0$ | $0$ |
| $0$ | $\frac{5\sqrt{66}i}{2112}$ | $0$ | $-\frac{9\sqrt{33}i}{352}$ | $0$ | $\frac{\sqrt{330}i}{64}$ | $-\frac{\sqrt{385}i}{2464}$ | $0$ | $-\frac{\sqrt{165}i}{528}$ | $0$ | $\frac{9\sqrt{11}i}{352}$ | $0$ | $0$ | $0$ |
| $-\frac{\sqrt{110}i}{704}$ | $0$ | $-\frac{5\sqrt{11}i}{352}$ | $0$ | $\frac{27\sqrt{22}i}{704}$ | $0$ | $0$ | $\frac{\sqrt{165}i}{528}$ | $0$ | $\frac{5\sqrt{33}i}{1056}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{1155}i}{224}$ |
| $0$ | $\frac{5\sqrt{330}i}{2112}$ | $0$ | $\frac{5\sqrt{165}i}{1056}$ | $0$ | $-\frac{9\sqrt{66}i}{704}$ | $\frac{9\sqrt{77}i}{1232}$ | $0$ | $-\frac{5\sqrt{33}i}{1056}$ | $0$ | $0$ | $0$ | $-\frac{9\sqrt{11}i}{352}$ | $0$ |
| $\frac{9\sqrt{66}i}{704}$ | $0$ | $-\frac{5\sqrt{165}i}{1056}$ | $0$ | $-\frac{5\sqrt{330}i}{2112}$ | $0$ | $0$ | $-\frac{9\sqrt{11}i}{352}$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{33}i}{1056}$ | $0$ | $\frac{9\sqrt{77}i}{1232}$ |
| $0$ | $-\frac{27\sqrt{22}i}{704}$ | $0$ | $\frac{5\sqrt{11}i}{352}$ | $0$ | $\frac{\sqrt{110}i}{704}$ | $-\frac{\sqrt{1155}i}{224}$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{33}i}{1056}$ | $0$ | $\frac{\sqrt{165}i}{528}$ | $0$ |
| $-\frac{\sqrt{330}i}{64}$ | $0$ | $\frac{9\sqrt{33}i}{352}$ | $0$ | $-\frac{5\sqrt{66}i}{2112}$ | $0$ | $0$ | $0$ | $0$ | $\frac{9\sqrt{11}i}{352}$ | $0$ | $-\frac{\sqrt{165}i}{528}$ | $0$ | $-\frac{\sqrt{385}i}{2464}$ |
| $0$ | $\frac{5\sqrt{462}i}{448}$ | $0$ | $-\frac{9\sqrt{231}i}{2464}$ | $0$ | $\frac{\sqrt{2310}i}{14784}$ | $0$ | $0$ | $\frac{\sqrt{1155}i}{224}$ | $0$ | $-\frac{9\sqrt{77}i}{1232}$ | $0$ | $\frac{\sqrt{385}i}{2464}$ | $0$ |

| No. | symmetry |
|-----|----------|
| 856 | $\dfrac{\sqrt{210}xz\left(x^4-16x^2y^2+2x^2z^2+16y^4-16y^2z^2+z^4\right)}{16}$ |

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{Q}^{(a)}_{6,2}(E_g,3)$

$$
\begin{array}{cccccccccccccc}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2310}}{14784} & 0 & -\frac{\sqrt{110}}{704} & 0 & -\frac{9\sqrt{66}}{704} & 0 & -\frac{\sqrt{330}}{64} & 0 \\[4pt]
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{66}}{2112} & 0 & \frac{5\sqrt{330}}{2112} & 0 & \frac{27\sqrt{22}}{704} & 0 & \frac{5\sqrt{462}}{448} \\[4pt]
0 & 0 & 0 & 0 & 0 & 0 & \frac{9\sqrt{231}}{2464} & 0 & \frac{5\sqrt{11}}{352} & 0 & -\frac{5\sqrt{165}}{1056} & 0 & -\frac{9\sqrt{33}}{352} & 0 \\[4pt]
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{9\sqrt{33}}{352} & 0 & -\frac{5\sqrt{165}}{1056} & 0 & \frac{5\sqrt{11}}{352} & 0 & \frac{9\sqrt{231}}{2464} \\[4pt]
0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{462}}{448} & 0 & \frac{27\sqrt{22}}{704} & 0 & \frac{5\sqrt{330}}{2112} & 0 & -\frac{5\sqrt{66}}{2112} & 0 \\[4pt]
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{330}}{64} & 0 & -\frac{9\sqrt{66}}{704} & 0 & -\frac{\sqrt{110}}{704} & 0 & \frac{\sqrt{2310}}{14784} \\[4pt]
\frac{\sqrt{2310}}{14784} & 0 & \frac{9\sqrt{231}}{2464} & 0 & \frac{5\sqrt{462}}{448} & 0 & 0 & -\frac{\sqrt{385}}{2464} & 0 & -\frac{9\sqrt{77}}{1232} & 0 & -\frac{\sqrt{1155}}{224} & 0 & 0 \\[4pt]
0 & -\frac{5\sqrt{66}}{2112} & 0 & -\frac{9\sqrt{33}}{352} & 0 & -\frac{\sqrt{330}}{64} & -\frac{\sqrt{385}}{2464} & 0 & \frac{\sqrt{165}}{528} & 0 & \frac{9\sqrt{11}}{352} & 0 & 0 & 0 \\[4pt]
-\frac{\sqrt{110}}{704} & 0 & \frac{5\sqrt{11}}{352} & 0 & \frac{27\sqrt{22}}{704} & 0 & 0 & \frac{\sqrt{165}}{528} & 0 & -\frac{5\sqrt{33}}{1056} & 0 & 0 & 0 & \frac{\sqrt{1155}}{224} \\[4pt]
0 & \frac{5\sqrt{330}}{2112} & 0 & -\frac{5\sqrt{165}}{1056} & 0 & -\frac{9\sqrt{66}}{704} & -\frac{9\sqrt{77}}{1232} & 0 & -\frac{5\sqrt{33}}{1056} & 0 & 0 & 0 & -\frac{9\sqrt{11}}{352} & 0 \\[4pt]
-\frac{9\sqrt{66}}{704} & 0 & -\frac{5\sqrt{165}}{1056} & 0 & \frac{5\sqrt{330}}{2112} & 0 & 0 & \frac{9\sqrt{11}}{352} & 0 & 0 & 0 & \frac{5\sqrt{33}}{1056} & 0 & \frac{9\sqrt{77}}{1232} \\[4pt]
0 & \frac{27\sqrt{22}}{704} & 0 & \frac{5\sqrt{11}}{352} & 0 & -\frac{\sqrt{110}}{704} & -\frac{\sqrt{1155}}{224} & 0 & 0 & 0 & \frac{5\sqrt{33}}{1056} & 0 & -\frac{\sqrt{165}}{528} & 0 \\[4pt]
-\frac{\sqrt{330}}{64} & 0 & -\frac{9\sqrt{33}}{352} & 0 & -\frac{5\sqrt{66}}{2112} & 0 & 0 & 0 & -\frac{9\sqrt{11}}{352} & 0 & -\frac{\sqrt{165}}{528} & 0 & \frac{\sqrt{385}}{2464} & \\[4pt]
0 & \frac{5\sqrt{462}}{448} & 0 & \frac{9\sqrt{231}}{2464} & 0 & \frac{\sqrt{2310}}{14784} & 0 & 0 & \frac{\sqrt{1155}}{224} & 0 & \frac{9\sqrt{77}}{1232} & 0 & \frac{\sqrt{385}}{2464} & 0 \\
\end{array}
$$

| No. | symmetry | |
|-----|----------|--|
| 857 | | $-\frac{x^2}{2} - \frac{y^2}{2} + z^2$ |

*continued …*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $-\frac{5\sqrt{21}}{147}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{15\sqrt{14}}{196}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $\frac{\sqrt{21}}{147}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{210}}{196}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $\frac{4\sqrt{21}}{147}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{7}}{98}$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $\frac{4\sqrt{21}}{147}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{7}}{98}$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{21}}{147}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{210}}{196}$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{21}}{147}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{15\sqrt{14}}{196}$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{21}}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $-\frac{15\sqrt{14}}{196}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{21}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $-\frac{3\sqrt{210}}{196}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{21}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $-\frac{3\sqrt{7}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{21}}{98}$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $\frac{3\sqrt{7}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{21}}{98}$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{210}}{196}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{21}}{98}$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{15\sqrt{14}}{196}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{21}}{98}$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{21}}{14}$ |

multipole: $\mathbb{Q}_2^{(1,-1;a)}(A_{1g})$

| 858 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |
|---|---|---|

*continued ...*

316

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

$\mathbb{Q}_2^{(1,-1;a)}(B_{1g})$

$$\begin{pmatrix}
0 & 0 & -\frac{\sqrt{70}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{196} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{3\sqrt{14}}{98} & 0 & 0 & \frac{\sqrt{30}}{28} & 0 & 0 & 0 & -\frac{\sqrt{42}}{49} & 0 & 0 & 0 \\
-\frac{\sqrt{70}}{98} & 0 & 0 & 0 & -\frac{3\sqrt{14}}{98} & 0 & 0 & \frac{\sqrt{105}}{49} & 0 & 0 & 0 & -\frac{3\sqrt{35}}{98} & 0 & 0 \\
0 & -\frac{3\sqrt{14}}{98} & 0 & 0 & 0 & -\frac{\sqrt{70}}{98} & 0 & 0 & \frac{3\sqrt{35}}{98} & 0 & 0 & 0 & -\frac{\sqrt{105}}{49} & 0 \\
0 & 0 & -\frac{3\sqrt{14}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{49} & 0 & 0 & 0 & -\frac{\sqrt{30}}{28} \\
0 & 0 & 0 & -\frac{\sqrt{70}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{196} & 0 & 0 & 0 \\
0 & \frac{\sqrt{30}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{14} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{105}}{49} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{35}}{98} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{3\sqrt{35}}{98} & 0 & 0 & \frac{\sqrt{3}}{14} & 0 & 0 & 0 & \frac{\sqrt{105}}{49} & 0 & 0 & 0 \\
-\frac{\sqrt{210}}{196} & 0 & 0 & 0 & \frac{\sqrt{42}}{49} & 0 & 0 & \frac{3\sqrt{35}}{98} & 0 & 0 & 0 & \frac{\sqrt{105}}{49} & 0 & 0 \\
0 & -\frac{\sqrt{42}}{49} & 0 & 0 & 0 & \frac{\sqrt{210}}{196} & 0 & 0 & \frac{\sqrt{105}}{49} & 0 & 0 & 0 & \frac{3\sqrt{35}}{98} & 0 \\
0 & 0 & -\frac{3\sqrt{35}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}}{49} & 0 & 0 & 0 & \frac{\sqrt{3}}{14} \\
0 & 0 & 0 & -\frac{\sqrt{105}}{49} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{35}}{98} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{14} & 0 & 0 \\
\end{pmatrix}$$

| 859 | symmetry | $\sqrt{3}xy$ |
|---|---|---|

*continued ...*

Table 10

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_2^{(1,-1;a)}(B_{2g})$

$$\begin{pmatrix}
0 & 0 & \frac{\sqrt{70}i}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{196} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{3\sqrt{14}i}{98} & 0 & 0 & \frac{\sqrt{30}i}{28} & 0 & 0 & 0 & \frac{\sqrt{42}i}{49} & 0 & 0 & 0 \\
-\frac{\sqrt{70}i}{98} & 0 & 0 & 0 & \frac{3\sqrt{14}i}{98} & 0 & 0 & \frac{\sqrt{105}i}{49} & 0 & 0 & 0 & \frac{3\sqrt{35}i}{98} & 0 & 0 \\
0 & -\frac{3\sqrt{14}i}{98} & 0 & 0 & 0 & \frac{\sqrt{70}i}{98} & 0 & 0 & \frac{3\sqrt{35}i}{98} & 0 & 0 & 0 & \frac{\sqrt{105}i}{49} & 0 \\
0 & 0 & -\frac{3\sqrt{14}i}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{49} & 0 & 0 & 0 & \frac{\sqrt{30}i}{28} \\
0 & 0 & 0 & -\frac{\sqrt{70}i}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{196} & 0 & 0 & 0 \\
0 & -\frac{\sqrt{30}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{14} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{105}i}{49} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{35}i}{98} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{3\sqrt{35}i}{98} & 0 & 0 & \frac{\sqrt{3}i}{14} & 0 & 0 & 0 & -\frac{\sqrt{105}i}{49} & 0 & 0 & 0 \\
-\frac{\sqrt{210}i}{196} & 0 & 0 & 0 & -\frac{\sqrt{42}i}{49} & 0 & 0 & \frac{3\sqrt{35}i}{98} & 0 & 0 & 0 & -\frac{\sqrt{105}i}{49} & 0 & 0 \\
0 & -\frac{\sqrt{42}i}{49} & 0 & 0 & 0 & -\frac{\sqrt{210}i}{196} & 0 & 0 & \frac{\sqrt{105}i}{49} & 0 & 0 & 0 & -\frac{3\sqrt{35}i}{98} & 0 \\
0 & 0 & -\frac{3\sqrt{35}i}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}i}{49} & 0 & 0 & 0 & -\frac{\sqrt{3}i}{14} \\
0 & 0 & 0 & -\frac{\sqrt{105}i}{49} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{35}i}{98} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{14} & 0 & 0
\end{pmatrix}$$

| 860 | symmetry | $\sqrt{3}yz$ |

| No. | multipole | matrix |
|-----|-----------|--------|

$$\mathbb{Q}_{2,1}^{(1,-1;a)}(E_g)$$

$$
\begin{pmatrix}
0 & \frac{\sqrt{35}i}{49} & 0 & 0 & 0 & 0 & \frac{5\sqrt{6}i}{56} & 0 & \frac{15\sqrt{14}i}{392} & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{35}i}{49} & 0 & \frac{\sqrt{14}i}{49} & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{392} & 0 & \frac{11\sqrt{42}i}{392} & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{14}i}{49} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{35}i}{196} & 0 & \frac{\sqrt{21}i}{28} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{14}i}{49} & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{28} & 0 & \frac{3\sqrt{35}i}{196} & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{14}i}{49} & 0 & -\frac{\sqrt{35}i}{49} & 0 & 0 & 0 & 0 & -\frac{11\sqrt{42}i}{392} & 0 & -\frac{\sqrt{210}i}{392} & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{35}i}{49} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{15\sqrt{14}i}{392} & 0 & -\frac{5\sqrt{6}i}{56} \\
-\frac{5\sqrt{6}i}{56} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3i}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{210}i}{392} & 0 & 0 & 0 & 0 & \frac{3i}{14} & 0 & -\frac{2\sqrt{21}i}{49} & 0 & 0 & 0 & 0 & 0 \\
-\frac{15\sqrt{14}i}{392} & 0 & \frac{3\sqrt{35}i}{196} & 0 & 0 & 0 & 0 & \frac{2\sqrt{21}i}{49} & 0 & -\frac{\sqrt{105}i}{98} & 0 & 0 & 0 & 0 \\
0 & -\frac{11\sqrt{42}i}{392} & 0 & \frac{\sqrt{21}i}{28} & 0 & 0 & 0 & 0 & \frac{\sqrt{105}i}{98} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{21}i}{28} & 0 & \frac{11\sqrt{42}i}{392} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}i}{98} & 0 & 0 \\
0 & 0 & 0 & -\frac{3\sqrt{35}i}{196} & 0 & \frac{15\sqrt{14}i}{392} & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}i}{98} & 0 & \frac{2\sqrt{21}i}{49} & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{392} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{21}i}{49} & 0 & \frac{3i}{14} \\
0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{6}i}{56} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3i}{14} & 0
\end{pmatrix}
$$

| 861 | symmetry | $\sqrt{3}xz$ |

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{Q}_{2,2}^{(1,-1;a)}(E_g)$ | $0$ | $-\frac{\sqrt{35}}{49}$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{6}}{56}$ | $0$ | $-\frac{15\sqrt{14}}{392}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{35}}{49}$ | $0$ | $-\frac{\sqrt{14}}{49}$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{210}}{392}$ | $0$ | $-\frac{11\sqrt{42}}{392}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{14}}{49}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{35}}{196}$ | $0$ | $-\frac{\sqrt{21}}{28}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{14}}{49}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{21}}{28}$ | $0$ | $-\frac{3\sqrt{35}}{196}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{14}}{49}$ | $0$ | $\frac{\sqrt{35}}{49}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{11\sqrt{42}}{392}$ | $0$ | $\frac{\sqrt{210}}{392}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{35}}{49}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{15\sqrt{14}}{392}$ | $0$ | $\frac{5\sqrt{6}}{56}$ |
| | | $\frac{5\sqrt{6}}{56}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{3}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{210}}{392}$ | $0$ | $0$ | $0$ | $0$ | $\frac{3}{14}$ | $0$ | $\frac{2\sqrt{21}}{49}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $-\frac{15\sqrt{14}}{392}$ | $0$ | $-\frac{3\sqrt{35}}{196}$ | $0$ | $0$ | $0$ | $0$ | $\frac{2\sqrt{21}}{49}$ | $0$ | $\frac{\sqrt{105}}{98}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{11\sqrt{42}}{392}$ | $0$ | $-\frac{\sqrt{21}}{28}$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{105}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{21}}{28}$ | $0$ | $-\frac{11\sqrt{42}}{392}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{105}}{98}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{3\sqrt{35}}{196}$ | $0$ | $-\frac{15\sqrt{14}}{392}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{105}}{98}$ | $0$ | $-\frac{2\sqrt{21}}{49}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{210}}{392}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{21}}{49}$ | $0$ | $-\frac{3}{14}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{6}}{56}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3}{14}$ | $0$ |

| 862 | symmetry | $\frac{\sqrt{21}\left(x^4-3x^2y^2-3x^2z^2+y^4-3y^2z^2+z^4\right)}{6}$ |

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

$\mathbb{Q}_4^{(1,-1;a)}(A_{1g},1)$

$$\begin{pmatrix} \frac{1}{42} & 0 & 0 & 0 & \frac{\sqrt{5}}{42} & 0 & 0 & \frac{5\sqrt{6}}{84} & 0 & 0 & 0 & \frac{5\sqrt{2}}{84} & 0 & 0 \\ 0 & -\frac{1}{14} & 0 & 0 & 0 & \frac{\sqrt{5}}{42} & 0 & 0 & -\frac{\sqrt{10}}{21} & 0 & 0 & 0 & \frac{\sqrt{30}}{42} & 0 \\ 0 & 0 & \frac{1}{21} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{3}}{84} & 0 & 0 & 0 & \frac{\sqrt{105}}{84} \\ 0 & 0 & 0 & \frac{1}{21} & 0 & 0 & -\frac{\sqrt{105}}{84} & 0 & 0 & 0 & \frac{5\sqrt{3}}{84} & 0 & 0 & 0 \\ \frac{\sqrt{5}}{42} & 0 & 0 & 0 & -\frac{1}{14} & 0 & 0 & -\frac{\sqrt{30}}{42} & 0 & 0 & 0 & \frac{\sqrt{10}}{21} & 0 & 0 \\ 0 & \frac{\sqrt{5}}{42} & 0 & 0 & 0 & \frac{1}{42} & 0 & 0 & -\frac{5\sqrt{2}}{84} & 0 & 0 & 0 & -\frac{5\sqrt{6}}{84} & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{105}}{84} & 0 & 0 & -\frac{1}{6} & 0 & 0 & 0 & -\frac{\sqrt{35}}{42} & 0 & 0 & 0 \\ \frac{5\sqrt{6}}{84} & 0 & 0 & 0 & -\frac{\sqrt{30}}{42} & 0 & 0 & \frac{13}{42} & 0 & 0 & 0 & -\frac{5\sqrt{3}}{42} & 0 & 0 \\ 0 & -\frac{\sqrt{10}}{21} & 0 & 0 & 0 & -\frac{5\sqrt{2}}{84} & 0 & 0 & \frac{1}{14} & 0 & 0 & 0 & -\frac{5\sqrt{3}}{42} & 0 \\ 0 & 0 & -\frac{5\sqrt{3}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3}{14} & 0 & 0 & 0 & -\frac{\sqrt{35}}{42} \\ 0 & 0 & 0 & \frac{5\sqrt{3}}{84} & 0 & 0 & -\frac{\sqrt{35}}{42} & 0 & 0 & 0 & -\frac{3}{14} & 0 & 0 & 0 \\ \frac{5\sqrt{2}}{84} & 0 & 0 & 0 & \frac{\sqrt{10}}{21} & 0 & 0 & -\frac{5\sqrt{3}}{42} & 0 & 0 & 0 & \frac{1}{14} & 0 & 0 \\ 0 & \frac{\sqrt{30}}{42} & 0 & 0 & 0 & -\frac{5\sqrt{6}}{84} & 0 & 0 & -\frac{5\sqrt{3}}{42} & 0 & 0 & 0 & \frac{13}{42} & 0 \\ 0 & 0 & \frac{\sqrt{105}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{35}}{42} & 0 & 0 & 0 & -\frac{1}{6} \end{pmatrix}$$

| 863 | symmetry | $-\frac{\sqrt{15}\left(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4\right)}{12}$ |

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|-----|-----------|--------|--|--|--|--|--|--|--|--|--|--|--|--|--|
| | $\mathbb{Q}_4^{(1,-1;a)}(A_{1g},2)$ | $\frac{\sqrt{35}}{294}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{7}}{42}$ | $0$ | $0$ | $\frac{5\sqrt{210}}{588}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{70}}{84}$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{35}}{98}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{7}}{42}$ | $0$ | $0$ | $-\frac{5\sqrt{14}}{147}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{42}}{42}$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{35}}{147}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{105}}{588}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{3}}{12}$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{35}}{147}$ | $0$ | $0$ | $\frac{\sqrt{3}}{12}$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{105}}{588}$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{7}}{42}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{35}}{98}$ | $0$ | $0$ | $\frac{\sqrt{42}}{42}$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{14}}{147}$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{7}}{42}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{35}}{294}$ | $0$ | $0$ | $\frac{\sqrt{70}}{84}$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{210}}{588}$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{3}}{12}$ | $0$ | $0$ | $-\frac{\sqrt{35}}{42}$ | $0$ | $0$ | $0$ | $\frac{1}{6}$ | $0$ | $0$ | $0$ |
| | | $\frac{5\sqrt{210}}{588}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{42}}{42}$ | $0$ | $0$ | $\frac{13\sqrt{35}}{294}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{105}}{42}$ | $0$ | $0$ |
| | | $0$ | $-\frac{5\sqrt{14}}{147}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{70}}{84}$ | $0$ | $0$ | $\frac{\sqrt{35}}{98}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{105}}{42}$ | $0$ |
| | | $0$ | $0$ | $-\frac{5\sqrt{105}}{588}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{35}}{98}$ | $0$ | $0$ | $0$ | $\frac{1}{6}$ |
| | | $0$ | $0$ | $0$ | $\frac{5\sqrt{105}}{588}$ | $0$ | $0$ | $\frac{1}{6}$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{35}}{98}$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{70}}{84}$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{14}}{147}$ | $0$ | $0$ | $\frac{\sqrt{105}}{42}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{35}}{98}$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{42}}{42}$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{210}}{588}$ | $0$ | $0$ | $\frac{\sqrt{105}}{42}$ | $0$ | $0$ | $0$ | $\frac{13\sqrt{35}}{294}$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{3}}{12}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{1}{6}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{35}}{42}$ |

| 864 | symmetry | $\frac{\sqrt{35}xy(x-y)(x+y)}{2}$ |

Table  10

| No. | multipole | matrix | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

$$\mathbb{Q}_4^{(1,-1;a)}(A_{2g})$$

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{3}i}{21}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{30}i}{42}$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{3}i}{21}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2}i}{7}$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{7}i}{14}$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{7}i}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $\frac{\sqrt{3}i}{21}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2}i}{7}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $\frac{\sqrt{3}i}{21}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{30}i}{42}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $\frac{\sqrt{7}i}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{21}i}{21}$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{2}i}{7}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{5}i}{7}$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{30}i}{42}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{5}i}{7}$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{21}i}{21}$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{21}i}{21}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $\frac{\sqrt{30}i}{42}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{5}i}{7}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $\frac{\sqrt{2}i}{7}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{5}i}{7}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $\frac{\sqrt{7}i}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{21}i}{21}$ | $0$ | $0$ | $0$ | $0$ |

| 865 | symmetry | $\frac{\sqrt{5}(x-y)(x+y)\left(x^2+y^2-6z^2\right)}{4}$ |
|---|---|---|

*continued ...*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

The matrix for $\mathbb{Q}_4^{(1,-1;a)}(B_{1g})$:

$$
\begin{pmatrix}
0 & 0 & -\frac{\sqrt{42}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{14}}{98} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{210}}{294} & 0 & 0 & \frac{3\sqrt{2}}{28} & 0 & 0 & 0 & -\frac{\sqrt{70}}{196} & 0 & 0 & 0 \\
-\frac{\sqrt{42}}{98} & 0 & 0 & 0 & \frac{\sqrt{210}}{294} & 0 & 0 & -\frac{9\sqrt{7}}{196} & 0 & 0 & 0 & \frac{17\sqrt{21}}{588} & 0 & 0 \\
0 & \frac{\sqrt{210}}{294} & 0 & 0 & 0 & -\frac{\sqrt{42}}{98} & 0 & 0 & -\frac{17\sqrt{21}}{588} & 0 & 0 & 0 & \frac{9\sqrt{7}}{196} & 0 \\
0 & 0 & \frac{\sqrt{210}}{294} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{196} & 0 & 0 & 0 & -\frac{3\sqrt{2}}{28} \\
0 & 0 & 0 & -\frac{\sqrt{42}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{14}}{98} & 0 & 0 & 0 \\
0 & \frac{3\sqrt{2}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{7} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{9\sqrt{7}}{196} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}}{147} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{17\sqrt{21}}{588} & 0 & 0 & \frac{\sqrt{5}}{7} & 0 & 0 & 0 & -\frac{4\sqrt{7}}{49} & 0 & 0 & 0 \\
-\frac{5\sqrt{14}}{98} & 0 & 0 & 0 & \frac{\sqrt{70}}{196} & 0 & 0 & \frac{\sqrt{21}}{147} & 0 & 0 & 0 & -\frac{4\sqrt{7}}{49} & 0 & 0 \\
0 & -\frac{\sqrt{70}}{196} & 0 & 0 & 0 & \frac{5\sqrt{14}}{98} & 0 & 0 & -\frac{4\sqrt{7}}{49} & 0 & 0 & 0 & \frac{\sqrt{21}}{147} & 0 \\
0 & 0 & \frac{17\sqrt{21}}{588} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{4\sqrt{7}}{49} & 0 & 0 & 0 & \frac{\sqrt{5}}{7} \\
0 & 0 & 0 & \frac{9\sqrt{7}}{196} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}}{147} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{3\sqrt{2}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{7} & 0 & 0 \\
\end{pmatrix}
$$

| 866 | symmetry | $-\frac{\sqrt{5}xy\left(x^2+y^2-6z^2\right)}{2}$ |

Table  10

| No. | multipole | matrix | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 0 | $-\frac{\sqrt{42}i}{98}$ | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{5\sqrt{14}i}{98}$ | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | $\frac{\sqrt{210}i}{294}$ | 0 | 0 | $-\frac{3\sqrt{2}i}{28}$ | 0 | 0 | 0 | $-\frac{\sqrt{70}i}{196}$ | 0 | 0 | 0 |
| | | $\frac{\sqrt{42}i}{98}$ | 0 | 0 | 0 | $\frac{\sqrt{210}i}{294}$ | 0 | 0 | $\frac{9\sqrt{7}i}{196}$ | 0 | 0 | 0 | $\frac{17\sqrt{21}i}{588}$ | 0 | 0 |
| | $\mathbb{Q}_4^{(1,-1;a)}(B_{2g})$ | 0 | $-\frac{\sqrt{210}i}{294}$ | 0 | 0 | 0 | $-\frac{\sqrt{42}i}{98}$ | 0 | 0 | $\frac{17\sqrt{21}i}{588}$ | 0 | 0 | 0 | $\frac{9\sqrt{7}i}{196}$ | 0 |
| | | 0 | 0 | $-\frac{\sqrt{210}i}{294}$ | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{70}i}{196}$ | 0 | 0 | 0 | $-\frac{3\sqrt{2}i}{28}$ |
| | | 0 | 0 | 0 | $\frac{\sqrt{42}i}{98}$ | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{5\sqrt{14}i}{98}$ | 0 | 0 | 0 |
| | | 0 | $\frac{3\sqrt{2}i}{28}$ | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{5}i}{7}$ | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | $-\frac{9\sqrt{7}i}{196}$ | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{21}i}{147}$ | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | $-\frac{17\sqrt{21}i}{588}$ | 0 | 0 | $-\frac{\sqrt{5}i}{7}$ | 0 | 0 | 0 | $-\frac{4\sqrt{7}i}{49}$ | 0 | 0 | 0 |
| | | $\frac{5\sqrt{14}i}{98}$ | 0 | 0 | 0 | $\frac{\sqrt{70}i}{196}$ | 0 | 0 | $-\frac{\sqrt{21}i}{147}$ | 0 | 0 | 0 | $-\frac{4\sqrt{7}i}{49}$ | 0 | 0 |
| | | 0 | $\frac{\sqrt{70}i}{196}$ | 0 | 0 | 0 | $\frac{5\sqrt{14}i}{98}$ | 0 | 0 | $\frac{4\sqrt{7}i}{49}$ | 0 | 0 | 0 | $\frac{\sqrt{21}i}{147}$ | 0 |
| | | 0 | 0 | $-\frac{17\sqrt{21}i}{588}$ | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{4\sqrt{7}i}{49}$ | 0 | 0 | 0 | $\frac{\sqrt{5}i}{7}$ |
| | | 0 | 0 | 0 | $-\frac{9\sqrt{7}i}{196}$ | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{21}i}{147}$ | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | $\frac{3\sqrt{2}i}{28}$ | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{5}i}{7}$ | 0 | 0 |

| 867 | symmetry | $\frac{\sqrt{35}yz(y-z)(y+z)}{2}$ |

*continued …*

Table 10

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{4,1}^{(1,-1;a)}(E_g,1)$

$$\begin{pmatrix}
0 & \frac{\sqrt{3}i}{42} & 0 & \frac{\sqrt{6}i}{84} & 0 & 0 & \frac{\sqrt{70}i}{112} & 0 & \frac{5\sqrt{30}i}{168} & 0 & \frac{5\sqrt{2}i}{112} & 0 & 0 & 0 \\
-\frac{\sqrt{3}i}{42} & 0 & -\frac{\sqrt{30}i}{84} & 0 & 0 & 0 & 0 & -\frac{13\sqrt{2}i}{112} & 0 & -\frac{\sqrt{10}i}{56} & 0 & \frac{\sqrt{6}i}{48} & 0 & 0 \\
0 & \frac{\sqrt{30}i}{84} & 0 & 0 & 0 & -\frac{\sqrt{6}i}{84} & \frac{3\sqrt{7}i}{112} & 0 & \frac{\sqrt{3}i}{336} & 0 & -\frac{\sqrt{5}i}{16} & 0 & -\frac{i}{112} & 0 \\
-\frac{\sqrt{6}i}{84} & 0 & 0 & 0 & \frac{\sqrt{30}i}{84} & 0 & 0 & \frac{i}{112} & 0 & \frac{\sqrt{5}i}{16} & 0 & -\frac{\sqrt{3}i}{336} & 0 & -\frac{3\sqrt{7}i}{112} \\
0 & 0 & 0 & -\frac{\sqrt{30}i}{84} & 0 & -\frac{\sqrt{3}i}{42} & 0 & 0 & -\frac{\sqrt{6}i}{48} & 0 & \frac{\sqrt{10}i}{56} & 0 & \frac{13\sqrt{2}i}{112} & 0 \\
0 & 0 & \frac{\sqrt{6}i}{84} & 0 & \frac{\sqrt{3}i}{42} & 0 & 0 & 0 & 0 & -\frac{5\sqrt{2}i}{112} & 0 & -\frac{5\sqrt{30}i}{168} & 0 & -\frac{\sqrt{70}i}{112} \\
-\frac{\sqrt{70}i}{112} & 0 & -\frac{3\sqrt{7}i}{112} & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}i}{42} & 0 & -\frac{\sqrt{21}i}{42} & 0 & 0 & 0 & 0 \\
0 & \frac{13\sqrt{2}i}{112} & 0 & -\frac{i}{112} & 0 & 0 & \frac{\sqrt{105}i}{42} & 0 & \frac{\sqrt{5}i}{14} & 0 & -\frac{\sqrt{3}i}{21} & 0 & 0 & 0 \\
-\frac{5\sqrt{30}i}{168} & 0 & -\frac{\sqrt{3}i}{336} & 0 & \frac{\sqrt{6}i}{48} & 0 & 0 & -\frac{\sqrt{5}i}{14} & 0 & \frac{3i}{14} & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{10}i}{56} & 0 & -\frac{\sqrt{5}i}{16} & 0 & \frac{5\sqrt{2}i}{112} & \frac{\sqrt{21}i}{42} & 0 & -\frac{3i}{14} & 0 & 0 & 0 & \frac{\sqrt{3}i}{21} & 0 \\
-\frac{5\sqrt{2}i}{112} & 0 & \frac{\sqrt{5}i}{16} & 0 & -\frac{\sqrt{10}i}{56} & 0 & 0 & \frac{\sqrt{3}i}{21} & 0 & 0 & 0 & -\frac{3i}{14} & 0 & \frac{\sqrt{21}i}{42} \\
0 & -\frac{\sqrt{6}i}{48} & 0 & \frac{\sqrt{3}i}{336} & 0 & \frac{5\sqrt{30}i}{168} & 0 & 0 & 0 & 0 & \frac{3i}{14} & 0 & -\frac{\sqrt{5}i}{14} & 0 \\
0 & 0 & \frac{i}{112} & 0 & -\frac{13\sqrt{2}i}{112} & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{21} & 0 & \frac{\sqrt{5}i}{14} & 0 & \frac{\sqrt{105}i}{42} \\
0 & 0 & 0 & \frac{3\sqrt{7}i}{112} & 0 & \frac{\sqrt{70}i}{112} & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{42} & 0 & -\frac{\sqrt{105}i}{42} & 0 \\
\end{pmatrix}$$

| 868 | symmetry | $\frac{\sqrt{35}xz(x-z)(x+z)}{2}$ |
|---|---|---|

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{Q}_{4,2}^{(1,-1;a)}(E_g,1)$ | $0$ | $-\frac{\sqrt{3}}{42}$ | $0$ | $\frac{\sqrt{6}}{84}$ | $0$ | $0$ | $\frac{\sqrt{70}}{112}$ | $0$ | $-\frac{5\sqrt{30}}{168}$ | $0$ | $\frac{5\sqrt{2}}{112}$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{3}}{42}$ | $0$ | $\frac{\sqrt{30}}{84}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{13\sqrt{2}}{112}$ | $0$ | $\frac{\sqrt{10}}{56}$ | $0$ | $\frac{\sqrt{6}}{48}$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{30}}{84}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{6}}{84}$ | $-\frac{3\sqrt{7}}{112}$ | $0$ | $\frac{\sqrt{3}}{336}$ | $0$ | $\frac{\sqrt{5}}{16}$ | $0$ | $-\frac{1}{112}$ | $0$ |
| | | $\frac{\sqrt{6}}{84}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{30}}{84}$ | $0$ | $0$ | $-\frac{1}{112}$ | $0$ | $\frac{\sqrt{5}}{16}$ | $0$ | $\frac{\sqrt{3}}{336}$ | $0$ | $-\frac{3\sqrt{7}}{112}$ |
| | | $0$ | $0$ | $0$ | $-\frac{\sqrt{30}}{84}$ | $0$ | $\frac{\sqrt{3}}{42}$ | $0$ | $0$ | $\frac{\sqrt{6}}{48}$ | $0$ | $\frac{\sqrt{10}}{56}$ | $0$ | $-\frac{13\sqrt{2}}{112}$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{6}}{84}$ | $0$ | $\frac{\sqrt{3}}{42}$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{2}}{112}$ | $0$ | $-\frac{5\sqrt{30}}{168}$ | $0$ | $\frac{\sqrt{70}}{112}$ |
| | | $\frac{\sqrt{70}}{112}$ | $0$ | $-\frac{3\sqrt{7}}{112}$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{105}}{42}$ | $0$ | $-\frac{\sqrt{21}}{42}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{13\sqrt{2}}{112}$ | $0$ | $-\frac{1}{112}$ | $0$ | $0$ | $\frac{\sqrt{105}}{42}$ | $0$ | $-\frac{\sqrt{5}}{14}$ | $0$ | $-\frac{\sqrt{3}}{21}$ | $0$ | $0$ | $0$ |
| | | $-\frac{5\sqrt{30}}{168}$ | $0$ | $\frac{\sqrt{3}}{336}$ | $0$ | $\frac{\sqrt{6}}{48}$ | $0$ | $0$ | $-\frac{\sqrt{5}}{14}$ | $0$ | $-\frac{3}{14}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{10}}{56}$ | $0$ | $\frac{\sqrt{5}}{16}$ | $0$ | $\frac{5\sqrt{2}}{112}$ | $-\frac{\sqrt{21}}{42}$ | $0$ | $-\frac{3}{14}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{3}}{21}$ | $0$ |
| | | $\frac{5\sqrt{2}}{112}$ | $0$ | $\frac{\sqrt{5}}{16}$ | $0$ | $\frac{\sqrt{10}}{56}$ | $0$ | $0$ | $-\frac{\sqrt{3}}{21}$ | $0$ | $0$ | $0$ | $\frac{3}{14}$ | $0$ | $\frac{\sqrt{21}}{42}$ |
| | | $0$ | $\frac{\sqrt{6}}{48}$ | $0$ | $\frac{\sqrt{3}}{336}$ | $0$ | $-\frac{5\sqrt{30}}{168}$ | $0$ | $0$ | $0$ | $0$ | $\frac{3}{14}$ | $0$ | $\frac{\sqrt{5}}{14}$ | $0$ |
| | | $0$ | $0$ | $-\frac{1}{112}$ | $0$ | $-\frac{13\sqrt{2}}{112}$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{3}}{21}$ | $0$ | $\frac{\sqrt{5}}{14}$ | $0$ | $-\frac{\sqrt{105}}{42}$ |
| | | $0$ | $0$ | $0$ | $-\frac{3\sqrt{7}}{112}$ | $0$ | $\frac{\sqrt{70}}{112}$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{21}}{42}$ | $0$ | $-\frac{\sqrt{105}}{42}$ | $0$ |
| 869 | symmetry | $\frac{\sqrt{5}yz\left(6x^2-y^2-z^2\right)}{2}$ | | | | | | | | | | | | | | |

Table  10

| No. | multipole | matrix | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

$\mathbb{Q}_{4,1}^{(1,-1;a)}(E_g,2)$

$$
\begin{pmatrix}
0 & \frac{\sqrt{21}i}{294} & 0 & -\frac{\sqrt{42}i}{84} & 0 & 0 & \frac{\sqrt{10}i}{112} & 0 & \frac{5\sqrt{210}i}{1176} & 0 & -\frac{5\sqrt{14}i}{112} & 0 & 0 & 0 \\[4pt]
-\frac{\sqrt{21}i}{294} & 0 & -\frac{\sqrt{210}i}{588} & 0 & 0 & 0 & 0 & -\frac{13\sqrt{14}i}{784} & 0 & -\frac{\sqrt{70}i}{392} & 0 & -\frac{\sqrt{42}i}{48} & 0 & 0 \\[4pt]
0 & \frac{\sqrt{210}i}{588} & 0 & 0 & 0 & \frac{\sqrt{42}i}{84} & -\frac{3i}{16} & 0 & \frac{\sqrt{21}i}{2352} & 0 & -\frac{\sqrt{35}i}{112} & 0 & \frac{\sqrt{7}i}{112} & 0 \\[4pt]
\frac{\sqrt{42}i}{84} & 0 & 0 & 0 & \frac{\sqrt{210}i}{588} & 0 & 0 & -\frac{\sqrt{7}i}{112} & 0 & \frac{\sqrt{35}i}{112} & 0 & -\frac{\sqrt{21}i}{2352} & 0 & \frac{3i}{16} \\[4pt]
0 & 0 & 0 & -\frac{\sqrt{210}i}{588} & 0 & -\frac{\sqrt{21}i}{294} & 0 & 0 & \frac{\sqrt{42}i}{48} & 0 & \frac{\sqrt{70}i}{392} & 0 & \frac{13\sqrt{14}i}{784} & 0 \\[4pt]
0 & 0 & -\frac{\sqrt{42}i}{84} & 0 & \frac{\sqrt{21}i}{294} & 0 & 0 & 0 & 0 & \frac{5\sqrt{14}i}{112} & 0 & -\frac{5\sqrt{210}i}{1176} & 0 & -\frac{\sqrt{10}i}{112} \\[4pt]
-\frac{\sqrt{10}i}{112} & 0 & \frac{3i}{16} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{42} & 0 & \frac{\sqrt{3}i}{6} & 0 & 0 & 0 & 0 \\[4pt]
0 & \frac{13\sqrt{14}i}{784} & 0 & \frac{\sqrt{7}i}{112} & 0 & 0 & \frac{\sqrt{15}i}{42} & 0 & \frac{\sqrt{35}i}{98} & 0 & \frac{\sqrt{21}i}{21} & 0 & 0 & 0 \\[4pt]
-\frac{5\sqrt{210}i}{1176} & 0 & -\frac{\sqrt{21}i}{2352} & 0 & -\frac{\sqrt{42}i}{48} & 0 & 0 & -\frac{\sqrt{35}i}{98} & 0 & \frac{3\sqrt{7}i}{98} & 0 & 0 & 0 & 0 \\[4pt]
0 & \frac{\sqrt{70}i}{392} & 0 & -\frac{\sqrt{35}i}{112} & 0 & -\frac{5\sqrt{14}i}{112} & -\frac{\sqrt{3}i}{6} & 0 & -\frac{3\sqrt{7}i}{98} & 0 & 0 & 0 & -\frac{\sqrt{21}i}{21} & 0 \\[4pt]
\frac{5\sqrt{14}i}{112} & 0 & \frac{\sqrt{35}i}{112} & 0 & -\frac{\sqrt{70}i}{392} & 0 & 0 & -\frac{\sqrt{21}i}{21} & 0 & 0 & 0 & -\frac{3\sqrt{7}i}{98} & 0 & -\frac{\sqrt{3}i}{6} \\[4pt]
0 & \frac{\sqrt{42}i}{48} & 0 & \frac{\sqrt{21}i}{2352} & 0 & \frac{5\sqrt{210}i}{1176} & 0 & 0 & 0 & 0 & \frac{3\sqrt{7}i}{98} & 0 & -\frac{\sqrt{35}i}{98} & 0 \\[4pt]
0 & 0 & -\frac{\sqrt{7}i}{112} & 0 & -\frac{13\sqrt{14}i}{784} & 0 & 0 & 0 & 0 & \frac{\sqrt{21}i}{21} & 0 & \frac{\sqrt{35}i}{98} & 0 & \frac{\sqrt{15}i}{42} \\[4pt]
0 & 0 & 0 & -\frac{3i}{16} & 0 & \frac{\sqrt{10}i}{112} & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{6} & 0 & -\frac{\sqrt{15}i}{42} & 0
\end{pmatrix}
$$

| No. | multipole | matrix |
|---|---|---|
| 870 | symmetry | $-\dfrac{\sqrt{5}xz\left(x^2-6y^2+z^2\right)}{2}$ |

Table 10

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{4,2}^{(1,-1;a)}(E_g,2)$

$$\begin{pmatrix}
0 & -\frac{\sqrt{21}}{294} & 0 & -\frac{\sqrt{42}}{84} & 0 & 0 & \frac{\sqrt{10}}{112} & 0 & -\frac{5\sqrt{210}}{1176} & 0 & -\frac{5\sqrt{14}}{112} & 0 & 0 & 0 \\
-\frac{\sqrt{21}}{294} & 0 & \frac{\sqrt{210}}{588} & 0 & 0 & 0 & 0 & -\frac{13\sqrt{14}}{784} & 0 & \frac{\sqrt{70}}{392} & 0 & -\frac{\sqrt{42}}{48} & 0 & 0 \\
0 & \frac{\sqrt{210}}{588} & 0 & 0 & 0 & \frac{\sqrt{42}}{84} & \frac{3}{16} & 0 & \frac{\sqrt{21}}{2352} & 0 & \frac{\sqrt{35}}{112} & 0 & \frac{\sqrt{7}}{112} & 0 \\
-\frac{\sqrt{42}}{84} & 0 & 0 & 0 & -\frac{\sqrt{210}}{588} & 0 & 0 & \frac{\sqrt{7}}{112} & 0 & \frac{\sqrt{35}}{112} & 0 & \frac{\sqrt{21}}{2352} & 0 & \frac{3}{16} \\
0 & 0 & 0 & -\frac{\sqrt{210}}{588} & 0 & \frac{\sqrt{21}}{294} & 0 & 0 & -\frac{\sqrt{42}}{48} & 0 & \frac{\sqrt{70}}{392} & 0 & -\frac{13\sqrt{14}}{784} & 0 \\
0 & 0 & \frac{\sqrt{42}}{84} & 0 & \frac{\sqrt{21}}{294} & 0 & 0 & 0 & 0 & -\frac{5\sqrt{14}}{112} & 0 & -\frac{5\sqrt{210}}{1176} & 0 & \frac{\sqrt{10}}{112} \\
\frac{\sqrt{10}}{112} & 0 & \frac{3}{16} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{42} & 0 & \frac{\sqrt{3}}{6} & 0 & 0 & 0 & 0 \\
0 & -\frac{13\sqrt{14}}{784} & 0 & \frac{\sqrt{7}}{112} & 0 & 0 & \frac{\sqrt{15}}{42} & 0 & -\frac{\sqrt{35}}{98} & 0 & \frac{\sqrt{21}}{21} & 0 & 0 & 0 \\
-\frac{5\sqrt{210}}{1176} & 0 & \frac{\sqrt{21}}{2352} & 0 & -\frac{\sqrt{42}}{48} & 0 & 0 & -\frac{\sqrt{35}}{98} & 0 & -\frac{3\sqrt{7}}{98} & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{70}}{392} & 0 & \frac{\sqrt{35}}{112} & 0 & -\frac{5\sqrt{14}}{112} & \frac{\sqrt{3}}{6} & 0 & -\frac{3\sqrt{7}}{98} & 0 & 0 & 0 & -\frac{\sqrt{21}}{21} & 0 \\
-\frac{5\sqrt{14}}{112} & 0 & \frac{\sqrt{35}}{112} & 0 & \frac{\sqrt{70}}{392} & 0 & 0 & \frac{\sqrt{21}}{21} & 0 & 0 & 0 & \frac{3\sqrt{7}}{98} & 0 & -\frac{\sqrt{3}}{6} \\
0 & -\frac{\sqrt{42}}{48} & 0 & \frac{\sqrt{21}}{2352} & 0 & -\frac{5\sqrt{210}}{1176} & 0 & 0 & 0 & 0 & \frac{3\sqrt{7}}{98} & 0 & \frac{\sqrt{35}}{98} & 0 \\
0 & 0 & \frac{\sqrt{7}}{112} & 0 & -\frac{13\sqrt{14}}{784} & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}}{21} & 0 & \frac{\sqrt{35}}{98} & 0 & -\frac{\sqrt{15}}{42} \\
0 & 0 & 0 & \frac{3}{16} & 0 & \frac{\sqrt{10}}{112} & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{6} & 0 & -\frac{\sqrt{15}}{42} & 0
\end{pmatrix}$$

| 871 | symmetry | $\frac{\sqrt{2}\left(2x^6-15x^4y^2-15x^4z^2-15x^2y^4+180x^2y^2z^2-15x^2z^4+2y^6-15y^4z^2-15y^2z^4+2z^6\right)}{8}$ |

*continued …*

Table 10

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_6^{(1,-1;a)}(A_{1g},1)$

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{231}}{1848}$ | 0 | 0 | 0 | $\frac{\sqrt{77}}{88}$ | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{385}}{616}$ | 0 | 0 | 0 | $-\frac{\sqrt{1155}}{264}$ |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{5\sqrt{462}}{1848}$ | 0 | 0 | $\frac{\sqrt{330}}{264}$ |
| 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{330}}{264}$ | 0 | 0 | 0 | $\frac{5\sqrt{462}}{1848}$ | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{1155}}{264}$ | 0 | 0 | 0 | $-\frac{\sqrt{385}}{616}$ | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{77}}{88}$ | 0 | 0 | 0 | $\frac{\sqrt{231}}{1848}$ |
| 0 | 0 | 0 | $-\frac{\sqrt{330}}{264}$ | 0 | 0 | $\frac{\sqrt{154}}{616}$ | 0 | 0 | 0 | $-\frac{3\sqrt{110}}{88}$ | 0 | 0 |
| $-\frac{\sqrt{231}}{1848}$ | 0 | 0 | 0 | $\frac{\sqrt{1155}}{264}$ | 0 | 0 | $-\frac{5\sqrt{154}}{616}$ | 0 | 0 | 0 | $\frac{\sqrt{462}}{88}$ | 0 |
| 0 | $\frac{\sqrt{385}}{616}$ | 0 | 0 | 0 | $-\frac{\sqrt{77}}{88}$ | 0 | 0 | $\frac{9\sqrt{154}}{616}$ | 0 | 0 | 0 | $\frac{\sqrt{462}}{88}$ |
| 0 | 0 | $-\frac{5\sqrt{462}}{1848}$ | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{5\sqrt{154}}{616}$ | 0 | 0 | $-\frac{3\sqrt{110}}{88}$ |
| 0 | 0 | 0 | $\frac{5\sqrt{462}}{1848}$ | 0 | 0 | $-\frac{3\sqrt{110}}{88}$ | 0 | 0 | 0 | $-\frac{5\sqrt{154}}{616}$ | 0 | 0 |
| $\frac{\sqrt{77}}{88}$ | 0 | 0 | 0 | $-\frac{\sqrt{385}}{616}$ | 0 | 0 | $\frac{\sqrt{462}}{88}$ | 0 | 0 | 0 | $\frac{9\sqrt{154}}{616}$ | 0 |
| 0 | $-\frac{\sqrt{1155}}{264}$ | 0 | 0 | 0 | $\frac{\sqrt{231}}{1848}$ | 0 | 0 | $\frac{\sqrt{462}}{88}$ | 0 | 0 | 0 | $-\frac{5\sqrt{154}}{616}$ |
| 0 | 0 | $\frac{\sqrt{330}}{264}$ | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{3\sqrt{110}}{88}$ | 0 | 0 | $\frac{\sqrt{154}}{616}$ |

| No. | symmetry | |
|---|---|---|
| 872 | symmetry | $-\frac{\sqrt{14}\left(x^6-15x^4z^2+15x^2z^4+y^6-15y^4z^2+15y^2z^4-2z^6\right)}{8}$ |

Table 10

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_6^{(1,-1;a)}(A_{1g}, 2)$

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{33}}{264}$ | 0 | 0 | 0 | $-\frac{\sqrt{11}}{88}$ | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{55}}{88}$ | 0 | 0 | 0 | $\frac{\sqrt{165}}{264}$ | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{5\sqrt{66}}{264}$ | 0 | 0 | 0 | $-\frac{\sqrt{2310}}{1848}$ |
| 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{2310}}{1848}$ | 0 | 0 | 0 | $\frac{5\sqrt{66}}{264}$ | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{165}}{264}$ | 0 | 0 | 0 | $-\frac{\sqrt{55}}{88}$ | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{11}}{88}$ | 0 | 0 | 0 | $\frac{\sqrt{33}}{264}$ | 0 |
| 0 | 0 | 0 | $\frac{\sqrt{2310}}{1848}$ | 0 | 0 | $\frac{\sqrt{22}}{88}$ | 0 | 0 | 0 | $\frac{3\sqrt{770}}{616}$ | 0 | 0 | 0 |
| $-\frac{\sqrt{33}}{264}$ | 0 | 0 | 0 | $-\frac{\sqrt{165}}{264}$ | 0 | 0 | $-\frac{5\sqrt{22}}{88}$ | 0 | 0 | 0 | $-\frac{\sqrt{66}}{88}$ | 0 | 0 |
| 0 | $\frac{\sqrt{55}}{88}$ | 0 | 0 | 0 | $\frac{\sqrt{11}}{88}$ | 0 | 0 | $\frac{9\sqrt{22}}{88}$ | 0 | 0 | 0 | $-\frac{\sqrt{66}}{88}$ | 0 |
| 0 | 0 | $-\frac{5\sqrt{66}}{264}$ | 0 | 0 | 0 | 0 | 0 | $-\frac{5\sqrt{22}}{88}$ | 0 | 0 | 0 | $\frac{3\sqrt{770}}{616}$ | 0 |
| 0 | 0 | 0 | $\frac{5\sqrt{66}}{264}$ | 0 | 0 | $\frac{3\sqrt{770}}{616}$ | 0 | 0 | 0 | $-\frac{5\sqrt{22}}{88}$ | 0 | 0 | 0 |
| $-\frac{\sqrt{11}}{88}$ | 0 | 0 | 0 | $-\frac{\sqrt{55}}{88}$ | 0 | 0 | $-\frac{\sqrt{66}}{88}$ | 0 | 0 | 0 | $\frac{9\sqrt{22}}{88}$ | 0 | 0 |
| 0 | $\frac{\sqrt{165}}{264}$ | 0 | 0 | 0 | $\frac{\sqrt{33}}{264}$ | 0 | 0 | $-\frac{\sqrt{66}}{88}$ | 0 | 0 | 0 | $-\frac{5\sqrt{22}}{88}$ | 0 |
| 0 | 0 | $-\frac{\sqrt{2310}}{1848}$ | 0 | 0 | 0 | 0 | 0 | $\frac{3\sqrt{770}}{616}$ | 0 | 0 | 0 | $\frac{\sqrt{22}}{88}$ | 0 |

| No. | | |
|---|---|---|
| 873 | symmetry | $-\frac{3\sqrt{7}xy(x-y)(x+y)\left(x^2+y^2-10z^2\right)}{4}$ |

Table 10

| No. | multipole | matrix | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{Q}_6^{(1,-1;a)}(A_{2g})$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{22}i}{44}$ | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{330}i}{132}$ | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{1155}i}{462}$ |
| | | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{1155}i}{462}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{330}i}{132}$ | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{22}i}{44}$ | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | $-\frac{\sqrt{1155}i}{462}$ | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{3\sqrt{385}i}{154}$ | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | $\frac{\sqrt{330}i}{132}$ | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{33}i}{22}$ | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{22}i}{44}$ | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{33}i}{22}$ | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{3\sqrt{385}i}{154}$ |
| | | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{3\sqrt{385}i}{154}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | $-\frac{\sqrt{22}i}{44}$ | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{33}i}{22}$ | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | $\frac{\sqrt{330}i}{132}$ | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{33}i}{22}$ | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | $-\frac{\sqrt{1155}i}{462}$ | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{3\sqrt{385}i}{154}$ | 0 | 0 | 0 | 0 |

| 874 | symmetry | $-\frac{\sqrt{2310}(x-y)(x+y)(x-z)(x+z)(y-z)(y+z)}{8}$ |

Table 10

| No. | multipole | matrix |
|-----|-----------|--------|

$$\mathbb{Q}_6^{(1,-1;a)}(B_{1g},1)$$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{24} & 0 & 0 & 0 & -\frac{\sqrt{35}}{56} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{168} & 0 & 0 & 0 & -\frac{\sqrt{5}}{24} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{24} & 0 & 0 & 0 & \frac{\sqrt{6}}{24} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{24} & 0 & 0 & 0 & -\frac{\sqrt{2}}{24} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{24} & 0 & 0 & 0 & \frac{\sqrt{7}}{168} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{35}}{56} & 0 & 0 & 0 & -\frac{1}{24} & 0 & 0 & 0 \\
0 & -\frac{\sqrt{7}}{168} & 0 & 0 & 0 & \frac{\sqrt{35}}{56} & 0 & 0 & -\frac{\sqrt{70}}{56} & 0 & 0 & 0 & \frac{\sqrt{210}}{56} & 0 \\
0 & 0 & \frac{\sqrt{2}}{24} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{8} & 0 & 0 & 0 & \frac{\sqrt{210}}{56} \\
0 & 0 & 0 & -\frac{\sqrt{6}}{24} & 0 & 0 & -\frac{\sqrt{70}}{56} & 0 & 0 & 0 & -\frac{\sqrt{2}}{8} & 0 & 0 & 0 \\
\frac{1}{24} & 0 & 0 & 0 & \frac{\sqrt{5}}{24} & 0 & 0 & \frac{\sqrt{6}}{8} & 0 & 0 & 0 & -\frac{\sqrt{2}}{8} & 0 & 0 \\
0 & -\frac{\sqrt{5}}{24} & 0 & 0 & 0 & -\frac{1}{24} & 0 & 0 & -\frac{\sqrt{2}}{8} & 0 & 0 & 0 & \frac{\sqrt{6}}{8} & 0 \\
0 & 0 & \frac{\sqrt{6}}{24} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{8} & 0 & 0 & 0 & -\frac{\sqrt{70}}{56} \\
0 & 0 & 0 & -\frac{\sqrt{2}}{24} & 0 & 0 & \frac{\sqrt{210}}{56} & 0 & 0 & 0 & \frac{\sqrt{6}}{8} & 0 & 0 & 0 \\
-\frac{\sqrt{35}}{56} & 0 & 0 & 0 & \frac{\sqrt{7}}{168} & 0 & 0 & \frac{\sqrt{210}}{56} & 0 & 0 & 0 & -\frac{\sqrt{70}}{56} & 0 & 0
\end{pmatrix}$$

| 875 | symmetry | $\dfrac{\sqrt{42}(x-y)(x+y)\left(x^4-9x^2y^2-5x^2z^2+y^4-5y^2z^2+5z^4\right)}{8}$ |

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{Q}_6^{(1,-1;a)}(B_{1g},2)$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{55}}{264}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{77}}{56}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{385}}{1848}$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{11}}{264}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{110}}{264}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{330}}{264}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{330}}{264}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{110}}{264}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{11}}{264}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{385}}{1848}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{77}}{56}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{55}}{264}$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{385}}{1848}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{77}}{56}$ | $0$ | $0$ | $\frac{5\sqrt{154}}{616}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{462}}{56}$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{110}}{264}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{330}}{88}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{462}}{56}$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{330}}{264}$ | $0$ | $0$ | $\frac{5\sqrt{154}}{616}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{110}}{88}$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{55}}{264}$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{11}}{264}$ | $0$ | $0$ | $-\frac{\sqrt{330}}{88}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{110}}{88}$ | $0$ | $0$ |
| | | $0$ | $\frac{5\sqrt{11}}{264}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{55}}{264}$ | $0$ | $0$ | $\frac{\sqrt{110}}{88}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{330}}{88}$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{330}}{264}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{110}}{88}$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{154}}{616}$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{110}}{264}$ | $0$ | $0$ | $\frac{\sqrt{462}}{56}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{330}}{88}$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{77}}{56}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{385}}{1848}$ | $0$ | $0$ | $\frac{\sqrt{462}}{56}$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{154}}{616}$ | $0$ | $0$ |
| 876 | symmetry | $\frac{\sqrt{462}xy(x^2-3y^2)(3x^2-y^2)}{16}$ | | | | | | | | | | | | | | |

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{Q}_6^{(1,-1;a)}(B_{2g},1)$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{7}i}{14}$ |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{7}i}{14}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{7}i}{14}$ | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{42}i}{14}$ | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{42}i}{14}$ |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{42}i}{14}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | $-\frac{\sqrt{7}i}{14}$ | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{42}i}{14}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 877 | symmetry | $\frac{\sqrt{210}xy\left(x^4+2x^2y^2-16x^2z^2+y^4-16y^2z^2+16z^4\right)}{16}$ | | | | | | | | | | | | | |

Table 10

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_6^{(1,-1;a)}(B_{2g},2)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{11}i}{66} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{77}i}{462} & 0 & 0 & 0 & -\frac{\sqrt{55}i}{66} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{22}i}{66} & 0 & 0 & 0 & \frac{\sqrt{66}i}{66} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{66}i}{66} & 0 & 0 & 0 & -\frac{\sqrt{22}i}{66} \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{55}i}{66} & 0 & 0 & \frac{\sqrt{77}i}{462} \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{11}i}{66} & 0 & 0 \\
0 & -\frac{\sqrt{77}i}{462} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{770}i}{154} & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{22}i}{66} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{66}i}{22} & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{66}i}{66} & 0 & 0 & \frac{\sqrt{770}i}{154} & 0 & 0 & 0 & -\frac{\sqrt{22}i}{22} & 0 & 0 \\
-\frac{\sqrt{11}i}{66} & 0 & 0 & 0 & \frac{\sqrt{55}i}{66} & 0 & 0 & -\frac{\sqrt{66}i}{22} & 0 & 0 & 0 & -\frac{\sqrt{22}i}{22} & 0 \\
0 & \frac{\sqrt{55}i}{66} & 0 & 0 & 0 & -\frac{\sqrt{11}i}{66} & 0 & 0 & \frac{\sqrt{22}i}{22} & 0 & 0 & 0 & \frac{\sqrt{66}i}{22} \\
0 & 0 & -\frac{\sqrt{66}i}{66} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{22}i}{22} & 0 & 0 & -\frac{\sqrt{770}i}{154} \\
0 & 0 & 0 & \frac{\sqrt{22}i}{66} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{66}i}{22} & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{77}i}{462} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{770}i}{154} & 0
\end{pmatrix}$$

| 878 | symmetry | $\frac{3\sqrt{7}yz(y-z)(y+z)\left(10x^2-y^2-z^2\right)}{4}$ |

Table 10

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{6,1}^{(1,-1;a)}(E_g,1)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{462}i}{7392} & 0 & \frac{\sqrt{22}i}{352} & 0 & -\frac{\sqrt{330}i}{352} & 0 & -\frac{\sqrt{66}i}{96} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{330}i}{1056} & 0 & -\frac{5\sqrt{66}i}{1056} & 0 & \frac{3\sqrt{110}i}{352} & 0 & \frac{\sqrt{2310}i}{672} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{1155}i}{1232} & 0 & \frac{\sqrt{55}i}{176} & 0 & \frac{5\sqrt{33}i}{528} & 0 & -\frac{\sqrt{165}i}{176} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{165}i}{176} & 0 & -\frac{5\sqrt{33}i}{528} & 0 & -\frac{\sqrt{55}i}{176} & 0 & \frac{\sqrt{1155}i}{1232} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2310}i}{672} & 0 & -\frac{3\sqrt{110}i}{352} & 0 & \frac{5\sqrt{66}i}{1056} & 0 & \frac{\sqrt{330}i}{1056} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{66}i}{96} & 0 & \frac{\sqrt{330}i}{352} & 0 & -\frac{\sqrt{22}i}{352} & 0 & -\frac{\sqrt{462}i}{7392} \\
-\frac{\sqrt{462}i}{7392} & 0 & \frac{\sqrt{1155}i}{1232} & 0 & \frac{\sqrt{2310}i}{672} & 0 & 0 & -\frac{3\sqrt{77}i}{616} & 0 & \frac{3\sqrt{385}i}{308} & 0 & \frac{\sqrt{231}i}{56} & 0 & 0 \\
0 & \frac{\sqrt{330}i}{1056} & 0 & -\frac{\sqrt{165}i}{176} & 0 & -\frac{\sqrt{66}i}{96} & \frac{3\sqrt{77}i}{616} & 0 & \frac{\sqrt{33}i}{44} & 0 & -\frac{3\sqrt{55}i}{88} & 0 & 0 & 0 \\
-\frac{\sqrt{22}i}{352} & 0 & -\frac{\sqrt{55}i}{176} & 0 & \frac{3\sqrt{110}i}{352} & 0 & 0 & -\frac{\sqrt{33}i}{44} & 0 & -\frac{\sqrt{165}i}{88} & 0 & 0 & 0 & -\frac{\sqrt{231}i}{56} \\
0 & \frac{5\sqrt{66}i}{1056} & 0 & \frac{5\sqrt{33}i}{528} & 0 & -\frac{\sqrt{330}i}{352} & -\frac{3\sqrt{385}i}{308} & 0 & \frac{\sqrt{165}i}{88} & 0 & 0 & 0 & \frac{3\sqrt{55}i}{88} & 0 \\
\frac{\sqrt{330}i}{352} & 0 & -\frac{5\sqrt{33}i}{528} & 0 & -\frac{5\sqrt{66}i}{1056} & 0 & 0 & \frac{3\sqrt{55}i}{88} & 0 & 0 & 0 & \frac{\sqrt{165}i}{88} & 0 & -\frac{3\sqrt{385}i}{308} \\
0 & -\frac{3\sqrt{110}i}{352} & 0 & \frac{\sqrt{55}i}{176} & 0 & \frac{\sqrt{22}i}{352} & -\frac{\sqrt{231}i}{56} & 0 & 0 & 0 & -\frac{\sqrt{165}i}{88} & 0 & -\frac{\sqrt{33}i}{44} & 0 \\
\frac{\sqrt{66}i}{96} & 0 & \frac{\sqrt{165}i}{176} & 0 & -\frac{\sqrt{330}i}{1056} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{55}i}{88} & 0 & \frac{\sqrt{33}i}{44} & 0 & \frac{3\sqrt{77}i}{616} \\
0 & -\frac{\sqrt{2310}i}{672} & 0 & -\frac{\sqrt{1155}i}{1232} & 0 & \frac{\sqrt{462}i}{7392} & 0 & 0 & \frac{\sqrt{231}i}{56} & 0 & \frac{3\sqrt{385}i}{308} & 0 & -\frac{3\sqrt{77}i}{616} & 0
\end{pmatrix}$$

| 879 | symmetry | $-\frac{3\sqrt{7}xz(x-z)(x+z)\left(x^2-10y^2+z^2\right)}{4}$ |

*continued …*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{Q}_{6,2}^{(1,-1;a)}(E_g,1)$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{462}}{7392}$ | $0$ | $-\frac{\sqrt{22}}{352}$ | $0$ | $-\frac{\sqrt{330}}{352}$ | $0$ | $\frac{\sqrt{66}}{96}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{330}}{1056}$ | $0$ | $\frac{5\sqrt{66}}{1056}$ | $0$ | $\frac{3\sqrt{110}}{352}$ | $0$ | $-\frac{\sqrt{2310}}{672}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{1155}}{1232}$ | $0$ | $\frac{\sqrt{55}}{176}$ | $0$ | $-\frac{5\sqrt{33}}{528}$ | $0$ | $-\frac{\sqrt{165}}{176}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{165}}{176}$ | $0$ | $-\frac{5\sqrt{33}}{528}$ | $0$ | $\frac{\sqrt{55}}{176}$ | $0$ | $\frac{\sqrt{1155}}{1232}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2310}}{672}$ | $0$ | $\frac{3\sqrt{110}}{352}$ | $0$ | $\frac{5\sqrt{66}}{1056}$ | $0$ | $-\frac{\sqrt{330}}{1056}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{66}}{96}$ | $0$ | $-\frac{\sqrt{330}}{352}$ | $0$ | $-\frac{\sqrt{22}}{352}$ | $0$ | $\frac{\sqrt{462}}{7392}$ |
| | | $\frac{\sqrt{462}}{7392}$ | $0$ | $\frac{\sqrt{1155}}{1232}$ | $0$ | $-\frac{\sqrt{2310}}{672}$ | $0$ | $0$ | $\frac{3\sqrt{77}}{616}$ | $0$ | $\frac{3\sqrt{385}}{308}$ | $0$ | $-\frac{\sqrt{231}}{56}$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{330}}{1056}$ | $0$ | $-\frac{\sqrt{165}}{176}$ | $0$ | $\frac{\sqrt{66}}{96}$ | $\frac{3\sqrt{77}}{616}$ | $0$ | $-\frac{\sqrt{33}}{44}$ | $0$ | $-\frac{3\sqrt{55}}{88}$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{22}}{352}$ | $0$ | $\frac{\sqrt{55}}{176}$ | $0$ | $\frac{3\sqrt{110}}{352}$ | $0$ | $0$ | $-\frac{\sqrt{33}}{44}$ | $0$ | $\frac{\sqrt{165}}{88}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{231}}{56}$ |
| | | $0$ | $\frac{5\sqrt{66}}{1056}$ | $0$ | $-\frac{5\sqrt{33}}{528}$ | $0$ | $-\frac{\sqrt{330}}{352}$ | $\frac{3\sqrt{385}}{308}$ | $0$ | $\frac{\sqrt{165}}{88}$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{55}}{88}$ | $0$ |
| | | $-\frac{\sqrt{330}}{352}$ | $0$ | $-\frac{5\sqrt{33}}{528}$ | $0$ | $\frac{5\sqrt{66}}{1056}$ | $0$ | $0$ | $-\frac{3\sqrt{55}}{88}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{165}}{88}$ | $0$ | $-\frac{3\sqrt{385}}{308}$ |
| | | $0$ | $\frac{3\sqrt{110}}{352}$ | $0$ | $\frac{\sqrt{55}}{176}$ | $0$ | $-\frac{\sqrt{22}}{352}$ | $-\frac{\sqrt{231}}{56}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{165}}{88}$ | $0$ | $\frac{\sqrt{33}}{44}$ | $0$ |
| | | $\frac{\sqrt{66}}{96}$ | $0$ | $-\frac{\sqrt{165}}{176}$ | $0$ | $-\frac{\sqrt{330}}{1056}$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{55}}{88}$ | $0$ | $\frac{\sqrt{33}}{44}$ | $0$ | $-\frac{3\sqrt{77}}{616}$ |
| | | $0$ | $-\frac{\sqrt{2310}}{672}$ | $0$ | $\frac{\sqrt{1155}}{1232}$ | $0$ | $\frac{\sqrt{462}}{7392}$ | $0$ | $0$ | $\frac{\sqrt{231}}{56}$ | $0$ | $-\frac{3\sqrt{385}}{308}$ | $0$ | $-\frac{3\sqrt{77}}{616}$ | $0$ |

| 880 | symmetry | $\frac{\sqrt{462}\,yz\left(y^2-3z^2\right)\left(3y^2-z^2\right)}{16}$ |

*continued ...*

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Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{7}i}{448}$ | $0$ | $\frac{\sqrt{3}i}{64}$ | $0$ | $\frac{\sqrt{5}i}{64}$ | $0$ | $\frac{i}{64}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{5}i}{64}$ | $0$ | $-\frac{5i}{64}$ | $0$ | $-\frac{\sqrt{15}i}{64}$ | $0$ | $-\frac{\sqrt{35}i}{448}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{70}i}{448}$ | $0$ | $\frac{\sqrt{30}i}{64}$ | $0$ | $\frac{5\sqrt{2}i}{64}$ | $0$ | $\frac{\sqrt{10}i}{64}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{10}i}{64}$ | $0$ | $-\frac{5\sqrt{2}i}{64}$ | $0$ | $-\frac{\sqrt{30}i}{64}$ | $0$ | $-\frac{\sqrt{70}i}{448}$ |
| | $\mathbb{Q}_{6,1}^{(1,-1;a)}(E_g,2)$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{35}i}{448}$ | $0$ | $\frac{\sqrt{15}i}{64}$ | $0$ | $\frac{5i}{64}$ | $0$ | $\frac{\sqrt{5}i}{64}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{i}{64}$ | $0$ | $-\frac{\sqrt{5}i}{64}$ | $0$ | $-\frac{\sqrt{3}i}{64}$ | $0$ | $-\frac{\sqrt{7}i}{448}$ |
| | | $-\frac{\sqrt{7}i}{448}$ | $0$ | $-\frac{\sqrt{70}i}{448}$ | $0$ | $-\frac{\sqrt{35}i}{448}$ | $0$ | $0$ | $-\frac{3\sqrt{42}i}{224}$ | $0$ | $-\frac{\sqrt{210}i}{112}$ | $0$ | $-\frac{3\sqrt{14}i}{224}$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{5}i}{64}$ | $0$ | $\frac{\sqrt{10}i}{64}$ | $0$ | $\frac{i}{64}$ | $\frac{3\sqrt{42}i}{224}$ | $0$ | $\frac{3\sqrt{2}i}{16}$ | $0$ | $\frac{\sqrt{30}i}{32}$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{3}i}{64}$ | $0$ | $-\frac{\sqrt{30}i}{64}$ | $0$ | $-\frac{\sqrt{15}i}{64}$ | $0$ | $0$ | $-\frac{3\sqrt{2}i}{16}$ | $0$ | $-\frac{3\sqrt{10}i}{32}$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{14}i}{224}$ |
| | | $0$ | $\frac{5i}{64}$ | $0$ | $\frac{5\sqrt{2}i}{64}$ | $0$ | $\frac{\sqrt{5}i}{64}$ | $\frac{\sqrt{210}i}{112}$ | $0$ | $\frac{3\sqrt{10}i}{32}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{30}i}{32}$ | $0$ |
| | | $-\frac{\sqrt{5}i}{64}$ | $0$ | $-\frac{5\sqrt{2}i}{64}$ | $0$ | $-\frac{5i}{64}$ | $0$ | $0$ | $-\frac{\sqrt{30}i}{32}$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{10}i}{32}$ | $0$ | $\frac{\sqrt{210}i}{112}$ |
| | | $0$ | $\frac{\sqrt{15}i}{64}$ | $0$ | $\frac{\sqrt{30}i}{64}$ | $0$ | $\frac{\sqrt{3}i}{64}$ | $\frac{3\sqrt{14}i}{224}$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{10}i}{32}$ | $0$ | $-\frac{3\sqrt{2}i}{16}$ | $0$ |
| | | $-\frac{i}{64}$ | $0$ | $-\frac{\sqrt{10}i}{64}$ | $0$ | $-\frac{\sqrt{5}i}{64}$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{30}i}{32}$ | $0$ | $\frac{3\sqrt{2}i}{16}$ | $0$ | $\frac{3\sqrt{42}i}{224}$ |
| | | $0$ | $\frac{\sqrt{35}i}{448}$ | $0$ | $\frac{\sqrt{70}i}{448}$ | $0$ | $\frac{\sqrt{7}i}{448}$ | $0$ | $0$ | $-\frac{3\sqrt{14}i}{224}$ | $0$ | $-\frac{\sqrt{210}i}{112}$ | $0$ | $-\frac{3\sqrt{42}i}{224}$ | $0$ |
| 881 | symmetry | $\frac{\sqrt{462}xz(x^2-3z^2)(3x^2-z^2)}{16}$ | | | | | | | | | | | | | |

*continued …*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{7}}{448}$ | $0$ | $-\frac{\sqrt{3}}{64}$ | $0$ | $\frac{\sqrt{5}}{64}$ | $0$ | $-\frac{1}{64}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{5}}{64}$ | $0$ | $\frac{5}{64}$ | $0$ | $-\frac{\sqrt{15}}{64}$ | $0$ | $\frac{\sqrt{35}}{448}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{70}}{448}$ | $0$ | $\frac{\sqrt{30}}{64}$ | $0$ | $-\frac{5\sqrt{2}}{64}$ | $0$ | $\frac{\sqrt{10}}{64}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{10}}{64}$ | $0$ | $-\frac{5\sqrt{2}}{64}$ | $0$ | $\frac{\sqrt{30}}{64}$ | $0$ | $-\frac{\sqrt{70}}{448}$ |
| | $\mathbb{Q}_{6,2}^{(1,-1;a)}(E_g,2)$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{35}}{448}$ | $0$ | $-\frac{\sqrt{15}}{64}$ | $0$ | $\frac{5}{64}$ | $0$ | $-\frac{\sqrt{5}}{64}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{1}{64}$ | $0$ | $\frac{\sqrt{5}}{64}$ | $0$ | $-\frac{\sqrt{3}}{64}$ | $0$ | $\frac{\sqrt{7}}{448}$ |
| | | $\frac{\sqrt{7}}{448}$ | $0$ | $-\frac{\sqrt{70}}{448}$ | $0$ | $\frac{\sqrt{35}}{448}$ | $0$ | $0$ | $\frac{3\sqrt{42}}{224}$ | $0$ | $-\frac{\sqrt{210}}{112}$ | $0$ | $\frac{3\sqrt{14}}{224}$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{5}}{64}$ | $0$ | $\frac{\sqrt{10}}{64}$ | $0$ | $-\frac{1}{64}$ | $\frac{3\sqrt{42}}{224}$ | $0$ | $-\frac{3\sqrt{2}}{16}$ | $0$ | $\frac{\sqrt{30}}{32}$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{3}}{64}$ | $0$ | $\frac{\sqrt{30}}{64}$ | $0$ | $-\frac{\sqrt{15}}{64}$ | $0$ | $0$ | $-\frac{3\sqrt{2}}{16}$ | $0$ | $\frac{3\sqrt{10}}{32}$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{14}}{224}$ |
| | | $0$ | $\frac{5}{64}$ | $0$ | $-\frac{5\sqrt{2}}{64}$ | $0$ | $\frac{\sqrt{5}}{64}$ | $-\frac{\sqrt{210}}{112}$ | $0$ | $\frac{3\sqrt{10}}{32}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{30}}{32}$ | $0$ |
| | | $\frac{\sqrt{5}}{64}$ | $0$ | $-\frac{5\sqrt{2}}{64}$ | $0$ | $\frac{5}{64}$ | $0$ | $0$ | $\frac{\sqrt{30}}{32}$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{10}}{32}$ | $0$ | $\frac{\sqrt{210}}{112}$ |
| | | $0$ | $-\frac{\sqrt{15}}{64}$ | $0$ | $\frac{\sqrt{30}}{64}$ | $0$ | $-\frac{\sqrt{3}}{64}$ | $\frac{3\sqrt{14}}{224}$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{10}}{32}$ | $0$ | $\frac{3\sqrt{2}}{16}$ | $0$ |
| | | $-\frac{1}{64}$ | $0$ | $\frac{\sqrt{10}}{64}$ | $0$ | $-\frac{\sqrt{5}}{64}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{30}}{32}$ | $0$ | $\frac{3\sqrt{2}}{16}$ | $0$ | $-\frac{3\sqrt{42}}{224}$ |
| | | $0$ | $\frac{\sqrt{35}}{448}$ | $0$ | $-\frac{\sqrt{70}}{448}$ | $0$ | $\frac{\sqrt{7}}{448}$ | $0$ | $0$ | $-\frac{3\sqrt{14}}{224}$ | $0$ | $\frac{\sqrt{210}}{112}$ | $0$ | $-\frac{3\sqrt{42}}{224}$ | $0$ |
| 882 | symmetry | $\frac{\sqrt{210}yz\left(16x^4-16x^2y^2-16x^2z^2+y^4+2y^2z^2+z^4\right)}{16}$ | | | | | | | | | | | | | |

*continued …*

Table 10

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{Q}_{6,1}^{(1,-1;a)}(E_g,3)$

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{385}i}{14784}$ | $0$ | $\frac{\sqrt{165}i}{2112}$ | $0$ | $-\frac{9\sqrt{11}i}{704}$ | $0$ | $\frac{\sqrt{55}i}{64}$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{11}i}{2112}$ | $0$ | $-\frac{5\sqrt{55}i}{2112}$ | $0$ | $\frac{9\sqrt{33}i}{704}$ | $0$ | $-\frac{5\sqrt{77}i}{448}$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{9\sqrt{154}i}{4928}$ | $0$ | $\frac{5\sqrt{66}i}{2112}$ | $0$ | $\frac{5\sqrt{110}i}{2112}$ | $0$ | $-\frac{9\sqrt{22}i}{704}$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{9\sqrt{22}i}{704}$ | $0$ | $-\frac{5\sqrt{110}i}{2112}$ | $0$ | $-\frac{5\sqrt{66}i}{2112}$ | $0$ | $\frac{9\sqrt{154}i}{4928}$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{77}i}{448}$ | $0$ | $-\frac{9\sqrt{33}i}{704}$ | $0$ | $\frac{5\sqrt{55}i}{2112}$ | $0$ | $\frac{5\sqrt{11}i}{2112}$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{55}i}{64}$ | $0$ | $\frac{9\sqrt{11}i}{704}$ | $0$ | $-\frac{\sqrt{165}i}{2112}$ | $0$ | $-\frac{\sqrt{385}i}{14784}$ |
| $-\frac{\sqrt{385}i}{14784}$ | $0$ | $\frac{9\sqrt{154}i}{4928}$ | $0$ | $-\frac{5\sqrt{77}i}{448}$ | $0$ | $0$ | $-\frac{\sqrt{2310}i}{2464}$ | $0$ | $\frac{9\sqrt{462}i}{1232}$ | $0$ | $-\frac{3\sqrt{770}i}{224}$ | $0$ | $0$ |
| $0$ | $\frac{5\sqrt{11}i}{2112}$ | $0$ | $-\frac{9\sqrt{22}i}{704}$ | $0$ | $\frac{\sqrt{55}i}{64}$ | $\frac{\sqrt{2310}i}{2464}$ | $0$ | $\frac{\sqrt{110}i}{176}$ | $0$ | $-\frac{9\sqrt{66}i}{352}$ | $0$ | $0$ | $0$ |
| $-\frac{\sqrt{165}i}{2112}$ | $0$ | $-\frac{5\sqrt{66}i}{2112}$ | $0$ | $\frac{9\sqrt{33}i}{704}$ | $0$ | $0$ | $-\frac{\sqrt{110}i}{176}$ | $0$ | $-\frac{5\sqrt{22}i}{352}$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{770}i}{224}$ |
| $0$ | $\frac{5\sqrt{55}i}{2112}$ | $0$ | $\frac{5\sqrt{110}i}{2112}$ | $0$ | $-\frac{9\sqrt{11}i}{704}$ | $-\frac{9\sqrt{462}i}{1232}$ | $0$ | $\frac{5\sqrt{22}i}{352}$ | $0$ | $0$ | $0$ | $\frac{9\sqrt{66}i}{352}$ | $0$ |
| $\frac{9\sqrt{11}i}{704}$ | $0$ | $-\frac{5\sqrt{110}i}{2112}$ | $0$ | $-\frac{5\sqrt{55}i}{2112}$ | $0$ | $0$ | $\frac{9\sqrt{66}i}{352}$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{22}i}{352}$ | $0$ | $-\frac{9\sqrt{462}i}{1232}$ |
| $0$ | $-\frac{9\sqrt{33}i}{704}$ | $0$ | $\frac{5\sqrt{66}i}{2112}$ | $0$ | $\frac{\sqrt{165}i}{2112}$ | $\frac{3\sqrt{770}i}{224}$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{22}i}{352}$ | $0$ | $-\frac{\sqrt{110}i}{176}$ | $0$ |
| $-\frac{\sqrt{55}i}{64}$ | $0$ | $\frac{9\sqrt{22}i}{704}$ | $0$ | $-\frac{5\sqrt{11}i}{2112}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{9\sqrt{66}i}{352}$ | $0$ | $\frac{\sqrt{110}i}{176}$ | $0$ | $\frac{\sqrt{2310}i}{2464}$ |
| $0$ | $\frac{5\sqrt{77}i}{448}$ | $0$ | $-\frac{9\sqrt{154}i}{4928}$ | $0$ | $\frac{\sqrt{385}i}{14784}$ | $0$ | $0$ | $-\frac{3\sqrt{770}i}{224}$ | $0$ | $\frac{9\sqrt{462}i}{1232}$ | $0$ | $-\frac{\sqrt{2310}i}{2464}$ | $0$ |

| No. | symmetry |
|-----|----------|
| 883 | $\frac{\sqrt{210}\,xz\left(x^4-16x^2y^2+2x^2z^2+16y^4-16y^2z^2+z^4\right)}{16}$ |

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{Q}_{6,2}^{(1,-1;a)}(E_g,3)$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{385}}{14784}$ | $0$ | $-\frac{\sqrt{165}}{2112}$ | $0$ | $-\frac{9\sqrt{11}}{704}$ | $0$ | $-\frac{\sqrt{55}}{64}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{11}}{2112}$ | $0$ | $\frac{5\sqrt{55}}{2112}$ | $0$ | $\frac{9\sqrt{33}}{704}$ | $0$ | $\frac{5\sqrt{77}}{448}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{9\sqrt{154}}{4928}$ | $0$ | $\frac{5\sqrt{66}}{2112}$ | $0$ | $-\frac{5\sqrt{110}}{2112}$ | $0$ | $-\frac{9\sqrt{22}}{704}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{9\sqrt{22}}{704}$ | $0$ | $-\frac{5\sqrt{110}}{2112}$ | $0$ | $\frac{5\sqrt{66}}{2112}$ | $0$ | $\frac{9\sqrt{154}}{4928}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{77}}{448}$ | $0$ | $\frac{9\sqrt{33}}{704}$ | $0$ | $\frac{5\sqrt{55}}{2112}$ | $0$ | $-\frac{5\sqrt{11}}{2112}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{55}}{64}$ | $0$ | $-\frac{9\sqrt{11}}{704}$ | $0$ | $-\frac{\sqrt{165}}{2112}$ | $0$ | $\frac{\sqrt{385}}{14784}$ |
| | | $\frac{\sqrt{385}}{14784}$ | $0$ | $\frac{9\sqrt{154}}{4928}$ | $0$ | $\frac{5\sqrt{77}}{448}$ | $0$ | $0$ | $\frac{\sqrt{2310}}{2464}$ | $0$ | $\frac{9\sqrt{462}}{1232}$ | $0$ | $\frac{3\sqrt{770}}{224}$ | $0$ | $0$ |
| | | $0$ | $-\frac{5\sqrt{11}}{2112}$ | $0$ | $-\frac{9\sqrt{22}}{704}$ | $0$ | $-\frac{\sqrt{55}}{64}$ | $\frac{\sqrt{2310}}{2464}$ | $0$ | $-\frac{\sqrt{110}}{176}$ | $0$ | $-\frac{9\sqrt{66}}{352}$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{165}}{2112}$ | $0$ | $\frac{5\sqrt{66}}{2112}$ | $0$ | $\frac{9\sqrt{33}}{704}$ | $0$ | $0$ | $-\frac{\sqrt{110}}{176}$ | $0$ | $\frac{5\sqrt{22}}{352}$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{770}}{224}$ |
| | | $0$ | $\frac{5\sqrt{55}}{2112}$ | $0$ | $-\frac{5\sqrt{110}}{2112}$ | $0$ | $-\frac{9\sqrt{11}}{704}$ | $\frac{9\sqrt{462}}{1232}$ | $0$ | $\frac{5\sqrt{22}}{352}$ | $0$ | $0$ | $0$ | $\frac{9\sqrt{66}}{352}$ | $0$ |
| | | $-\frac{9\sqrt{11}}{704}$ | $0$ | $-\frac{5\sqrt{110}}{2112}$ | $0$ | $\frac{5\sqrt{55}}{2112}$ | $0$ | $0$ | $-\frac{9\sqrt{66}}{352}$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{22}}{352}$ | $0$ | $-\frac{9\sqrt{462}}{1232}$ |
| | | $0$ | $\frac{9\sqrt{33}}{704}$ | $0$ | $\frac{5\sqrt{66}}{2112}$ | $0$ | $-\frac{\sqrt{165}}{2112}$ | $\frac{3\sqrt{770}}{224}$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{22}}{352}$ | $0$ | $\frac{\sqrt{110}}{176}$ | $0$ |
| | | $-\frac{\sqrt{55}}{64}$ | $0$ | $-\frac{9\sqrt{22}}{704}$ | $0$ | $-\frac{5\sqrt{11}}{2112}$ | $0$ | $0$ | $0$ | $0$ | $\frac{9\sqrt{66}}{352}$ | $0$ | $\frac{\sqrt{110}}{176}$ | $0$ | $-\frac{\sqrt{2310}}{2464}$ |
| | | $0$ | $\frac{5\sqrt{77}}{448}$ | $0$ | $\frac{9\sqrt{154}}{4928}$ | $0$ | $\frac{\sqrt{385}}{14784}$ | $0$ | $0$ | $-\frac{3\sqrt{770}}{224}$ | $0$ | $-\frac{9\sqrt{462}}{1232}$ | $0$ | $-\frac{\sqrt{2310}}{2464}$ | $0$ |

| 884 | symmetry | 1 |
|---|---|---|

*continued ...*

Table 10

| No. | multipole | matrix |
|-----|-----------|--------|
| | $\mathbb{Q}_0^{(1,1;a)}(A_{1g})$ | $\begin{pmatrix} -\frac{\sqrt{42}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{42}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{42}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{42}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{42}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{28} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{28} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{28} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{28} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{28} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{28} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{28} \end{pmatrix}$ |
| 885 | symmetry | $-\frac{x^2}{2} - \frac{y^2}{2} + z^2$ |

Table 10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{Q}_2^{(1,1;a)}(A_{1g})$$

$$
\begin{pmatrix}
\frac{15\sqrt{7}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{42}}{147} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{3\sqrt{7}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{49} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{6\sqrt{7}}{49} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{21}}{147} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{6\sqrt{7}}{49} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt{21}}{147} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{3\sqrt{7}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{49} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{15\sqrt{7}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{42}}{147} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{5\sqrt{42}}{147} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{98} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{70}}{49} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{7}}{98} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{2\sqrt{21}}{147} & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{7}}{98} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{2\sqrt{21}}{147} & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{7}}{98} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{70}}{49} & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{7}}{98} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{42}}{147} & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{98} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{14}
\end{pmatrix}
$$

| 886 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |

344

Table 10

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{Q}_2^{(1,1;a)}(B_{1g})$ | $\begin{pmatrix} 0 & 0 & \frac{3\sqrt{210}}{196} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{147} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{9\sqrt{42}}{196} & 0 & 0 & \frac{\sqrt{10}}{21} & 0 & 0 & 0 & -\frac{4\sqrt{14}}{147} & 0 & 0 & 0 \\ \frac{3\sqrt{210}}{196} & 0 & 0 & 0 & \frac{9\sqrt{42}}{196} & 0 & 0 & \frac{4\sqrt{35}}{147} & 0 & 0 & 0 & -\frac{2\sqrt{105}}{147} & 0 & 0 \\ 0 & \frac{9\sqrt{42}}{196} & 0 & 0 & 0 & \frac{3\sqrt{210}}{196} & 0 & 0 & \frac{2\sqrt{105}}{147} & 0 & 0 & 0 & -\frac{4\sqrt{35}}{147} & 0 \\ 0 & 0 & \frac{9\sqrt{42}}{196} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{4\sqrt{14}}{147} & 0 & 0 & 0 & -\frac{\sqrt{10}}{21} \\ 0 & 0 & 0 & \frac{3\sqrt{210}}{196} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{147} & 0 & 0 & 0 \\ 0 & \frac{\sqrt{10}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{14} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{4\sqrt{35}}{147} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}}{98} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{2\sqrt{105}}{147} & 0 & 0 & -\frac{1}{14} & 0 & 0 & 0 & -\frac{\sqrt{35}}{49} & 0 & 0 & 0 \\ -\frac{\sqrt{70}}{147} & 0 & 0 & 0 & \frac{4\sqrt{14}}{147} & 0 & 0 & -\frac{\sqrt{105}}{98} & 0 & 0 & 0 & -\frac{\sqrt{35}}{49} & 0 & 0 \\ 0 & -\frac{4\sqrt{14}}{147} & 0 & 0 & 0 & \frac{\sqrt{70}}{147} & 0 & 0 & -\frac{\sqrt{35}}{49} & 0 & 0 & 0 & -\frac{\sqrt{105}}{98} & 0 \\ 0 & 0 & -\frac{2\sqrt{105}}{147} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{35}}{49} & 0 & 0 & 0 & -\frac{1}{14} \\ 0 & 0 & 0 & -\frac{4\sqrt{35}}{147} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}}{98} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{14} & 0 & 0 \end{pmatrix}$ |
| 887 | symmetry | $\sqrt{3}xy$ |

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $0$ | $0$ | $-\frac{3\sqrt{210}i}{196}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{70}i}{147}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{9\sqrt{42}i}{196}$ | $0$ | $0$ | $\frac{\sqrt{10}i}{21}$ | $0$ | $0$ | $0$ | $\frac{4\sqrt{14}i}{147}$ | $0$ | $0$ | $0$ |
| | | $\frac{3\sqrt{210}i}{196}$ | $0$ | $0$ | $0$ | $-\frac{9\sqrt{42}i}{196}$ | $0$ | $0$ | $\frac{4\sqrt{35}i}{147}$ | $0$ | $0$ | $0$ | $\frac{2\sqrt{105}i}{147}$ | $0$ | $0$ |
| | | $0$ | $\frac{9\sqrt{42}i}{196}$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{210}i}{196}$ | $0$ | $0$ | $\frac{2\sqrt{105}i}{147}$ | $0$ | $0$ | $0$ | $\frac{4\sqrt{35}i}{147}$ | $0$ |
| | | $0$ | $0$ | $\frac{9\sqrt{42}i}{196}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{4\sqrt{14}i}{147}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{10}i}{21}$ |
| | | $0$ | $0$ | $0$ | $\frac{3\sqrt{210}i}{196}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{70}i}{147}$ | $0$ | $0$ | $0$ |
| | $\mathbb{Q}_2^{(1,1;a)}(B_{2g})$ | $0$ | $-\frac{\sqrt{10}i}{21}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{i}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $-\frac{4\sqrt{35}i}{147}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{105}i}{98}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{2\sqrt{105}i}{147}$ | $0$ | $0$ | $-\frac{i}{14}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{35}i}{49}$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{70}i}{147}$ | $0$ | $0$ | $0$ | $-\frac{4\sqrt{14}i}{147}$ | $0$ | $0$ | $-\frac{\sqrt{105}i}{98}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{35}i}{49}$ | $0$ | $0$ |
| | | $0$ | $-\frac{4\sqrt{14}i}{147}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{70}i}{147}$ | $0$ | $0$ | $-\frac{\sqrt{35}i}{49}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{105}i}{98}$ | $0$ |
| | | $0$ | $0$ | $-\frac{2\sqrt{105}i}{147}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{35}i}{49}$ | $0$ | $0$ | $0$ | $\frac{i}{14}$ |
| | | $0$ | $0$ | $0$ | $-\frac{4\sqrt{35}i}{147}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{105}i}{98}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{10}i}{21}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{i}{14}$ | $0$ | $0$ |

| 888 | symmetry | $\sqrt{3}yz$ |
|---|---|---|

*continued ...*

Table 10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{Q}_{2,1}^{(1,1;a)}(E_g)$$

$$\begin{pmatrix}
0 & -\frac{3\sqrt{105}i}{98} & 0 & 0 & 0 & 0 & \frac{5\sqrt{2}i}{42} & 0 & \frac{5\sqrt{42}i}{294} & 0 & 0 & 0 & 0 & 0 \\
\frac{3\sqrt{105}i}{98} & 0 & -\frac{3\sqrt{42}i}{98} & 0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{294} & 0 & \frac{11\sqrt{14}i}{294} & 0 & 0 & 0 & 0 \\
0 & \frac{3\sqrt{42}i}{98} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}i}{147} & 0 & \frac{\sqrt{7}i}{21} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{3\sqrt{42}i}{98} & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{21} & 0 & \frac{\sqrt{105}i}{147} & 0 & 0 \\
0 & 0 & 0 & -\frac{3\sqrt{42}i}{98} & 0 & \frac{3\sqrt{105}i}{98} & 0 & 0 & 0 & 0 & -\frac{11\sqrt{14}i}{294} & 0 & -\frac{\sqrt{70}i}{294} & 0 \\
0 & 0 & 0 & 0 & -\frac{3\sqrt{105}i}{98} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{42}i}{294} & 0 & -\frac{5\sqrt{2}i}{42} \\
-\frac{5\sqrt{2}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{70}i}{294} & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{14} & 0 & \frac{2\sqrt{7}i}{49} & 0 & 0 & 0 & 0 & 0 \\
-\frac{5\sqrt{42}i}{294} & 0 & \frac{\sqrt{105}i}{147} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{7}i}{49} & 0 & \frac{\sqrt{35}i}{98} & 0 & 0 & 0 & 0 \\
0 & -\frac{11\sqrt{14}i}{294} & 0 & \frac{\sqrt{7}i}{21} & 0 & 0 & 0 & 0 & -\frac{\sqrt{35}i}{98} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{7}i}{21} & 0 & \frac{11\sqrt{14}i}{294} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{35}i}{98} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{105}i}{147} & 0 & \frac{5\sqrt{42}i}{294} & 0 & 0 & 0 & 0 & \frac{\sqrt{35}i}{98} & 0 & -\frac{2\sqrt{7}i}{49} & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{294} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt{7}i}{49} & 0 & -\frac{\sqrt{3}i}{14} \\
0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{2}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{14} & 0
\end{pmatrix}$$

| 889 | symmetry | $\sqrt{3}xz$ |

347

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{Q}_{2,2}^{(1,1;a)}(E_g)$ | $0$ | $\frac{3\sqrt{105}}{98}$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{2}}{42}$ | $0$ | $-\frac{5\sqrt{42}}{294}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $\frac{3\sqrt{105}}{98}$ | $0$ | $\frac{3\sqrt{42}}{98}$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{70}}{294}$ | $0$ | $-\frac{11\sqrt{14}}{294}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{3\sqrt{42}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{105}}{147}$ | $0$ | $-\frac{\sqrt{7}}{21}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{42}}{98}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{7}}{21}$ | $0$ | $-\frac{\sqrt{105}}{147}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{3\sqrt{42}}{98}$ | $0$ | $-\frac{3\sqrt{105}}{98}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{11\sqrt{14}}{294}$ | $0$ | $\frac{\sqrt{70}}{294}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{105}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{42}}{294}$ | $0$ | $\frac{5\sqrt{2}}{42}$ |
| | | $\frac{5\sqrt{2}}{42}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{3}}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{70}}{294}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{3}}{14}$ | $0$ | $-\frac{2\sqrt{7}}{49}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $-\frac{5\sqrt{42}}{294}$ | $0$ | $-\frac{\sqrt{105}}{147}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{7}}{49}$ | $0$ | $-\frac{\sqrt{35}}{98}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{11\sqrt{14}}{294}$ | $0$ | $-\frac{\sqrt{7}}{21}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{35}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{7}}{21}$ | $0$ | $-\frac{11\sqrt{14}}{294}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{35}}{98}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{\sqrt{105}}{147}$ | $0$ | $-\frac{5\sqrt{42}}{294}$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{35}}{98}$ | $0$ | $\frac{2\sqrt{7}}{49}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{70}}{294}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{2\sqrt{7}}{49}$ | $0$ | $\frac{\sqrt{3}}{14}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{2}}{42}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{3}}{14}$ | $0$ |
| 890 | symmetry | $\frac{\sqrt{21}\left(x^4-3x^2y^2-3x^2z^2+y^4-3y^2z^2+z^4\right)}{6}$ | | | | | | | | | | | | | |

*continued ...*

Table 10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{Q}_4^{(1,1;a)}(A_{1g},1)$$

$$
\begin{pmatrix}
-\frac{\sqrt{110}}{84} & 0 & 0 & 0 & -\frac{5\sqrt{22}}{84} & 0 & 0 & \frac{2\sqrt{165}}{231} & 0 & 0 & 0 & \frac{2\sqrt{55}}{231} & 0 & 0 \\
0 & \frac{\sqrt{110}}{28} & 0 & 0 & 0 & -\frac{5\sqrt{22}}{84} & 0 & 0 & -\frac{8\sqrt{11}}{231} & 0 & 0 & 0 & \frac{4\sqrt{33}}{231} & 0 \\
0 & 0 & -\frac{\sqrt{110}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{330}}{231} & 0 & 0 & 0 & \frac{\sqrt{462}}{231} \\
0 & 0 & 0 & -\frac{\sqrt{110}}{42} & 0 & 0 & -\frac{\sqrt{462}}{231} & 0 & 0 & 0 & \frac{\sqrt{330}}{231} & 0 & 0 & 0 \\
-\frac{5\sqrt{22}}{84} & 0 & 0 & 0 & \frac{\sqrt{110}}{28} & 0 & 0 & -\frac{4\sqrt{33}}{231} & 0 & 0 & 0 & \frac{8\sqrt{11}}{231} & 0 & 0 \\
0 & -\frac{5\sqrt{22}}{84} & 0 & 0 & 0 & -\frac{\sqrt{110}}{84} & 0 & 0 & -\frac{2\sqrt{55}}{231} & 0 & 0 & 0 & -\frac{2\sqrt{165}}{231} & 0 \\
0 & 0 & 0 & -\frac{\sqrt{462}}{231} & 0 & 0 & \frac{\sqrt{110}}{264} & 0 & 0 & 0 & \frac{5\sqrt{154}}{1848} & 0 & 0 & 0 \\
\frac{2\sqrt{165}}{231} & 0 & 0 & 0 & -\frac{4\sqrt{33}}{231} & 0 & 0 & -\frac{13\sqrt{110}}{1848} & 0 & 0 & 0 & \frac{5\sqrt{330}}{1848} & 0 & 0 \\
0 & -\frac{8\sqrt{11}}{231} & 0 & 0 & 0 & -\frac{2\sqrt{55}}{231} & 0 & 0 & -\frac{\sqrt{110}}{616} & 0 & 0 & 0 & \frac{5\sqrt{330}}{1848} & 0 \\
0 & 0 & -\frac{\sqrt{330}}{231} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{110}}{616} & 0 & 0 & 0 & \frac{5\sqrt{154}}{1848} \\
0 & 0 & 0 & \frac{\sqrt{330}}{231} & 0 & 0 & \frac{5\sqrt{154}}{1848} & 0 & 0 & 0 & \frac{3\sqrt{110}}{616} & 0 & 0 & 0 \\
\frac{2\sqrt{55}}{231} & 0 & 0 & 0 & \frac{8\sqrt{11}}{231} & 0 & 0 & \frac{5\sqrt{330}}{1848} & 0 & 0 & 0 & -\frac{\sqrt{110}}{616} & 0 & 0 \\
0 & \frac{4\sqrt{33}}{231} & 0 & 0 & 0 & -\frac{2\sqrt{165}}{231} & 0 & 0 & \frac{5\sqrt{330}}{1848} & 0 & 0 & 0 & -\frac{13\sqrt{110}}{1848} & 0 \\
0 & 0 & \frac{\sqrt{462}}{231} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{154}}{1848} & 0 & 0 & 0 & \frac{\sqrt{110}}{264}
\end{pmatrix}
$$

| 891 | symmetry | $-\dfrac{\sqrt{15}\left(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4\right)}{12}$ |

*continued …*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{Q}_4^{(1,1;a)}(A_{1g},2)$ | $-\frac{5\sqrt{154}}{588}$ | 0 | 0 | 0 | $\frac{\sqrt{770}}{84}$ | 0 | 0 | $\frac{10\sqrt{231}}{1617}$ | 0 | 0 | 0 | $-\frac{2\sqrt{77}}{231}$ | 0 | 0 |
| | | 0 | $\frac{5\sqrt{154}}{196}$ | 0 | 0 | 0 | $\frac{\sqrt{770}}{84}$ | 0 | 0 | $-\frac{8\sqrt{385}}{1617}$ | 0 | 0 | 0 | $-\frac{4\sqrt{1155}}{1155}$ | 0 |
| | | 0 | 0 | $-\frac{5\sqrt{154}}{294}$ | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{5\sqrt{462}}{1617}$ | 0 | 0 | 0 | $-\frac{\sqrt{330}}{165}$ |
| | | 0 | 0 | 0 | $-\frac{5\sqrt{154}}{294}$ | 0 | 0 | $\frac{\sqrt{330}}{165}$ | 0 | 0 | 0 | $\frac{5\sqrt{462}}{1617}$ | 0 | 0 | 0 |
| | | $\frac{\sqrt{770}}{84}$ | 0 | 0 | 0 | $\frac{5\sqrt{154}}{196}$ | 0 | 0 | $\frac{4\sqrt{1155}}{1155}$ | 0 | 0 | 0 | $\frac{8\sqrt{385}}{1617}$ | 0 | 0 |
| | | 0 | $\frac{\sqrt{770}}{84}$ | 0 | 0 | 0 | $-\frac{5\sqrt{154}}{588}$ | 0 | 0 | $\frac{2\sqrt{77}}{231}$ | 0 | 0 | 0 | $-\frac{10\sqrt{231}}{1617}$ | 0 |
| | | 0 | 0 | 0 | $\frac{\sqrt{330}}{165}$ | 0 | 0 | $\frac{5\sqrt{154}}{1848}$ | 0 | 0 | 0 | $-\frac{\sqrt{110}}{264}$ | 0 | 0 | 0 |
| | | $\frac{10\sqrt{231}}{1617}$ | 0 | 0 | 0 | $\frac{4\sqrt{1155}}{1155}$ | 0 | 0 | $-\frac{65\sqrt{154}}{12936}$ | 0 | 0 | 0 | $-\frac{5\sqrt{462}}{1848}$ | 0 | 0 |
| | | 0 | $-\frac{8\sqrt{385}}{1617}$ | 0 | 0 | 0 | $\frac{2\sqrt{77}}{231}$ | 0 | 0 | $-\frac{5\sqrt{154}}{4312}$ | 0 | 0 | 0 | $-\frac{5\sqrt{462}}{1848}$ | 0 |
| | | 0 | 0 | $-\frac{5\sqrt{462}}{1617}$ | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{15\sqrt{154}}{4312}$ | 0 | 0 | 0 | $-\frac{\sqrt{110}}{264}$ |
| | | 0 | 0 | 0 | $\frac{5\sqrt{462}}{1617}$ | 0 | 0 | $-\frac{\sqrt{110}}{264}$ | 0 | 0 | 0 | $\frac{15\sqrt{154}}{4312}$ | 0 | 0 | 0 |
| | | $-\frac{2\sqrt{77}}{231}$ | 0 | 0 | 0 | $\frac{8\sqrt{385}}{1617}$ | 0 | 0 | $-\frac{5\sqrt{462}}{1848}$ | 0 | 0 | 0 | $-\frac{5\sqrt{154}}{4312}$ | 0 | 0 |
| | | 0 | $-\frac{4\sqrt{1155}}{1155}$ | 0 | 0 | 0 | $-\frac{10\sqrt{231}}{1617}$ | 0 | 0 | $-\frac{5\sqrt{462}}{1848}$ | 0 | 0 | 0 | $-\frac{65\sqrt{154}}{12936}$ | 0 |
| | | 0 | 0 | $-\frac{\sqrt{330}}{165}$ | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{110}}{264}$ | 0 | 0 | 0 | $\frac{5\sqrt{154}}{1848}$ |

| 892 | symmetry | $\frac{\sqrt{35}xy(x-y)(x+y)}{2}$ |

*continued …*

Table 10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{Q}_4^{(1,1;a)}(A_{2g})$$

$$
\begin{pmatrix}
0 & 0 & 0 & 0 & \frac{\sqrt{330}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{4\sqrt{33}i}{231} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{330}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{8\sqrt{55}i}{385} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{770}i}{385} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{770}i}{385} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{330}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{8\sqrt{55}i}{385} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{330}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{4\sqrt{33}i}{231} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{2\sqrt{770}i}{385} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2310}i}{924} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{8\sqrt{55}i}{385} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{22}i}{308} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{4\sqrt{33}i}{231} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{22}i}{308} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2310}i}{924} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2310}i}{924} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{4\sqrt{33}i}{231} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{22}i}{308} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{8\sqrt{55}i}{385} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{22}i}{308} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{2\sqrt{770}i}{385} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2310}i}{924} & 0 & 0 & 0 & 0 \\
\end{pmatrix}
$$

| 893 | symmetry | $\frac{\sqrt{5}(x-y)(x+y)\left(x^2+y^2-6z^2\right)}{4}$ |

*continued ...*

Table 10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{Q}_4^{(1,1;a)}(B_{1g})$$

$$
\begin{pmatrix}
0 & 0 & \frac{\sqrt{1155}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{4\sqrt{385}}{539} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{5\sqrt{231}}{294} & 0 & 0 & \frac{6\sqrt{55}}{385} & 0 & 0 & 0 & -\frac{2\sqrt{77}}{539} & 0 & 0 & 0 \\
\frac{\sqrt{1155}}{98} & 0 & 0 & 0 & -\frac{5\sqrt{231}}{294} & 0 & 0 & -\frac{9\sqrt{770}}{2695} & 0 & 0 & 0 & \frac{17\sqrt{2310}}{8085} & 0 & 0 \\
0 & -\frac{5\sqrt{231}}{294} & 0 & 0 & 0 & \frac{\sqrt{1155}}{98} & 0 & 0 & -\frac{17\sqrt{2310}}{8085} & 0 & 0 & 0 & \frac{9\sqrt{770}}{2695} & 0 \\
0 & 0 & -\frac{5\sqrt{231}}{294} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt{77}}{539} & 0 & 0 & 0 & -\frac{6\sqrt{55}}{385} \\
0 & 0 & 0 & \frac{\sqrt{1155}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{4\sqrt{385}}{539} & 0 & 0 & 0 \\
0 & \frac{6\sqrt{55}}{385} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{22}}{308} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{9\sqrt{770}}{2695} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2310}}{6468} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{17\sqrt{2310}}{8085} & 0 & 0 & -\frac{5\sqrt{22}}{308} & 0 & 0 & 0 & \frac{\sqrt{770}}{539} & 0 & 0 & 0 \\
-\frac{4\sqrt{385}}{539} & 0 & 0 & 0 & \frac{2\sqrt{77}}{539} & 0 & 0 & -\frac{\sqrt{2310}}{6468} & 0 & 0 & 0 & \frac{\sqrt{770}}{539} & 0 & 0 \\
0 & -\frac{2\sqrt{77}}{539} & 0 & 0 & 0 & \frac{4\sqrt{385}}{539} & 0 & 0 & \frac{\sqrt{770}}{539} & 0 & 0 & 0 & -\frac{\sqrt{2310}}{6468} & 0 \\
0 & 0 & \frac{17\sqrt{2310}}{8085} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{770}}{539} & 0 & 0 & 0 & -\frac{5\sqrt{22}}{308} \\
0 & 0 & 0 & \frac{9\sqrt{770}}{2695} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2310}}{6468} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{6\sqrt{55}}{385} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{22}}{308} & 0 & 0 \\
\end{pmatrix}
$$

| 894 | symmetry | $-\dfrac{\sqrt{5}xy\left(x^2+y^2-6z^2\right)}{2}$ |
|---|---|---|

*continued …*

Table 10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{Q}_4^{(1,1;a)}(B_{2g})$$

$$
\begin{pmatrix}
0 & 0 & \frac{\sqrt{1155}i}{98} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{4\sqrt{385}i}{539} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{5\sqrt{231}i}{294} & 0 & 0 & -\frac{6\sqrt{55}i}{385} & 0 & 0 & 0 & -\frac{2\sqrt{77}i}{539} & 0 & 0 & 0 \\
-\frac{\sqrt{1155}i}{98} & 0 & 0 & 0 & -\frac{5\sqrt{231}i}{294} & 0 & 0 & \frac{9\sqrt{770}i}{2695} & 0 & 0 & 0 & \frac{17\sqrt{2310}i}{8085} & 0 & 0 \\
0 & \frac{5\sqrt{231}i}{294} & 0 & 0 & 0 & \frac{\sqrt{1155}i}{98} & 0 & 0 & \frac{17\sqrt{2310}i}{8085} & 0 & 0 & 0 & \frac{9\sqrt{770}i}{2695} & 0 \\
0 & 0 & \frac{5\sqrt{231}i}{294} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{77}i}{539} & 0 & 0 & 0 & -\frac{6\sqrt{55}i}{385} \\
0 & 0 & 0 & -\frac{\sqrt{1155}i}{98} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{4\sqrt{385}i}{539} & 0 & 0 & 0 \\
0 & \frac{6\sqrt{55}i}{385} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{22}i}{308} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{9\sqrt{770}i}{2695} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2310}i}{6468} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{17\sqrt{2310}i}{8085} & 0 & 0 & \frac{5\sqrt{22}i}{308} & 0 & 0 & 0 & \frac{\sqrt{770}i}{539} & 0 & 0 & 0 \\
\frac{4\sqrt{385}i}{539} & 0 & 0 & 0 & \frac{2\sqrt{77}i}{539} & 0 & 0 & \frac{\sqrt{2310}i}{6468} & 0 & 0 & 0 & \frac{\sqrt{770}i}{539} & 0 & 0 \\
0 & \frac{2\sqrt{77}i}{539} & 0 & 0 & 0 & \frac{4\sqrt{385}i}{539} & 0 & 0 & -\frac{\sqrt{770}i}{539} & 0 & 0 & 0 & -\frac{\sqrt{2310}i}{6468} & 0 \\
0 & 0 & -\frac{17\sqrt{2310}i}{8085} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{770}i}{539} & 0 & 0 & 0 & -\frac{5\sqrt{22}i}{308} \\
0 & 0 & 0 & -\frac{9\sqrt{770}i}{2695} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2310}i}{6468} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{6\sqrt{55}i}{385} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{22}i}{308} & 0 & 0 \\
\end{pmatrix}
$$

| 895 | symmetry | $\frac{\sqrt{35}yz(y-z)(y+z)}{2}$ |

Table 10

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{4,1}^{(1,1;a)}(E_g, 1)$

$$\begin{pmatrix}
0 & -\frac{\sqrt{330}i}{84} & 0 & -\frac{\sqrt{165}i}{84} & 0 & 0 & \frac{\sqrt{77}i}{154} & 0 & \frac{5\sqrt{33}i}{231} & 0 & \frac{\sqrt{55}i}{154} & 0 & 0 & 0 \\
\frac{\sqrt{330}i}{84} & 0 & \frac{5\sqrt{33}i}{84} & 0 & 0 & 0 & 0 & -\frac{13\sqrt{55}i}{770} & 0 & -\frac{\sqrt{11}i}{77} & 0 & \frac{\sqrt{165}i}{330} & 0 & 0 \\
0 & -\frac{5\sqrt{33}i}{84} & 0 & 0 & 0 & \frac{\sqrt{165}i}{84} & \frac{3\sqrt{770}i}{1540} & 0 & \frac{\sqrt{330}i}{4620} & 0 & -\frac{\sqrt{22}i}{44} & 0 & -\frac{\sqrt{110}i}{1540} & 0 \\
\frac{\sqrt{165}i}{84} & 0 & 0 & 0 & -\frac{5\sqrt{33}i}{84} & 0 & 0 & \frac{\sqrt{110}i}{1540} & 0 & \frac{\sqrt{22}i}{44} & 0 & -\frac{\sqrt{330}i}{4620} & 0 & -\frac{3\sqrt{770}i}{1540} \\
0 & 0 & 0 & \frac{5\sqrt{33}i}{84} & 0 & \frac{\sqrt{330}i}{84} & 0 & 0 & -\frac{\sqrt{165}i}{330} & 0 & \frac{\sqrt{11}i}{77} & 0 & \frac{13\sqrt{55}i}{770} & 0 \\
0 & 0 & -\frac{\sqrt{165}i}{84} & 0 & -\frac{\sqrt{330}i}{84} & 0 & 0 & 0 & 0 & -\frac{\sqrt{55}i}{154} & 0 & -\frac{5\sqrt{33}i}{231} & 0 & -\frac{\sqrt{77}i}{154} \\
-\frac{\sqrt{77}i}{154} & 0 & -\frac{3\sqrt{770}i}{1540} & 0 & 0 & 0 & 0 & \frac{5\sqrt{462}i}{1848} & 0 & \frac{\sqrt{2310}i}{1848} & 0 & 0 & 0 & 0 \\
0 & \frac{13\sqrt{55}i}{770} & 0 & -\frac{\sqrt{110}i}{1540} & 0 & 0 & -\frac{5\sqrt{462}i}{1848} & 0 & -\frac{5\sqrt{22}i}{616} & 0 & \frac{\sqrt{330}i}{924} & 0 & 0 & 0 \\
-\frac{5\sqrt{33}i}{231} & 0 & -\frac{\sqrt{330}i}{4620} & 0 & \frac{\sqrt{165}i}{330} & 0 & 0 & \frac{5\sqrt{22}i}{616} & 0 & -\frac{3\sqrt{110}i}{616} & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{11}i}{77} & 0 & -\frac{\sqrt{22}i}{44} & 0 & \frac{\sqrt{55}i}{154} & -\frac{\sqrt{2310}i}{1848} & 0 & \frac{3\sqrt{110}i}{616} & 0 & 0 & 0 & -\frac{\sqrt{330}i}{924} & 0 \\
-\frac{\sqrt{55}i}{154} & 0 & \frac{\sqrt{22}i}{44} & 0 & -\frac{\sqrt{11}i}{77} & 0 & 0 & -\frac{\sqrt{330}i}{924} & 0 & 0 & 0 & \frac{3\sqrt{110}i}{616} & 0 & -\frac{\sqrt{2310}i}{1848} \\
0 & -\frac{\sqrt{165}i}{330} & 0 & \frac{\sqrt{330}i}{4620} & 0 & \frac{5\sqrt{33}i}{231} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{110}i}{616} & 0 & \frac{5\sqrt{22}i}{616} & 0 \\
0 & 0 & \frac{\sqrt{110}i}{1540} & 0 & -\frac{13\sqrt{55}i}{770} & 0 & 0 & 0 & 0 & \frac{\sqrt{330}i}{924} & 0 & -\frac{5\sqrt{22}i}{616} & 0 & -\frac{5\sqrt{462}i}{1848} \\
0 & 0 & 0 & \frac{3\sqrt{770}i}{1540} & 0 & \frac{\sqrt{77}i}{154} & 0 & 0 & 0 & 0 & \frac{\sqrt{2310}i}{1848} & 0 & \frac{5\sqrt{462}i}{1848} & 0
\end{pmatrix}$$

| 896 | symmetry | $\dfrac{\sqrt{35}xz(x-z)(x+z)}{2}$ |
|---|---|---|

*continued …*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{Q}_{4,2}^{(1,1;a)}(E_g,1)$ | $0$ | $\frac{\sqrt{330}}{84}$ | $0$ | $-\frac{\sqrt{165}}{84}$ | $0$ | $0$ | $\frac{\sqrt{77}}{154}$ | $0$ | $-\frac{5\sqrt{33}}{231}$ | $0$ | $\frac{\sqrt{55}}{154}$ | $0$ | $0$ | $0$ |
| | | $\frac{\sqrt{330}}{84}$ | $0$ | $-\frac{5\sqrt{33}}{84}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{13\sqrt{55}}{770}$ | $0$ | $\frac{\sqrt{11}}{77}$ | $0$ | $\frac{\sqrt{165}}{330}$ | $0$ | $0$ |
| | | $0$ | $-\frac{5\sqrt{33}}{84}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{165}}{84}$ | $-\frac{3\sqrt{770}}{1540}$ | $0$ | $\frac{\sqrt{330}}{4620}$ | $0$ | $\frac{\sqrt{22}}{44}$ | $0$ | $-\frac{\sqrt{110}}{1540}$ | $0$ |
| | | $-\frac{\sqrt{165}}{84}$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{33}}{84}$ | $0$ | $0$ | $-\frac{\sqrt{110}}{1540}$ | $0$ | $\frac{\sqrt{22}}{44}$ | $0$ | $\frac{\sqrt{330}}{4620}$ | $0$ | $-\frac{3\sqrt{770}}{1540}$ |
| | | $0$ | $0$ | $0$ | $\frac{5\sqrt{33}}{84}$ | $0$ | $-\frac{\sqrt{330}}{84}$ | $0$ | $0$ | $\frac{\sqrt{165}}{330}$ | $0$ | $\frac{\sqrt{11}}{77}$ | $0$ | $-\frac{13\sqrt{55}}{770}$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{165}}{84}$ | $0$ | $-\frac{\sqrt{330}}{84}$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{55}}{154}$ | $0$ | $-\frac{5\sqrt{33}}{231}$ | $0$ | $\frac{\sqrt{77}}{154}$ |
| | | $\frac{\sqrt{77}}{154}$ | $0$ | $-\frac{3\sqrt{770}}{1540}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{462}}{1848}$ | $0$ | $\frac{\sqrt{2310}}{1848}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{13\sqrt{55}}{770}$ | $0$ | $-\frac{\sqrt{110}}{1540}$ | $0$ | $0$ | $-\frac{5\sqrt{462}}{1848}$ | $0$ | $\frac{5\sqrt{22}}{616}$ | $0$ | $\frac{\sqrt{330}}{924}$ | $0$ | $0$ | $0$ |
| | | $-\frac{5\sqrt{33}}{231}$ | $0$ | $\frac{\sqrt{330}}{4620}$ | $0$ | $\frac{\sqrt{165}}{330}$ | $0$ | $0$ | $\frac{5\sqrt{22}}{616}$ | $0$ | $\frac{3\sqrt{110}}{616}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{11}}{77}$ | $0$ | $\frac{\sqrt{22}}{44}$ | $0$ | $\frac{\sqrt{55}}{154}$ | $\frac{\sqrt{2310}}{1848}$ | $0$ | $\frac{3\sqrt{110}}{616}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{330}}{924}$ | $0$ |
| | | $\frac{\sqrt{55}}{154}$ | $0$ | $\frac{\sqrt{22}}{44}$ | $0$ | $\frac{\sqrt{11}}{77}$ | $0$ | $0$ | $\frac{\sqrt{330}}{924}$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{110}}{616}$ | $0$ | $-\frac{\sqrt{2310}}{1848}$ |
| | | $0$ | $\frac{\sqrt{165}}{330}$ | $0$ | $\frac{\sqrt{330}}{4620}$ | $0$ | $-\frac{5\sqrt{33}}{231}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{110}}{616}$ | $0$ | $-\frac{5\sqrt{22}}{616}$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{110}}{1540}$ | $0$ | $-\frac{13\sqrt{55}}{770}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{330}}{924}$ | $0$ | $-\frac{5\sqrt{22}}{616}$ | $0$ | $\frac{5\sqrt{462}}{1848}$ |
| | | $0$ | $0$ | $0$ | $-\frac{3\sqrt{770}}{1540}$ | $0$ | $\frac{\sqrt{77}}{154}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2310}}{1848}$ | $0$ | $\frac{5\sqrt{462}}{1848}$ | $0$ |

| 897 | symmetry | $\frac{\sqrt{5}\,yz\left(6x^2-y^2-z^2\right)}{2}$ |

Table 10

| No. | multipole | matrix |
|---|---|---|

$\mathbb{Q}_{4,1}^{(1,1;a)}(E_g,2)$

$$\begin{pmatrix}
0 & -\frac{\sqrt{2310}i}{588} & 0 & \frac{\sqrt{1155}i}{84} & 0 & 0 & \frac{\sqrt{11}i}{154} & 0 & \frac{5\sqrt{231}i}{1617} & 0 & -\frac{\sqrt{385}i}{154} & 0 & 0 & 0 \\
\frac{\sqrt{2310}i}{588} & 0 & \frac{5\sqrt{231}i}{588} & 0 & 0 & 0 & 0 & -\frac{13\sqrt{385}i}{5390} & 0 & -\frac{\sqrt{77}i}{539} & 0 & -\frac{\sqrt{1155}i}{330} & 0 & 0 \\
0 & -\frac{5\sqrt{231}i}{588} & 0 & 0 & 0 & -\frac{\sqrt{1155}i}{84} & -\frac{3\sqrt{110}i}{220} & 0 & \frac{\sqrt{2310}i}{32340} & 0 & -\frac{\sqrt{154}i}{308} & 0 & \frac{\sqrt{770}i}{1540} & 0 \\
-\frac{\sqrt{1155}i}{84} & 0 & 0 & 0 & -\frac{5\sqrt{231}i}{588} & 0 & 0 & -\frac{\sqrt{770}i}{1540} & 0 & \frac{\sqrt{154}i}{308} & 0 & -\frac{\sqrt{2310}i}{32340} & 0 & \frac{3\sqrt{110}i}{220} \\
0 & 0 & 0 & \frac{5\sqrt{231}i}{588} & 0 & \frac{\sqrt{2310}i}{588} & 0 & 0 & \frac{\sqrt{1155}i}{330} & 0 & \frac{\sqrt{77}i}{539} & 0 & \frac{13\sqrt{385}i}{5390} & 0 \\
0 & 0 & \frac{\sqrt{1155}i}{84} & 0 & -\frac{\sqrt{2310}i}{588} & 0 & 0 & 0 & 0 & \frac{\sqrt{385}i}{154} & 0 & -\frac{5\sqrt{231}i}{1617} & 0 & -\frac{\sqrt{11}i}{154} \\
-\frac{\sqrt{11}i}{154} & 0 & \frac{3\sqrt{110}i}{220} & 0 & 0 & 0 & 0 & \frac{5\sqrt{66}i}{1848} & 0 & -\frac{\sqrt{330}i}{264} & 0 & 0 & 0 & 0 \\
0 & \frac{13\sqrt{385}i}{5390} & 0 & \frac{\sqrt{770}i}{1540} & 0 & 0 & -\frac{5\sqrt{66}i}{1848} & 0 & -\frac{5\sqrt{154}i}{4312} & 0 & -\frac{\sqrt{2310}i}{924} & 0 & 0 & 0 \\
-\frac{5\sqrt{231}i}{1617} & 0 & -\frac{\sqrt{2310}i}{32340} & 0 & -\frac{\sqrt{1155}i}{330} & 0 & 0 & \frac{5\sqrt{154}i}{4312} & 0 & -\frac{3\sqrt{770}i}{4312} & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{77}i}{539} & 0 & -\frac{\sqrt{154}i}{308} & 0 & -\frac{\sqrt{385}i}{154} & \frac{\sqrt{330}i}{264} & 0 & \frac{3\sqrt{770}i}{4312} & 0 & 0 & 0 & \frac{\sqrt{2310}i}{924} & 0 \\
\frac{\sqrt{385}i}{154} & 0 & \frac{\sqrt{154}i}{308} & 0 & -\frac{\sqrt{77}i}{539} & 0 & 0 & \frac{\sqrt{2310}i}{924} & 0 & 0 & 0 & \frac{3\sqrt{770}i}{4312} & 0 & \frac{\sqrt{330}i}{264} \\
0 & \frac{\sqrt{1155}i}{330} & 0 & \frac{\sqrt{2310}i}{32340} & 0 & \frac{5\sqrt{231}i}{1617} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{770}i}{4312} & 0 & \frac{5\sqrt{154}i}{4312} & 0 \\
0 & 0 & -\frac{\sqrt{770}i}{1540} & 0 & -\frac{13\sqrt{385}i}{5390} & 0 & 0 & 0 & 0 & -\frac{\sqrt{2310}i}{924} & 0 & -\frac{5\sqrt{154}i}{4312} & 0 & -\frac{5\sqrt{66}i}{1848} \\
0 & 0 & 0 & -\frac{3\sqrt{110}i}{220} & 0 & \frac{\sqrt{11}i}{154} & 0 & 0 & 0 & 0 & -\frac{\sqrt{330}i}{264} & 0 & \frac{5\sqrt{66}i}{1848} & 0
\end{pmatrix}$$

| 898 | symmetry | $-\frac{\sqrt{5}xz\left(x^2-6y^2+z^2\right)}{2}$ |

*continued ...*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $0$ | $\frac{\sqrt{2310}}{588}$ | $0$ | $\frac{\sqrt{1155}}{84}$ | $0$ | $0$ | $\frac{\sqrt{11}}{154}$ | $0$ | $-\frac{5\sqrt{231}}{1617}$ | $0$ | $-\frac{\sqrt{385}}{154}$ | $0$ | $0$ | $0$ |
| | | $\frac{\sqrt{2310}}{588}$ | $0$ | $-\frac{5\sqrt{231}}{588}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{13\sqrt{385}}{5390}$ | $0$ | $\frac{\sqrt{77}}{539}$ | $0$ | $-\frac{\sqrt{1155}}{330}$ | $0$ | $0$ |
| | | $0$ | $-\frac{5\sqrt{231}}{588}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{1155}}{84}$ | $\frac{3\sqrt{110}}{220}$ | $0$ | $\frac{\sqrt{2310}}{32340}$ | $0$ | $\frac{\sqrt{154}}{308}$ | $0$ | $\frac{\sqrt{770}}{1540}$ | $0$ |
| | | $\frac{\sqrt{1155}}{84}$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{231}}{588}$ | $0$ | $0$ | $\frac{\sqrt{770}}{1540}$ | $0$ | $\frac{\sqrt{154}}{308}$ | $0$ | $\frac{\sqrt{2310}}{32340}$ | $0$ | $\frac{3\sqrt{110}}{220}$ |
| | | $0$ | $0$ | $0$ | $\frac{5\sqrt{231}}{588}$ | $0$ | $-\frac{\sqrt{2310}}{588}$ | $0$ | $0$ | $-\frac{\sqrt{1155}}{330}$ | $0$ | $\frac{\sqrt{77}}{539}$ | $0$ | $-\frac{13\sqrt{385}}{5390}$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{1155}}{84}$ | $0$ | $-\frac{\sqrt{2310}}{588}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{385}}{154}$ | $0$ | $-\frac{5\sqrt{231}}{1617}$ | $0$ | $\frac{\sqrt{11}}{154}$ |
| | $\mathbb{Q}_{4,2}^{(1,1;a)}(E_g, 2)$ | $\frac{\sqrt{11}}{154}$ | $0$ | $\frac{3\sqrt{110}}{220}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{66}}{1848}$ | $0$ | $-\frac{\sqrt{330}}{264}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{13\sqrt{385}}{5390}$ | $0$ | $\frac{\sqrt{770}}{1540}$ | $0$ | $0$ | $-\frac{5\sqrt{66}}{1848}$ | $0$ | $\frac{5\sqrt{154}}{4312}$ | $0$ | $-\frac{\sqrt{2310}}{924}$ | $0$ | $0$ | $0$ |
| | | $-\frac{5\sqrt{231}}{1617}$ | $0$ | $\frac{\sqrt{2310}}{32340}$ | $0$ | $-\frac{\sqrt{1155}}{330}$ | $0$ | $0$ | $\frac{5\sqrt{154}}{4312}$ | $0$ | $\frac{3\sqrt{770}}{4312}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{77}}{539}$ | $0$ | $\frac{\sqrt{154}}{308}$ | $0$ | $-\frac{\sqrt{385}}{154}$ | $-\frac{\sqrt{330}}{264}$ | $0$ | $\frac{3\sqrt{770}}{4312}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{2310}}{924}$ | $0$ |
| | | $-\frac{\sqrt{385}}{154}$ | $0$ | $\frac{\sqrt{154}}{308}$ | $0$ | $\frac{\sqrt{77}}{539}$ | $0$ | $0$ | $-\frac{\sqrt{2310}}{924}$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{770}}{4312}$ | $0$ | $\frac{\sqrt{330}}{264}$ |
| | | $0$ | $-\frac{\sqrt{1155}}{330}$ | $0$ | $\frac{\sqrt{2310}}{32340}$ | $0$ | $-\frac{5\sqrt{231}}{1617}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{770}}{4312}$ | $0$ | $-\frac{5\sqrt{154}}{4312}$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{770}}{1540}$ | $0$ | $-\frac{13\sqrt{385}}{5390}$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{2310}}{924}$ | $0$ | $-\frac{5\sqrt{154}}{4312}$ | $0$ | $\frac{5\sqrt{66}}{1848}$ |
| | | $0$ | $0$ | $0$ | $\frac{3\sqrt{110}}{220}$ | $0$ | $\frac{\sqrt{11}}{154}$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{330}}{264}$ | $0$ | $\frac{5\sqrt{66}}{1848}$ | $0$ |

| 899 | symmetry | $z$ |
|---|---|---|

Table 10

| No. | multipole | matrix |
|-----|-----------|--------|

$$\mathbb{G}_1^{(1,0;a)}(A_{2g}) = \begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{28} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{14} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{14} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{28} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}i}{28} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{42}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{70}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{21}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{21}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

| No. | | |
|-----|-----------|--------|
| 900 | symmetry | $x$ |

*continued …*

Table 10

| No. | multipole | | | | | | matrix | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{6}i}{8}$ | $0$ | $-\frac{\sqrt{14}i}{56}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{210}i}{56}$ | $0$ | $-\frac{\sqrt{42}i}{56}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{35}i}{28}$ | $0$ | $-\frac{\sqrt{21}i}{28}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{21}i}{28}$ | $0$ | $-\frac{\sqrt{35}i}{28}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{42}i}{56}$ | $0$ | $-\frac{\sqrt{210}i}{56}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{14}i}{56}$ | $0$ | $-\frac{\sqrt{6}i}{8}$ |
| | $\mathbb{G}_{1,1}^{(1,0;a)}(E_g)$ | $-\frac{\sqrt{6}i}{8}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{210}i}{56}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $\frac{\sqrt{14}i}{56}$ | $0$ | $-\frac{\sqrt{35}i}{28}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{42}i}{56}$ | $0$ | $-\frac{\sqrt{21}i}{28}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{21}i}{28}$ | $0$ | $-\frac{\sqrt{42}i}{56}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{35}i}{28}$ | $0$ | $-\frac{\sqrt{14}i}{56}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{210}i}{56}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{6}i}{8}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |

| 901 | symmetry | $-y$ |
|---|---|---|

*continued ...*

Table 10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{G}_{1,2}^{(1,0;a)}(E_g)$$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{8} & 0 & \frac{\sqrt{14}}{56} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{56} & 0 & \frac{\sqrt{42}}{56} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{35}}{28} & 0 & \frac{\sqrt{21}}{28} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}}{28} & 0 & \frac{\sqrt{35}}{28} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{56} & 0 & \frac{\sqrt{210}}{56} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{56} & 0 & \frac{\sqrt{6}}{8} \\
\frac{\sqrt{6}}{8} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{210}}{56} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{14}}{56} & 0 & \frac{\sqrt{35}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{42}}{56} & 0 & \frac{\sqrt{21}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{21}}{28} & 0 & \frac{\sqrt{42}}{56} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{35}}{28} & 0 & \frac{\sqrt{14}}{56} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{210}}{56} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{8} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

| 902 | symmetry | $-\frac{z\left(3x^2+3y^2-2z^2\right)}{2}$ |

*continued ...*

Table 10

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{G}_3^{(1,0;a)}(A_{2g})$ | $\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{6} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{6} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{6} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{6} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ -\frac{\sqrt{6}i}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{3}i}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{3}i}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$ |
| 903 | symmetry | $\sqrt{15}xyz$ |

361

Table 10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{G}_3^{(1,0;a)}(B_{1g})$$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{6} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{12} & 0 & 0 & 0 & \frac{\sqrt{10}}{12} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{12} & 0 & 0 & 0 & \frac{\sqrt{3}}{12} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{12} & 0 & 0 & 0 & -\frac{1}{12} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{12} & 0 & 0 & 0 & -\frac{\sqrt{14}}{12} \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{6} & 0 & 0 & 0 \\
0 & \frac{\sqrt{14}}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{1}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{3}}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{2}}{6} & 0 & 0 & 0 & -\frac{\sqrt{10}}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{10}}{12} & 0 & 0 & 0 & -\frac{\sqrt{2}}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{3}}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{1}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

| 904 | symmetry | $\frac{\sqrt{15}z(x-y)(x+y)}{2}$ |

*continued ...*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{2}i}{6}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{14}i}{12}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{10}i}{12}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{i}{12}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{3}i}{12}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{3}i}{12}$ | $0$ | $0$ | $0$ | $-\frac{i}{12}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{10}i}{12}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{14}i}{12}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{2}i}{6}$ | $0$ | $0$ | $0$ |
| | $\mathbb{G}_3^{(1,0;a)}(B_{2g})$ | $0$ | $\frac{\sqrt{14}i}{12}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $\frac{i}{12}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{\sqrt{3}i}{12}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{2}i}{6}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{10}i}{12}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{10}i}{12}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2}i}{6}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{3}i}{12}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{i}{12}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{14}i}{12}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |

| 905 | symmetry | $\frac{x\left(2x^2-3y^2-3z^2\right)}{2}$ |
|---|---|---|

*continued …*

Table 10

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_{3,1}^{(1,0;a)}(E_g,1)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{48} & 0 & -\frac{\sqrt{2}i}{8} & 0 & \frac{\sqrt{30}i}{48} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{48} & 0 & -\frac{\sqrt{6}i}{24} & 0 & \frac{\sqrt{10}i}{16} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}i}{48} & 0 & -\frac{\sqrt{5}i}{16} & 0 & \frac{\sqrt{3}i}{48} & 0 & \frac{\sqrt{15}i}{16} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{16} & 0 & -\frac{\sqrt{3}i}{48} & 0 & \frac{\sqrt{5}i}{16} & 0 & \frac{\sqrt{105}i}{48} \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{16} & 0 & \frac{\sqrt{6}i}{24} & 0 & \frac{\sqrt{30}i}{48} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{48} & 0 & \frac{\sqrt{2}i}{8} & 0 & -\frac{\sqrt{42}i}{48} \\
-\frac{\sqrt{42}i}{48} & 0 & \frac{\sqrt{105}i}{48} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{30}i}{48} & 0 & \frac{\sqrt{15}i}{16} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{2}i}{8} & 0 & \frac{\sqrt{5}i}{16} & 0 & \frac{\sqrt{10}i}{16} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{6}i}{24} & 0 & \frac{\sqrt{3}i}{48} & 0 & \frac{\sqrt{30}i}{48} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{30}i}{48} & 0 & -\frac{\sqrt{3}i}{48} & 0 & -\frac{\sqrt{6}i}{24} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{10}i}{16} & 0 & -\frac{\sqrt{5}i}{16} & 0 & -\frac{\sqrt{2}i}{8} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{15}i}{16} & 0 & -\frac{\sqrt{30}i}{48} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{105}i}{48} & 0 & \frac{\sqrt{42}i}{48} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\end{pmatrix}$$

| No. | symmetry | |
|---|---|---|
| 906 | symmetry | $\frac{y\left(3x^2-2y^2+3z^2\right)}{2}$ |

Table 10

| No. | multipole | matrix |
|-----|-----------|--------|

$$\mathbb{G}_{3,2}^{(1,0;a)}(E_g,1)$$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{48} & 0 & \frac{\sqrt{2}}{8} & 0 & \frac{\sqrt{30}}{48} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{48} & 0 & \frac{\sqrt{6}}{24} & 0 & \frac{\sqrt{10}}{16} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}}{48} & 0 & -\frac{\sqrt{5}}{16} & 0 & -\frac{\sqrt{3}}{48} & 0 & \frac{\sqrt{15}}{16} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{16} & 0 & -\frac{\sqrt{3}}{48} & 0 & -\frac{\sqrt{5}}{16} & 0 & \frac{\sqrt{105}}{48} \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{16} & 0 & \frac{\sqrt{6}}{24} & 0 & -\frac{\sqrt{30}}{48} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{48} & 0 & \frac{\sqrt{2}}{8} & 0 & \frac{\sqrt{42}}{48} \\
\frac{\sqrt{42}}{48} & 0 & \frac{\sqrt{105}}{48} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{30}}{48} & 0 & \frac{\sqrt{15}}{16} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{2}}{8} & 0 & -\frac{\sqrt{5}}{16} & 0 & \frac{\sqrt{10}}{16} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{6}}{24} & 0 & -\frac{\sqrt{3}}{48} & 0 & \frac{\sqrt{30}}{48} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{30}}{48} & 0 & -\frac{\sqrt{3}}{48} & 0 & \frac{\sqrt{6}}{24} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{10}}{16} & 0 & -\frac{\sqrt{5}}{16} & 0 & \frac{\sqrt{2}}{8} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{15}}{16} & 0 & -\frac{\sqrt{30}}{48} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{105}}{48} & 0 & \frac{\sqrt{42}}{48} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

| 907 | symmetry | $\frac{\sqrt{15}\,x(y-z)(y+z)}{2}$ |

365

Table  10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{G}_{3,1}^{(1,0;a)}(E_g,2)$$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{48} & 0 & -\frac{\sqrt{30}i}{24} & 0 & -\frac{\sqrt{2}i}{16} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{2}i}{48} & 0 & -\frac{\sqrt{10}i}{24} & 0 & -\frac{\sqrt{6}i}{16} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{16} & 0 & -\frac{5\sqrt{3}i}{48} & 0 & \frac{\sqrt{5}i}{48} & 0 & -\frac{3i}{16} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3i}{16} & 0 & -\frac{\sqrt{5}i}{48} & 0 & \frac{5\sqrt{3}i}{48} & 0 & -\frac{\sqrt{7}i}{16} \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{16} & 0 & \frac{\sqrt{10}i}{24} & 0 & \frac{5\sqrt{2}i}{48} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{16} & 0 & \frac{\sqrt{30}i}{24} & 0 & -\frac{\sqrt{70}i}{48} \\
-\frac{\sqrt{70}i}{48} & 0 & -\frac{\sqrt{7}i}{16} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{5\sqrt{2}i}{48} & 0 & -\frac{3i}{16} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{30}i}{24} & 0 & \frac{5\sqrt{3}i}{48} & 0 & -\frac{\sqrt{6}i}{16} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{10}i}{24} & 0 & \frac{\sqrt{5}i}{48} & 0 & -\frac{\sqrt{2}i}{16} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{2}i}{16} & 0 & -\frac{\sqrt{5}i}{48} & 0 & -\frac{\sqrt{10}i}{24} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{6}i}{16} & 0 & -\frac{5\sqrt{3}i}{48} & 0 & -\frac{\sqrt{30}i}{24} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{3i}{16} & 0 & -\frac{5\sqrt{2}i}{48} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{7}i}{16} & 0 & \frac{\sqrt{70}i}{48} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

| 908 | symmetry | $-\frac{\sqrt{15}y(x-z)(x+z)}{2}$ |
|---|---|---|

*continued ...*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{G}_{3,2}^{(1,0;a)}(E_g,2)$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{70}}{48}$ | $0$ | $\frac{\sqrt{30}}{24}$ | $0$ | $-\frac{\sqrt{2}}{16}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{2}}{48}$ | $0$ | $\frac{\sqrt{10}}{24}$ | $0$ | $-\frac{\sqrt{6}}{16}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{7}}{16}$ | $0$ | $-\frac{5\sqrt{3}}{48}$ | $0$ | $-\frac{\sqrt{5}}{48}$ | $0$ | $-\frac{3}{16}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3}{16}$ | $0$ | $-\frac{\sqrt{5}}{48}$ | $0$ | $-\frac{5\sqrt{3}}{48}$ | $0$ | $-\frac{\sqrt{7}}{16}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{6}}{16}$ | $0$ | $\frac{\sqrt{10}}{24}$ | $0$ | $-\frac{5\sqrt{2}}{48}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2}}{16}$ | $0$ | $\frac{\sqrt{30}}{24}$ | $0$ | $\frac{\sqrt{70}}{48}$ |
| | | $\frac{\sqrt{70}}{48}$ | $0$ | $-\frac{\sqrt{7}}{16}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{5\sqrt{2}}{48}$ | $0$ | $-\frac{3}{16}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $\frac{\sqrt{30}}{24}$ | $0$ | $-\frac{5\sqrt{3}}{48}$ | $0$ | $-\frac{\sqrt{6}}{16}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{10}}{24}$ | $0$ | $-\frac{\sqrt{5}}{48}$ | $0$ | $-\frac{\sqrt{2}}{16}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{2}}{16}$ | $0$ | $-\frac{\sqrt{5}}{48}$ | $0$ | $\frac{\sqrt{10}}{24}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{6}}{16}$ | $0$ | $-\frac{5\sqrt{3}}{48}$ | $0$ | $\frac{\sqrt{30}}{24}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $-\frac{3}{16}$ | $0$ | $-\frac{5\sqrt{2}}{48}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{\sqrt{7}}{16}$ | $0$ | $\frac{\sqrt{70}}{48}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |

| 909 | symmetry | $\frac{3\sqrt{35}xyz(x-y)(x+y)}{2}$ |

*continued …*

367

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2}}{4}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{30}}{60}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{105}}{30}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{105}}{30}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{30}}{60}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{2}}{4}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | $\mathbb{G}_5^{(1,0;a)}(A_{1g})$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{105}}{30}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{30}}{60}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{2}}{4}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{2}}{4}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{30}}{60}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{105}}{30}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| 910 | symmetry | $\frac{z\left(15x^4+30x^2y^2-40x^2z^2+15y^4-40y^2z^2+8z^4\right)}{8}$ | | | | | | | | | | | | | |

*continued ...*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{G}_5^{(1,0;a)}(A_{2g},1)$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{210}i}{84}$ | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{3\sqrt{14}i}{28}$ | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{105}i}{42}$ | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{105}i}{42}$ | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{3\sqrt{14}i}{28}$ | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{210}i}{84}$ | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | $\frac{\sqrt{210}i}{84}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | $-\frac{3\sqrt{14}i}{28}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | $\frac{\sqrt{105}i}{42}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | $\frac{\sqrt{105}i}{42}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | $-\frac{3\sqrt{14}i}{28}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{210}i}{84}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 911 | symmetry | $\frac{3\sqrt{35}z\left(x^2-2xy-y^2\right)\left(x^2+2xy-y^2\right)}{8}$ | | | | | | | | | | | | | |

Table 10

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_5^{(1,0;a)}(A_{2g},2)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{4} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{60} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}i}{30} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}i}{30} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}i}{60} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{105}i}{30} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{60} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{30}i}{60} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{105}i}{30} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

| 912 | symmetry | $\frac{\sqrt{105}xyz\left(x^2+y^2-2z^2\right)}{2}$ |

Table 10

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_5^{(1,0;a)}(B_{1g})$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{12} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{60} & 0 & 0 & 0 & -\frac{\sqrt{2}}{6} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{5}}{15} & 0 & 0 & 0 & -\frac{\sqrt{15}}{30} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{30} & 0 & 0 & 0 & \frac{2\sqrt{5}}{15} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{6} & 0 & 0 & 0 & -\frac{\sqrt{70}}{60} \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{12} & 0 & 0 & 0 \\
0 & \frac{\sqrt{70}}{60} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{2\sqrt{5}}{15} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{15}}{30} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{10}}{12} & 0 & 0 & 0 & \frac{\sqrt{2}}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{2}}{6} & 0 & 0 & 0 & -\frac{\sqrt{10}}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{15}}{30} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{2\sqrt{5}}{15} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{60} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

| 913 | symmetry | $-\frac{\sqrt{105}z(x-y)(x+y)\left(x^2+y^2-2z^2\right)}{4}$ |
|---|---|---|

*continued …*

Table  10

| No. | multipole | matrix | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{10}i}{12}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{70}i}{60}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{2}i}{6}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{5}i}{15}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{15}i}{30}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{15}i}{30}$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{5}i}{15}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{2}i}{6}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{70}i}{60}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{10}i}{12}$ | $0$ | $0$ | $0$ | $0$ |
| | $\mathbb{G}_5^{(1,0;a)}(B_{2g})$ | $0$ | $-\frac{\sqrt{70}i}{60}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $\frac{2\sqrt{5}i}{15}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{\sqrt{15}i}{30}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $\frac{\sqrt{10}i}{12}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2}i}{6}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{2}i}{6}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{10}i}{12}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{15}i}{30}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{2\sqrt{5}i}{15}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{70}i}{60}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |

| 914 | symmetry | $\frac{x\left(8x^4-40x^2y^2-40x^2z^2+15y^4+30y^2z^2+15z^4\right)}{8}$ |

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{G}_{5,1}^{(1,0;a)}(E_g,1)$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{30}i}{192}$ | $0$ | $-\frac{5\sqrt{70}i}{448}$ | $0$ | $\frac{5\sqrt{42}i}{192}$ | $0$ | $-\frac{\sqrt{210}i}{64}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{23\sqrt{42}i}{1344}$ | $0$ | $\frac{13\sqrt{210}i}{1344}$ | $0$ | $-\frac{\sqrt{14}i}{64}$ | $0$ | $-\frac{7\sqrt{6}i}{64}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{7\sqrt{3}i}{96}$ | $0$ | $\frac{11\sqrt{7}i}{224}$ | $0$ | $-\frac{\sqrt{105}i}{672}$ | $0$ | $-\frac{\sqrt{21}i}{32}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{21}i}{32}$ | $0$ | $\frac{\sqrt{105}i}{672}$ | $0$ | $-\frac{11\sqrt{7}i}{224}$ | $0$ | $\frac{7\sqrt{3}i}{96}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{7\sqrt{6}i}{64}$ | $0$ | $\frac{\sqrt{14}i}{64}$ | $0$ | $-\frac{13\sqrt{210}i}{1344}$ | $0$ | $\frac{23\sqrt{42}i}{1344}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{210}i}{64}$ | $0$ | $-\frac{5\sqrt{42}i}{192}$ | $0$ | $\frac{5\sqrt{70}i}{448}$ | $0$ | $-\frac{\sqrt{30}i}{192}$ |
| | | $-\frac{\sqrt{30}i}{192}$ | $0$ | $\frac{7\sqrt{3}i}{96}$ | $0$ | $-\frac{7\sqrt{6}i}{64}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{23\sqrt{42}i}{1344}$ | $0$ | $-\frac{\sqrt{21}i}{32}$ | $0$ | $-\frac{\sqrt{210}i}{64}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $\frac{5\sqrt{70}i}{448}$ | $0$ | $-\frac{11\sqrt{7}i}{224}$ | $0$ | $-\frac{\sqrt{14}i}{64}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{13\sqrt{210}i}{1344}$ | $0$ | $-\frac{\sqrt{105}i}{672}$ | $0$ | $\frac{5\sqrt{42}i}{192}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $-\frac{5\sqrt{42}i}{192}$ | $0$ | $\frac{\sqrt{105}i}{672}$ | $0$ | $\frac{13\sqrt{210}i}{1344}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{14}i}{64}$ | $0$ | $\frac{11\sqrt{7}i}{224}$ | $0$ | $-\frac{5\sqrt{70}i}{448}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $\frac{\sqrt{210}i}{64}$ | $0$ | $\frac{\sqrt{21}i}{32}$ | $0$ | $-\frac{23\sqrt{42}i}{1344}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{7\sqrt{6}i}{64}$ | $0$ | $-\frac{7\sqrt{3}i}{96}$ | $0$ | $\frac{\sqrt{30}i}{192}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |

| 915 | symmetry | $-\frac{y\left(15x^4-40x^2y^2+30x^2z^2+8y^4-40y^2z^2+15z^4\right)}{8}$ |

Table 10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{G}_{5,2}^{(1,0;a)}(E_g,1)$$

$$
\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{192} & 0 & \frac{5\sqrt{70}}{448} & 0 & \frac{5\sqrt{42}}{192} & 0 & \frac{\sqrt{210}}{64} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{23\sqrt{42}}{1344} & 0 & -\frac{13\sqrt{210}}{1344} & 0 & -\frac{\sqrt{14}}{64} & 0 & \frac{7\sqrt{6}}{64} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{7\sqrt{3}}{96} & 0 & \frac{11\sqrt{7}}{224} & 0 & \frac{\sqrt{105}}{672} & 0 & -\frac{\sqrt{21}}{32} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}}{32} & 0 & \frac{\sqrt{105}}{672} & 0 & \frac{11\sqrt{7}}{224} & 0 & \frac{7\sqrt{3}}{96} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{7\sqrt{6}}{64} & 0 & -\frac{\sqrt{14}}{64} & 0 & -\frac{13\sqrt{210}}{1344} & 0 & -\frac{23\sqrt{42}}{1344} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{64} & 0 & \frac{5\sqrt{42}}{192} & 0 & \frac{5\sqrt{70}}{448} & 0 & \frac{\sqrt{30}}{192} \\
\frac{\sqrt{30}}{192} & 0 & \frac{7\sqrt{3}}{96} & 0 & \frac{7\sqrt{6}}{64} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{23\sqrt{42}}{1344} & 0 & -\frac{\sqrt{21}}{32} & 0 & \frac{\sqrt{210}}{64} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{5\sqrt{70}}{448} & 0 & \frac{11\sqrt{7}}{224} & 0 & -\frac{\sqrt{14}}{64} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{13\sqrt{210}}{1344} & 0 & \frac{\sqrt{105}}{672} & 0 & \frac{5\sqrt{42}}{192} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{5\sqrt{42}}{192} & 0 & \frac{\sqrt{105}}{672} & 0 & -\frac{13\sqrt{210}}{1344} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{14}}{64} & 0 & \frac{11\sqrt{7}}{224} & 0 & \frac{5\sqrt{70}}{448} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{210}}{64} & 0 & -\frac{\sqrt{21}}{32} & 0 & -\frac{23\sqrt{42}}{1344} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{7\sqrt{6}}{64} & 0 & \frac{7\sqrt{3}}{96} & 0 & \frac{\sqrt{30}}{192} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}
$$

| No. | multipole | matrix |
|---|---|---|
| 916 | symmetry | $\frac{3\sqrt{35}x\left(y^2-2yz-z^2\right)\left(y^2+2yz-z^2\right)}{8}$ |

*continued …*

Table 10

| No. | multipole | matrix |
|-----|-----------|--------|

$$\mathbb{G}_{5,1}^{(1,0;a)}(E_g,2)$$

$$
\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{192} & 0 & -\frac{5\sqrt{2}i}{64} & 0 & -\frac{3\sqrt{30}i}{64} & 0 & -\frac{5\sqrt{6}i}{192} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{23\sqrt{30}i}{960} & 0 & \frac{13\sqrt{6}i}{192} & 0 & \frac{9\sqrt{10}i}{320} & 0 & -\frac{\sqrt{210}i}{192} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{105}i}{160} & 0 & \frac{11\sqrt{5}i}{160} & 0 & -\frac{\sqrt{3}i}{96} & 0 & \frac{9\sqrt{15}i}{160} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{9\sqrt{15}i}{160} & 0 & \frac{\sqrt{3}i}{96} & 0 & -\frac{11\sqrt{5}i}{160} & 0 & -\frac{3\sqrt{105}i}{160} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{192} & 0 & -\frac{9\sqrt{10}i}{320} & 0 & -\frac{13\sqrt{6}i}{192} & 0 & \frac{23\sqrt{30}i}{960} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{6}i}{192} & 0 & \frac{3\sqrt{30}i}{64} & 0 & \frac{5\sqrt{2}i}{64} & 0 & -\frac{\sqrt{42}i}{192} \\
-\frac{\sqrt{42}i}{192} & 0 & -\frac{3\sqrt{105}i}{160} & 0 & -\frac{\sqrt{210}i}{192} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{23\sqrt{30}i}{960} & 0 & \frac{9\sqrt{15}i}{160} & 0 & -\frac{5\sqrt{6}i}{192} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{5\sqrt{2}i}{64} & 0 & -\frac{11\sqrt{5}i}{160} & 0 & \frac{9\sqrt{10}i}{320} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{13\sqrt{6}i}{192} & 0 & -\frac{\sqrt{3}i}{96} & 0 & -\frac{3\sqrt{30}i}{64} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{3\sqrt{30}i}{64} & 0 & \frac{\sqrt{3}i}{96} & 0 & \frac{13\sqrt{6}i}{192} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{9\sqrt{10}i}{320} & 0 & \frac{11\sqrt{5}i}{160} & 0 & -\frac{5\sqrt{2}i}{64} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{5\sqrt{6}i}{192} & 0 & -\frac{9\sqrt{15}i}{160} & 0 & -\frac{23\sqrt{30}i}{960} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{210}i}{192} & 0 & \frac{3\sqrt{105}i}{160} & 0 & \frac{\sqrt{42}i}{192} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\end{pmatrix}
$$

| 917 | symmetry | $-\frac{3\sqrt{35}y\left(x^2-2xz-z^2\right)\left(x^2+2xz-z^2\right)}{8}$ |

*continued ...*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|-----|-----------|--------|---|---|---|---|---|---|---|---|---|---|---|---|---|

$$
\mathbb{G}_{5,2}^{(1,0;a)}(E_g, 2)
$$

$$
\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{192} & 0 & \frac{5\sqrt{2}}{64} & 0 & -\frac{3\sqrt{30}}{64} & 0 & \frac{5\sqrt{6}}{192} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{23\sqrt{30}}{960} & 0 & -\frac{13\sqrt{6}}{192} & 0 & \frac{9\sqrt{10}}{320} & 0 & \frac{\sqrt{210}}{192} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{105}}{160} & 0 & \frac{11\sqrt{5}}{160} & 0 & \frac{\sqrt{3}}{96} & 0 & \frac{9\sqrt{15}}{160} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{9\sqrt{15}}{160} & 0 & \frac{\sqrt{3}}{96} & 0 & \frac{11\sqrt{5}}{160} & 0 & -\frac{3\sqrt{105}}{160} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{192} & 0 & \frac{9\sqrt{10}}{320} & 0 & -\frac{13\sqrt{6}}{192} & 0 & -\frac{23\sqrt{30}}{960} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{6}}{192} & 0 & -\frac{3\sqrt{30}}{64} & 0 & \frac{5\sqrt{2}}{64} & 0 & \frac{\sqrt{42}}{192} \\
\frac{\sqrt{42}}{192} & 0 & -\frac{3\sqrt{105}}{160} & 0 & \frac{\sqrt{210}}{192} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{23\sqrt{30}}{960} & 0 & \frac{9\sqrt{15}}{160} & 0 & \frac{5\sqrt{6}}{192} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{5\sqrt{2}}{64} & 0 & \frac{11\sqrt{5}}{160} & 0 & \frac{9\sqrt{10}}{320} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{13\sqrt{6}}{192} & 0 & \frac{\sqrt{3}}{96} & 0 & -\frac{3\sqrt{30}}{64} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{3\sqrt{30}}{64} & 0 & \frac{\sqrt{3}}{96} & 0 & -\frac{13\sqrt{6}}{192} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{9\sqrt{10}}{320} & 0 & \frac{11\sqrt{5}}{160} & 0 & \frac{5\sqrt{2}}{64} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{5\sqrt{6}}{192} & 0 & \frac{9\sqrt{15}}{160} & 0 & -\frac{23\sqrt{30}}{960} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{210}}{192} & 0 & -\frac{3\sqrt{105}}{160} & 0 & \frac{\sqrt{42}}{192} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\end{pmatrix}
$$

| No. | | |
|-----|--|--|
| 918 | symmetry | $\dfrac{\sqrt{105}\,x(y-z)(y+z)\left(2x^2-y^2-z^2\right)}{4}$ |

# Table 10

| No. | multipole | matrix |
|---|---|---|

$\mathbb{G}_{5,1}^{(1,0;a)}(E_g,3)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}i}{96} & 0 & -\frac{5\sqrt{6}i}{96} & 0 & \frac{\sqrt{10}i}{32} & 0 & \frac{5\sqrt{2}i}{32} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{23\sqrt{10}i}{480} & 0 & \frac{13\sqrt{2}i}{96} & 0 & -\frac{\sqrt{30}i}{160} & 0 & \frac{\sqrt{70}i}{32} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{35}i}{80} & 0 & \frac{11\sqrt{15}i}{240} & 0 & -\frac{i}{48} & 0 & -\frac{3\sqrt{5}i}{80} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{5}i}{80} & 0 & \frac{i}{48} & 0 & -\frac{11\sqrt{15}i}{240} & 0 & \frac{\sqrt{35}i}{80} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{32} & 0 & \frac{\sqrt{30}i}{160} & 0 & -\frac{13\sqrt{2}i}{96} & 0 & \frac{23\sqrt{10}i}{480} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{2}i}{32} & 0 & -\frac{\sqrt{10}i}{32} & 0 & \frac{5\sqrt{6}i}{96} & 0 & -\frac{\sqrt{14}i}{96} \\
-\frac{\sqrt{14}i}{96} & 0 & \frac{\sqrt{35}i}{80} & 0 & \frac{\sqrt{70}i}{32} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{23\sqrt{10}i}{480} & 0 & -\frac{3\sqrt{5}i}{80} & 0 & \frac{5\sqrt{2}i}{32} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{5\sqrt{6}i}{96} & 0 & -\frac{11\sqrt{15}i}{240} & 0 & -\frac{\sqrt{30}i}{160} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{13\sqrt{2}i}{96} & 0 & -\frac{i}{48} & 0 & \frac{\sqrt{10}i}{32} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{10}i}{32} & 0 & \frac{i}{48} & 0 & \frac{13\sqrt{2}i}{96} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{30}i}{160} & 0 & \frac{11\sqrt{15}i}{240} & 0 & -\frac{5\sqrt{6}i}{96} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{5\sqrt{2}i}{32} & 0 & \frac{3\sqrt{5}i}{80} & 0 & -\frac{23\sqrt{10}i}{480} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{70}i}{32} & 0 & -\frac{\sqrt{35}i}{80} & 0 & \frac{\sqrt{14}i}{96} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

| 919 | symmetry | $\dfrac{\sqrt{105}\,y(x-z)(x+z)\left(x^2-2y^2+z^2\right)}{4}$ |
|---|---|---|

Table 10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{G}_{5,2}^{(1,0;a)}(E_g,3)$$

$$
\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{96} & 0 & \frac{5\sqrt{6}}{96} & 0 & \frac{\sqrt{10}}{32} & 0 & -\frac{5\sqrt{2}}{32} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{23\sqrt{10}}{480} & 0 & -\frac{13\sqrt{2}}{96} & 0 & -\frac{\sqrt{30}}{160} & 0 & -\frac{\sqrt{70}}{32} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{35}}{80} & 0 & \frac{11\sqrt{15}}{240} & 0 & \frac{1}{48} & 0 & -\frac{3\sqrt{5}}{80} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{5}}{80} & 0 & \frac{1}{48} & 0 & \frac{11\sqrt{15}}{240} & 0 & \frac{\sqrt{35}}{80} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{32} & 0 & -\frac{\sqrt{30}}{160} & 0 & -\frac{13\sqrt{2}}{96} & 0 & -\frac{23\sqrt{10}}{480} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{2}}{32} & 0 & \frac{\sqrt{10}}{32} & 0 & \frac{5\sqrt{6}}{96} & 0 & \frac{\sqrt{14}}{96} \\
\frac{\sqrt{14}}{96} & 0 & \frac{\sqrt{35}}{80} & 0 & -\frac{\sqrt{70}}{32} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{23\sqrt{10}}{480} & 0 & -\frac{3\sqrt{5}}{80} & 0 & -\frac{5\sqrt{2}}{32} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{5\sqrt{6}}{96} & 0 & \frac{11\sqrt{15}}{240} & 0 & -\frac{\sqrt{30}}{160} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{13\sqrt{2}}{96} & 0 & \frac{1}{48} & 0 & \frac{\sqrt{10}}{32} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{10}}{32} & 0 & \frac{1}{48} & 0 & -\frac{13\sqrt{2}}{96} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{30}}{160} & 0 & \frac{11\sqrt{15}}{240} & 0 & \frac{5\sqrt{6}}{96} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{5\sqrt{2}}{32} & 0 & -\frac{3\sqrt{5}}{80} & 0 & -\frac{23\sqrt{10}}{480} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{70}}{32} & 0 & \frac{\sqrt{35}}{80} & 0 & \frac{\sqrt{14}}{96} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\end{pmatrix}
$$

| 920 | symmetry | $-\frac{x^2}{2} - \frac{y^2}{2} + z^2$ |
|---|---|---|

*continued ...*

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

$$\mathbb{T}_2^{(1,0;a)}(A_{1g})$$

$$
\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{42}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{28} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}i}{42} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}i}{42} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{28} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{42}i}{84} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{5\sqrt{42}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{70}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{21}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{21}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{42}i}{84} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\end{pmatrix}
$$

| 921 | symmetry | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |
|---|---|---|

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{T}_2^{(1,0;a)}(B_{1g})$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{70}i}{84}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{10}i}{12}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{14}i}{21}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{35}i}{21}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{105}i}{42}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{105}i}{42}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{35}i}{21}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{14}i}{21}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{10}i}{12}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{70}i}{84}$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{10}i}{12}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{35}i}{21}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{105}i}{42}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{70}i}{84}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{14}i}{21}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{14}i}{21}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{70}i}{84}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{105}i}{42}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{\sqrt{35}i}{21}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{10}i}{12}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |

| 922 | symmetry | $\sqrt{3}xy$ |

Table 10

| No. | multipole | matrix | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{70}}{84}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{10}}{12}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{14}}{21}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{35}}{21}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{105}}{42}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{105}}{42}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{35}}{21}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{14}}{21}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{10}}{12}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{70}}{84}$ | $0$ | $0$ | $0$ |
| | $\mathbb{T}_2^{(1,0;a)}(B_{2g})$ | $0$ | $\frac{\sqrt{10}}{12}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{35}}{21}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{105}}{42}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $\frac{\sqrt{70}}{84}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{14}}{21}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{14}}{21}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{70}}{84}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{105}}{42}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{35}}{21}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{10}}{12}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |

| 923 | symmetry | $\sqrt{3}yz$ |
|---|---|---|

*continued ...*

Table 10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{T}_{2,1}^{(1,0;a)}(E_g)$$

$$
\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{2}}{24} & 0 & \frac{5\sqrt{42}}{168} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{168} & 0 & \frac{11\sqrt{14}}{168} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}}{84} & 0 & \frac{\sqrt{7}}{12} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{12} & 0 & \frac{\sqrt{105}}{84} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{11\sqrt{14}}{168} & 0 & -\frac{\sqrt{70}}{168} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{42}}{168} & 0 & -\frac{5\sqrt{2}}{24} \\
\frac{5\sqrt{2}}{24} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{70}}{168} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{5\sqrt{42}}{168} & 0 & -\frac{\sqrt{105}}{84} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{11\sqrt{14}}{168} & 0 & -\frac{\sqrt{7}}{12} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{7}}{12} & 0 & -\frac{11\sqrt{14}}{168} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{105}}{84} & 0 & -\frac{5\sqrt{42}}{168} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{168} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{2}}{24} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\end{pmatrix}
$$

| 924 | symmetry | $\sqrt{3}xz$ |
|---|---|---|

382

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{T}_{2,2}^{(1,0;a)}(E_g)$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{2}i}{24}$ | $0$ | $\frac{5\sqrt{42}i}{168}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{70}i}{168}$ | $0$ | $\frac{11\sqrt{14}i}{168}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{105}i}{84}$ | $0$ | $\frac{\sqrt{7}i}{12}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{7}i}{12}$ | $0$ | $\frac{\sqrt{105}i}{84}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{11\sqrt{14}i}{168}$ | $0$ | $-\frac{\sqrt{70}i}{168}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{42}i}{168}$ | $0$ | $-\frac{5\sqrt{2}i}{24}$ |
| | | $\frac{5\sqrt{2}i}{24}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{70}i}{168}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $-\frac{5\sqrt{42}i}{168}$ | $0$ | $-\frac{\sqrt{105}i}{84}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{11\sqrt{14}i}{168}$ | $0$ | $-\frac{\sqrt{7}i}{12}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{7}i}{12}$ | $0$ | $-\frac{11\sqrt{14}i}{168}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{\sqrt{105}i}{84}$ | $0$ | $-\frac{5\sqrt{42}i}{168}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{70}i}{168}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{2}i}{24}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| 925 | symmetry | $\frac{\sqrt{21}\left(x^4-3x^2y^2-3x^2z^2+y^4-3y^2z^2+z^4\right)}{6}$ | | | | | | | | | | | | | |

*continued ...*

Table 10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{T}_4^{(1,0;a)}(A_{1g},1)$$

$$
\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{110}i}{44} & 0 & 0 & 0 & -\frac{\sqrt{330}i}{132} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{66}i}{33} & 0 & 0 & 0 & -\frac{\sqrt{22}i}{22} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{55}i}{44} & 0 & 0 & 0 & -\frac{\sqrt{77}i}{44} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{77}i}{44} & 0 & 0 & 0 & -\frac{\sqrt{55}i}{44} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{22}i}{22} & 0 & 0 & 0 & -\frac{\sqrt{66}i}{33} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{330}i}{132} & 0 & 0 & 0 & \frac{\sqrt{110}i}{44} & 0 \\
0 & 0 & 0 & -\frac{\sqrt{77}i}{44} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{110}i}{44} & 0 & 0 & 0 & -\frac{\sqrt{22}i}{22} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{66}i}{33} & 0 & 0 & 0 & -\frac{\sqrt{330}i}{132} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{55}i}{44} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{55}i}{44} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{330}i}{132} & 0 & 0 & 0 & \frac{\sqrt{66}i}{33} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{22}i}{22} & 0 & 0 & 0 & -\frac{\sqrt{110}i}{44} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{77}i}{44} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}
$$

| 926 | symmetry | $-\frac{\sqrt{15}\left(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4\right)}{12}$ |

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{154}i}{308}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{462}i}{132}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{2310}i}{231}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{770}i}{110}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{77}i}{308}$ | $0$ | $0$ | $0$ | $\frac{7\sqrt{55}i}{220}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{7\sqrt{55}i}{220}$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{77}i}{308}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{770}i}{110}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2310}i}{231}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{462}i}{132}$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{154}i}{308}$ | $0$ |
| | $\mathbb{T}_4^{(1,0;a)}(A_{1g},2)$ | $0$ | $0$ | $0$ | $\frac{7\sqrt{55}i}{220}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $\frac{5\sqrt{154}i}{308}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{770}i}{110}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{2310}i}{231}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{462}i}{132}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $-\frac{5\sqrt{77}i}{308}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{5\sqrt{77}i}{308}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{462}i}{132}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{2310}i}{231}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{770}i}{110}$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{154}i}{308}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $-\frac{7\sqrt{55}i}{220}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| 927 | symmetry | $\frac{\sqrt{35}xy(x-y)(x+y)}{2}$ | | | | | | | | | | | | | |

*continued ...*

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Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{T}_4^{(1,0;a)}(A_{2g})$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{22}}{22}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{330}}{55}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{1155}}{110}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{1155}}{110}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{330}}{55}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{22}}{22}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{\sqrt{1155}}{110}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{330}}{55}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{22}}{22}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{22}}{22}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{330}}{55}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{1155}}{110}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| 928 | symmetry | $\frac{\sqrt{5}(x-y)(x+y)\left(x^2+y^2-6z^2\right)}{4}$ | | | | | | | | | | | | | | |

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{T}_4^{(1,0;a)}(B_{1g})$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{2310}i}{154}$ | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{3\sqrt{330}i}{220}$ | 0 | 0 | 0 | $\frac{\sqrt{462}i}{308}$ | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{9\sqrt{1155}i}{1540}$ | 0 | 0 | 0 | $-\frac{17\sqrt{385}i}{1540}$ | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{17\sqrt{385}i}{1540}$ | 0 | 0 | 0 | $-\frac{9\sqrt{1155}i}{1540}$ | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{462}i}{308}$ | 0 | 0 | 0 | $\frac{3\sqrt{330}i}{220}$ |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{2310}i}{154}$ | 0 | 0 | 0 |
| | | 0 | $\frac{3\sqrt{330}i}{220}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | $-\frac{9\sqrt{1155}i}{1540}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | $-\frac{17\sqrt{385}i}{1540}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | $-\frac{\sqrt{2310}i}{154}$ | 0 | 0 | 0 | $\frac{\sqrt{462}i}{308}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | $-\frac{\sqrt{462}i}{308}$ | 0 | 0 | 0 | $\frac{\sqrt{2310}i}{154}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | $\frac{17\sqrt{385}i}{1540}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | $\frac{9\sqrt{1155}i}{1540}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | $-\frac{3\sqrt{330}i}{220}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| 929 | symmetry | $-\frac{\sqrt{5}xy\left(x^2+y^2-6z^2\right)}{2}$ |

Table 10

| No. | multipole | matrix | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

$\mathbb{T}_4^{(1,0;a)}(B_{2g})$

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{2310}}{154}$ | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{3\sqrt{330}}{220}$ | 0 | 0 | $-\frac{\sqrt{462}}{308}$ | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{9\sqrt{1155}}{1540}$ | 0 | 0 | $\frac{17\sqrt{385}}{1540}$ | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{17\sqrt{385}}{1540}$ | 0 | 0 | $\frac{9\sqrt{1155}}{1540}$ | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{462}}{308}$ | 0 | 0 | $-\frac{3\sqrt{330}}{220}$ |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{2310}}{154}$ | 0 | 0 |
| 0 | $-\frac{3\sqrt{330}}{220}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | $\frac{9\sqrt{1155}}{1540}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | $\frac{17\sqrt{385}}{1540}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $-\frac{\sqrt{2310}}{154}$ | 0 | 0 | 0 | $-\frac{\sqrt{462}}{308}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | $-\frac{\sqrt{462}}{308}$ | 0 | 0 | 0 | $-\frac{\sqrt{2310}}{154}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | $\frac{17\sqrt{385}}{1540}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | $\frac{9\sqrt{1155}}{1540}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | $-\frac{3\sqrt{330}}{220}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| 930 | symmetry | $\frac{\sqrt{35}yz(y-z)(y+z)}{2}$ |
|---|---|---|

*continued …*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{462}}{176}$ | $0$ | $\frac{5\sqrt{22}}{88}$ | $0$ | $\frac{\sqrt{330}}{176}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{13\sqrt{330}}{880}$ | $0$ | $-\frac{\sqrt{66}}{88}$ | $0$ | $\frac{7\sqrt{110}}{880}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{1155}}{880}$ | $0$ | $\frac{\sqrt{55}}{880}$ | $0$ | $-\frac{7\sqrt{33}}{176}$ | $0$ | $-\frac{\sqrt{165}}{880}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{165}}{880}$ | $0$ | $\frac{7\sqrt{33}}{176}$ | $0$ | $-\frac{\sqrt{55}}{880}$ | $0$ | $-\frac{3\sqrt{1155}}{880}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{7\sqrt{110}}{880}$ | $0$ | $\frac{\sqrt{66}}{88}$ | $0$ | $\frac{13\sqrt{330}}{880}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{330}}{176}$ | $0$ | $-\frac{5\sqrt{22}}{88}$ | $0$ | $-\frac{\sqrt{462}}{176}$ |
| | $\mathbb{T}_{4,1}^{(1,0;a)}(E_g,1)$ | $\frac{\sqrt{462}}{176}$ | $0$ | $\frac{3\sqrt{1155}}{880}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{13\sqrt{330}}{880}$ | $0$ | $\frac{\sqrt{165}}{880}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $\frac{5\sqrt{22}}{88}$ | $0$ | $\frac{\sqrt{55}}{880}$ | $0$ | $-\frac{7\sqrt{110}}{880}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{66}}{88}$ | $0$ | $\frac{7\sqrt{33}}{176}$ | $0$ | $-\frac{\sqrt{330}}{176}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $\frac{\sqrt{330}}{176}$ | $0$ | $-\frac{7\sqrt{33}}{176}$ | $0$ | $\frac{\sqrt{66}}{88}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{7\sqrt{110}}{880}$ | $0$ | $-\frac{\sqrt{55}}{880}$ | $0$ | $-\frac{5\sqrt{22}}{88}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{165}}{880}$ | $0$ | $\frac{13\sqrt{330}}{880}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{3\sqrt{1155}}{880}$ | $0$ | $-\frac{\sqrt{462}}{176}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |

| 931 | symmetry | $\frac{\sqrt{35}xz(x-z)(x+z)}{2}$ |

*continued …*

Table 10

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_{4,2}^{(1,0;a)}(E_g,1)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{462}i}{176} & 0 & \frac{5\sqrt{22}i}{88} & 0 & -\frac{\sqrt{330}i}{176} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{13\sqrt{330}i}{880} & 0 & -\frac{\sqrt{66}i}{88} & 0 & -\frac{7\sqrt{110}i}{880} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{1155}i}{880} & 0 & -\frac{\sqrt{55}i}{880} & 0 & -\frac{7\sqrt{33}i}{176} & 0 & \frac{\sqrt{165}i}{880} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{165}i}{880} & 0 & -\frac{7\sqrt{33}i}{176} & 0 & -\frac{\sqrt{55}i}{880} & 0 & \frac{3\sqrt{1155}i}{880} \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{7\sqrt{110}i}{880} & 0 & -\frac{\sqrt{66}i}{88} & 0 & \frac{13\sqrt{330}i}{880} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{330}i}{176} & 0 & \frac{5\sqrt{22}i}{88} & 0 & -\frac{\sqrt{462}i}{176} \\
\frac{\sqrt{462}i}{176} & 0 & -\frac{3\sqrt{1155}i}{880} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{13\sqrt{330}i}{880} & 0 & -\frac{\sqrt{165}i}{880} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{5\sqrt{22}i}{88} & 0 & \frac{\sqrt{55}i}{880} & 0 & \frac{7\sqrt{110}i}{880} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{66}i}{88} & 0 & \frac{7\sqrt{33}i}{176} & 0 & \frac{\sqrt{330}i}{176} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{330}i}{176} & 0 & \frac{7\sqrt{33}i}{176} & 0 & \frac{\sqrt{66}i}{88} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{7\sqrt{110}i}{880} & 0 & \frac{\sqrt{55}i}{880} & 0 & -\frac{5\sqrt{22}i}{88} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{165}i}{880} & 0 & -\frac{13\sqrt{330}i}{880} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{3\sqrt{1155}i}{880} & 0 & \frac{\sqrt{462}i}{176} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

| 932 | symmetry | $\dfrac{\sqrt{5}yz\left(6x^2-y^2-z^2\right)}{2}$ |

Table 10

| No. | multipole | matrix |
| --- | --- | --- |

| | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{66}}{176}$ | $0$ | $\frac{5\sqrt{154}}{616}$ | $0$ | $-\frac{\sqrt{2310}}{176}$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{13\sqrt{2310}}{6160}$ | $0$ | $-\frac{\sqrt{462}}{616}$ | $0$ | $-\frac{7\sqrt{770}}{880}$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{21\sqrt{165}}{880}$ | $0$ | $\frac{\sqrt{385}}{6160}$ | $0$ | $-\frac{\sqrt{231}}{176}$ | $0$ | $\frac{\sqrt{1155}}{880}$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{1155}}{880}$ | $0$ | $\frac{\sqrt{231}}{176}$ | $0$ | $-\frac{\sqrt{385}}{6160}$ | $0$ | $\frac{21\sqrt{165}}{880}$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{7\sqrt{770}}{880}$ | $0$ | $\frac{\sqrt{462}}{616}$ | $0$ | $\frac{13\sqrt{2310}}{6160}$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{2310}}{176}$ | $0$ | $-\frac{5\sqrt{154}}{616}$ | $0$ | $-\frac{\sqrt{66}}{176}$ |
| $\frac{\sqrt{66}}{176}$ | $0$ | $-\frac{21\sqrt{165}}{880}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $-\frac{13\sqrt{2310}}{6160}$ | $0$ | $-\frac{\sqrt{1155}}{880}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $\frac{5\sqrt{154}}{616}$ | $0$ | $\frac{\sqrt{385}}{6160}$ | $0$ | $\frac{7\sqrt{770}}{880}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $-\frac{\sqrt{462}}{616}$ | $0$ | $\frac{\sqrt{231}}{176}$ | $0$ | $\frac{\sqrt{2310}}{176}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $-\frac{\sqrt{2310}}{176}$ | $0$ | $-\frac{\sqrt{231}}{176}$ | $0$ | $\frac{\sqrt{462}}{616}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $-\frac{7\sqrt{770}}{880}$ | $0$ | $-\frac{\sqrt{385}}{6160}$ | $0$ | $-\frac{5\sqrt{154}}{616}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $\frac{\sqrt{1155}}{880}$ | $0$ | $\frac{13\sqrt{2310}}{6160}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $\frac{21\sqrt{165}}{880}$ | $0$ | $-\frac{\sqrt{66}}{176}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |

multipole: $\mathbb{T}_{4,1}^{(1,0;a)}(E_g, 2)$

| No. | | |
| --- | --- | --- |
| 933 | symmetry | $-\frac{\sqrt{5}xz(x^2-6y^2+z^2)}{2}$ |

*continued …*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{66}i}{176}$ | $0$ | $\frac{5\sqrt{154}i}{616}$ | $0$ | $\frac{\sqrt{2310}i}{176}$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{13\sqrt{2310}i}{6160}$ | $0$ | $-\frac{\sqrt{462}i}{616}$ | $0$ | $\frac{7\sqrt{770}i}{880}$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{21\sqrt{165}i}{880}$ | $0$ | $-\frac{\sqrt{385}i}{6160}$ | $0$ | $-\frac{\sqrt{231}i}{176}$ | $0$ | $-\frac{\sqrt{1155}i}{880}$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{1155}i}{880}$ | $0$ | $-\frac{\sqrt{231}i}{176}$ | $0$ | $-\frac{\sqrt{385}i}{6160}$ | $0$ | $-\frac{21\sqrt{165}i}{880}$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{7\sqrt{770}i}{880}$ | $0$ | $-\frac{\sqrt{462}i}{616}$ | $0$ | $\frac{13\sqrt{2310}i}{6160}$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{2310}i}{176}$ | $0$ | $\frac{5\sqrt{154}i}{616}$ | $0$ | $-\frac{\sqrt{66}i}{176}$ |
| $\frac{\sqrt{66}i}{176}$ | $0$ | $\frac{21\sqrt{165}i}{880}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $-\frac{13\sqrt{2310}i}{6160}$ | $0$ | $\frac{\sqrt{1155}i}{880}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $-\frac{5\sqrt{154}i}{616}$ | $0$ | $\frac{\sqrt{385}i}{6160}$ | $0$ | $-\frac{7\sqrt{770}i}{880}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $\frac{\sqrt{462}i}{616}$ | $0$ | $\frac{\sqrt{231}i}{176}$ | $0$ | $-\frac{\sqrt{2310}i}{176}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $-\frac{\sqrt{2310}i}{176}$ | $0$ | $\frac{\sqrt{231}i}{176}$ | $0$ | $\frac{\sqrt{462}i}{616}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $-\frac{7\sqrt{770}i}{880}$ | $0$ | $\frac{\sqrt{385}i}{6160}$ | $0$ | $-\frac{5\sqrt{154}i}{616}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $\frac{\sqrt{1155}i}{880}$ | $0$ | $-\frac{13\sqrt{2310}i}{6160}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $\frac{21\sqrt{165}i}{880}$ | $0$ | $\frac{\sqrt{66}i}{176}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |

multipole: $\mathbb{T}_{4,2}^{(1,0;a)}(E_g,2)$

| 934 | symmetry | $\frac{\sqrt{2}\left(2x^6-15x^4y^2-15x^4z^2-15x^2y^4+180x^2y^2z^2-15x^2z^4+2y^6-15y^4z^2-15y^2z^4+2z^6\right)}{8}$ |

*continued ...*

Table 10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{T}_6^{(1,0;a)}(A_{1g},1)$$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{33}i}{264} & 0 & 0 & 0 & -\frac{7\sqrt{11}i}{88} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{55}i}{88} & 0 & 0 & 0 & \frac{7\sqrt{165}i}{264} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{66}i}{264} & 0 & 0 & 0 & -\frac{\sqrt{2310}i}{264} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2310}i}{264} & 0 & 0 & 0 & -\frac{5\sqrt{66}i}{264} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{7\sqrt{165}i}{264} & 0 & 0 & 0 & \frac{\sqrt{55}i}{88} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{7\sqrt{11}i}{88} & 0 & 0 & 0 & -\frac{\sqrt{33}i}{264} & 0 \\
0 & 0 & 0 & -\frac{\sqrt{2310}i}{264} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{33}i}{264} & 0 & 0 & 0 & \frac{7\sqrt{165}i}{264} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{55}i}{88} & 0 & 0 & 0 & -\frac{7\sqrt{11}i}{88} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{5\sqrt{66}i}{264} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{5\sqrt{66}i}{264} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{7\sqrt{11}i}{88} & 0 & 0 & 0 & -\frac{\sqrt{55}i}{88} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{7\sqrt{165}i}{264} & 0 & 0 & 0 & \frac{\sqrt{33}i}{264} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{2310}i}{264} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

| 935 | symmetry | $-\frac{\sqrt{14}\left(x^6-15x^4z^2+15x^2z^4+y^6-15y^4z^2+15y^2z^4-2z^6\right)}{8}$ |

*continued …*

Table 10

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{T}_6^{(1,0;a)}(A_{1g},2)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{231}i}{264} & 0 & 0 & 0 & \frac{\sqrt{77}i}{88} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{385}i}{88} & 0 & 0 & 0 & -\frac{\sqrt{1155}i}{264} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{462}i}{264} & 0 & 0 & 0 & \frac{\sqrt{330}i}{264} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{330}i}{264} & 0 & 0 & 0 & -\frac{5\sqrt{462}i}{264} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{1155}i}{264} & 0 & 0 & 0 & \frac{\sqrt{385}i}{88} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{77}i}{88} & 0 & 0 & 0 & -\frac{\sqrt{231}i}{264} & 0 \\
0 & 0 & 0 & \frac{\sqrt{330}i}{264} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{231}i}{264} & 0 & 0 & 0 & -\frac{\sqrt{1155}i}{264} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{385}i}{88} & 0 & 0 & 0 & \frac{\sqrt{77}i}{88} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{5\sqrt{462}i}{264} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{5\sqrt{462}i}{264} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{77}i}{88} & 0 & 0 & 0 & -\frac{\sqrt{385}i}{88} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{1155}i}{264} & 0 & 0 & 0 & \frac{\sqrt{231}i}{264} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{330}i}{264} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

| 936 | symmetry | $-\dfrac{3\sqrt{7}xy(x-y)(x+y)\left(x^2+y^2-10z^2\right)}{4}$ |

*continued ...*

394

Table 10

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_6^{(1,0;a)}(A_{2g})$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{154}}{44} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2310}}{132} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{165}}{66} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{165}}{66} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2310}}{132} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{154}}{44} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{165}}{66} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{2310}}{132} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{154}}{44} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{154}}{44} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{2310}}{132} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{165}}{66} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\end{pmatrix}$$

| No. | | |
|---|---|---|
| 937 | symmetry | $-\frac{\sqrt{2310}(x-y)(x+y)(x-z)(x+z)(y-z)(y+z)}{8}$ |

*continued …*

Table 10

| No. | multipole | matrix |
|---|---|---|

Multipole: $\mathbb{T}_6^{(1,0;a)}(B_{1g},1)$

$$
\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}i}{24} & 0 & 0 & 0 & \frac{\sqrt{5}i}{8} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{i}{24} & 0 & 0 & 0 & \frac{\sqrt{35}i}{24} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}i}{24} & 0 & 0 & 0 & -\frac{\sqrt{42}i}{24} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{24} & 0 & 0 & 0 & \frac{\sqrt{14}i}{24} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{35}i}{24} & 0 & 0 & 0 & -\frac{i}{24} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}i}{8} & 0 & 0 & 0 & \frac{\sqrt{7}i}{24} & 0 & 0 & 0 \\
0 & -\frac{i}{24} & 0 & 0 & 0 & \frac{\sqrt{5}i}{8} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{14}i}{24} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{42}i}{24} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{7}i}{24} & 0 & 0 & 0 & \frac{\sqrt{35}i}{24} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{35}i}{24} & 0 & 0 & 0 & -\frac{\sqrt{7}i}{24} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{42}i}{24} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{14}i}{24} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{5}i}{8} & 0 & 0 & 0 & \frac{i}{24} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\end{pmatrix}
$$

| No. | | |
|---|---|---|
| 938 | symmetry | $\dfrac{\sqrt{42}(x-y)(x+y)\left(x^4-9x^2y^2-5x^2z^2+y^4-5y^2z^2+5z^4\right)}{8}$ |

| No. | multipole | matrix | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

$$
\begin{array}{ccccccccccccc}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{385}i}{264} & 0 & 0 & \frac{\sqrt{11}i}{8} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{55}i}{264} & 0 & 0 & 0 & -\frac{5\sqrt{77}i}{264} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{770}i}{264} & 0 & 0 & 0 & \frac{\sqrt{2310}i}{264} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2310}i}{264} & 0 & 0 & 0 & -\frac{\sqrt{770}i}{264} \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{77}i}{264} & 0 & 0 & \frac{\sqrt{55}i}{264} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{11}i}{8} & 0 & 0 & 0 & -\frac{\sqrt{385}i}{264} & 0 & 0 \\
0 & \frac{\sqrt{55}i}{264} & 0 & 0 & 0 & \frac{\sqrt{11}i}{8} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{770}i}{264} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{2310}i}{264} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{385}i}{264} & 0 & 0 & 0 & -\frac{5\sqrt{77}i}{264} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{5\sqrt{77}i}{264} & 0 & 0 & 0 & \frac{\sqrt{385}i}{264} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{2310}i}{264} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{770}i}{264} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{11}i}{8} & 0 & 0 & 0 & -\frac{\sqrt{55}i}{264} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{array}
$$

Multipole: $\mathbb{T}_6^{(1,0;a)}(B_{1g}, 2)$

| 939 | symmetry | $\frac{\sqrt{462}xy(x^2-3y^2)(3x^2-y^2)}{16}$ |
|---|---|---|

*continued ...*

Table 10

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_6^{(1,0;a)}(B_{2g},1)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{2} \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{2} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{1}{2} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{1}{2} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

| 940 | symmetry | $\dfrac{\sqrt{210}\,xy\left(x^4+2x^2y^2-16x^2z^2+y^4-16y^2z^2+16z^4\right)}{16}$ |

*continued ...*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{77}}{66}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{11}}{66}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{385}}{66}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{154}}{66}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{462}}{66}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{462}}{66}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{154}}{66}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{385}}{66}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{11}}{66}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{77}}{66}$ | $0$ | $0$ | $0$ |
| | $\mathbb{T}_6^{(1,0;a)}(B_{2g},2)$ | $0$ | $\frac{\sqrt{11}}{66}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{154}}{66}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{462}}{66}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $\frac{\sqrt{77}}{66}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{385}}{66}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{385}}{66}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{77}}{66}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{462}}{66}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{\sqrt{154}}{66}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{11}}{66}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |

| 941 | symmetry | $\frac{3\sqrt{7}yz(y-z)(y+z)\left(10x^2-y^2-z^2\right)}{4}$ |

*continued ...*

Table 10

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_{6,1}^{(1,0;a)}(E_g,1)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{66}}{1056} & 0 & \frac{\sqrt{154}}{352} & 0 & -\frac{\sqrt{2310}}{352} & 0 & -\frac{\sqrt{462}}{96} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2310}}{1056} & 0 & -\frac{5\sqrt{462}}{1056} & 0 & \frac{3\sqrt{770}}{352} & 0 & \frac{\sqrt{330}}{96} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{165}}{176} & 0 & \frac{\sqrt{385}}{176} & 0 & \frac{5\sqrt{231}}{528} & 0 & -\frac{\sqrt{1155}}{176} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{1155}}{176} & 0 & -\frac{5\sqrt{231}}{528} & 0 & -\frac{\sqrt{385}}{176} & 0 & \frac{\sqrt{165}}{176} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{330}}{96} & 0 & -\frac{3\sqrt{770}}{352} & 0 & \frac{5\sqrt{462}}{1056} & 0 & \frac{\sqrt{2310}}{1056} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{462}}{96} & 0 & \frac{\sqrt{2310}}{352} & 0 & -\frac{\sqrt{154}}{352} & 0 & -\frac{\sqrt{66}}{1056} \\
\frac{\sqrt{66}}{1056} & 0 & -\frac{\sqrt{165}}{176} & 0 & -\frac{\sqrt{330}}{96} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{2310}}{1056} & 0 & \frac{\sqrt{1155}}{176} & 0 & \frac{\sqrt{462}}{96} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{154}}{352} & 0 & \frac{\sqrt{385}}{176} & 0 & -\frac{3\sqrt{770}}{352} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{5\sqrt{462}}{1056} & 0 & -\frac{5\sqrt{231}}{528} & 0 & \frac{\sqrt{2310}}{352} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{2310}}{352} & 0 & \frac{5\sqrt{231}}{528} & 0 & \frac{5\sqrt{462}}{1056} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{3\sqrt{770}}{352} & 0 & -\frac{\sqrt{385}}{176} & 0 & -\frac{\sqrt{154}}{352} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{462}}{96} & 0 & -\frac{\sqrt{1155}}{176} & 0 & \frac{\sqrt{2310}}{1056} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{330}}{96} & 0 & \frac{\sqrt{165}}{176} & 0 & -\frac{\sqrt{66}}{1056} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

| 942 | symmetry | $-\frac{3\sqrt{7}xz(x-z)(x+z)\left(x^2-10y^2+z^2\right)}{4}$ |

Table 10

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_{6,2}^{(1,0;a)}(E_g,1)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{66}i}{1056} & 0 & \frac{\sqrt{154}i}{352} & 0 & \frac{\sqrt{2310}i}{352} & 0 & -\frac{\sqrt{462}i}{96} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2310}i}{1056} & 0 & -\frac{5\sqrt{462}i}{1056} & 0 & -\frac{3\sqrt{770}i}{352} & 0 & \frac{\sqrt{330}i}{96} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{165}i}{176} & 0 & -\frac{\sqrt{385}i}{176} & 0 & \frac{5\sqrt{231}i}{528} & 0 & \frac{\sqrt{1155}i}{176} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{1155}i}{176} & 0 & \frac{5\sqrt{231}i}{528} & 0 & -\frac{\sqrt{385}i}{176} & 0 & -\frac{\sqrt{165}i}{176} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{330}i}{96} & 0 & -\frac{3\sqrt{770}i}{352} & 0 & -\frac{5\sqrt{462}i}{1056} & 0 & \frac{\sqrt{2310}i}{1056} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{462}i}{96} & 0 & \frac{\sqrt{2310}i}{352} & 0 & \frac{\sqrt{154}i}{352} & 0 & -\frac{\sqrt{66}i}{1056} \\
\frac{\sqrt{66}i}{1056} & 0 & \frac{\sqrt{165}i}{176} & 0 & -\frac{\sqrt{330}i}{96} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{2310}i}{1056} & 0 & -\frac{\sqrt{1155}i}{176} & 0 & \frac{\sqrt{462}i}{96} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{154}i}{352} & 0 & \frac{\sqrt{385}i}{176} & 0 & \frac{3\sqrt{770}i}{352} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{5\sqrt{462}i}{1056} & 0 & -\frac{5\sqrt{231}i}{528} & 0 & -\frac{\sqrt{2310}i}{352} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{2310}i}{352} & 0 & -\frac{5\sqrt{231}i}{528} & 0 & \frac{5\sqrt{462}i}{1056} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{3\sqrt{770}i}{352} & 0 & \frac{\sqrt{385}i}{176} & 0 & -\frac{\sqrt{154}i}{352} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{462}i}{96} & 0 & -\frac{\sqrt{1155}i}{176} & 0 & -\frac{\sqrt{2310}i}{1056} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{330}i}{96} & 0 & \frac{\sqrt{165}i}{176} & 0 & \frac{\sqrt{66}i}{1056} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

| 943 | symmetry | $\frac{\sqrt{462}yz(y^2-3z^2)(3y^2-z^2)}{16}$ |

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|-----|-----------|--------|--|--|--|--|--|--|--|--|--|--|--|--|--|

$\mathbb{T}_{6,1}^{(1,0;a)}(E_g,2)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{64} & 0 & \frac{\sqrt{21}}{64} & 0 & \frac{\sqrt{35}}{64} & 0 & \frac{\sqrt{7}}{64} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{35}}{64} & 0 & -\frac{5\sqrt{7}}{64} & 0 & -\frac{\sqrt{105}}{64} & 0 & -\frac{\sqrt{5}}{64} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{64} & 0 & \frac{\sqrt{210}}{64} & 0 & \frac{5\sqrt{14}}{64} & 0 & \frac{\sqrt{70}}{64} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{64} & 0 & -\frac{5\sqrt{14}}{64} & 0 & -\frac{\sqrt{210}}{64} & 0 & -\frac{\sqrt{10}}{64} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{64} & 0 & \frac{\sqrt{105}}{64} & 0 & \frac{5\sqrt{7}}{64} & 0 & \frac{\sqrt{35}}{64} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{64} & 0 & -\frac{\sqrt{35}}{64} & 0 & -\frac{\sqrt{21}}{64} & 0 & -\frac{1}{64} \\
\frac{1}{64} & 0 & \frac{\sqrt{10}}{64} & 0 & \frac{\sqrt{5}}{64} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{35}}{64} & 0 & -\frac{\sqrt{70}}{64} & 0 & -\frac{\sqrt{7}}{64} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{21}}{64} & 0 & \frac{\sqrt{210}}{64} & 0 & \frac{\sqrt{105}}{64} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{5\sqrt{7}}{64} & 0 & -\frac{5\sqrt{14}}{64} & 0 & -\frac{\sqrt{35}}{64} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{35}}{64} & 0 & \frac{5\sqrt{14}}{64} & 0 & \frac{5\sqrt{7}}{64} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{105}}{64} & 0 & -\frac{\sqrt{210}}{64} & 0 & -\frac{\sqrt{21}}{64} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{7}}{64} & 0 & \frac{\sqrt{70}}{64} & 0 & \frac{\sqrt{35}}{64} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{5}}{64} & 0 & -\frac{\sqrt{10}}{64} & 0 & -\frac{1}{64} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

| 944 | symmetry | $\frac{\sqrt{462}\,xz\left(x^2-3z^2\right)\left(3x^2-z^2\right)}{16}$ |
|-----|----------|-----|

*continued …*

Table 10

| No. | multipole | matrix |
|---|---|---|

$\mathbb{T}_{6,2}^{(1,0;a)}(E_g, 2)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & -\frac{i}{64} & 0 & \frac{\sqrt{21}i}{64} & 0 & -\frac{\sqrt{35}i}{64} & 0 & \frac{\sqrt{7}i}{64} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{35}i}{64} & 0 & -\frac{5\sqrt{7}i}{64} & 0 & \frac{\sqrt{105}i}{64} & 0 & -\frac{\sqrt{5}i}{64} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{64} & 0 & -\frac{\sqrt{210}i}{64} & 0 & \frac{5\sqrt{14}i}{64} & 0 & -\frac{\sqrt{70}i}{64} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{64} & 0 & \frac{5\sqrt{14}i}{64} & 0 & -\frac{\sqrt{210}i}{64} & 0 & \frac{\sqrt{10}i}{64} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}i}{64} & 0 & \frac{\sqrt{105}i}{64} & 0 & -\frac{5\sqrt{7}i}{64} & 0 & \frac{\sqrt{35}i}{64} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{64} & 0 & -\frac{\sqrt{35}i}{64} & 0 & \frac{\sqrt{21}i}{64} & 0 & -\frac{i}{64} \\
\frac{i}{64} & 0 & -\frac{\sqrt{10}i}{64} & 0 & \frac{\sqrt{5}i}{64} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{35}i}{64} & 0 & \frac{\sqrt{70}i}{64} & 0 & -\frac{\sqrt{7}i}{64} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{21}i}{64} & 0 & \frac{\sqrt{210}i}{64} & 0 & -\frac{\sqrt{105}i}{64} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{5\sqrt{7}i}{64} & 0 & -\frac{5\sqrt{14}i}{64} & 0 & \frac{\sqrt{35}i}{64} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{35}i}{64} & 0 & -\frac{5\sqrt{14}i}{64} & 0 & \frac{5\sqrt{7}i}{64} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{105}i}{64} & 0 & \frac{\sqrt{210}i}{64} & 0 & -\frac{\sqrt{21}i}{64} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{7}i}{64} & 0 & \frac{\sqrt{70}i}{64} & 0 & -\frac{\sqrt{35}i}{64} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{5}i}{64} & 0 & -\frac{\sqrt{10}i}{64} & 0 & \frac{i}{64} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

| No. | multipole | matrix |
|---|---|---|
| 945 | symmetry | $\dfrac{\sqrt{210}yz\left(16x^4-16x^2y^2-16x^2z^2+y^4+2y^2z^2+z^4\right)}{16}$ |

Table 10

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{T}_{6,1}^{(1,0;a)}(E_g,3)$

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{55}}{2112}$ | 0 | $\frac{\sqrt{1155}}{2112}$ | 0 | $-\frac{9\sqrt{77}}{704}$ | 0 | $\frac{\sqrt{385}}{64}$ | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{5\sqrt{77}}{2112}$ | 0 | $-\frac{5\sqrt{385}}{2112}$ | 0 | $\frac{9\sqrt{231}}{704}$ | 0 | $-\frac{5\sqrt{11}}{64}$ |
| 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{9\sqrt{22}}{704}$ | 0 | $\frac{5\sqrt{462}}{2112}$ | 0 | $\frac{5\sqrt{770}}{2112}$ | 0 | $-\frac{9\sqrt{154}}{704}$ | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{9\sqrt{154}}{704}$ | 0 | $-\frac{5\sqrt{770}}{2112}$ | 0 | $-\frac{5\sqrt{462}}{2112}$ | 0 | $\frac{9\sqrt{22}}{704}$ |
| 0 | 0 | 0 | 0 | 0 | 0 | $\frac{5\sqrt{11}}{64}$ | 0 | $-\frac{9\sqrt{231}}{704}$ | 0 | $\frac{5\sqrt{385}}{2112}$ | 0 | $\frac{5\sqrt{77}}{2112}$ | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{385}}{64}$ | 0 | $\frac{9\sqrt{77}}{704}$ | 0 | $-\frac{\sqrt{1155}}{2112}$ | 0 | $-\frac{\sqrt{55}}{2112}$ |
| $\frac{\sqrt{55}}{2112}$ | 0 | $-\frac{9\sqrt{22}}{704}$ | 0 | $\frac{5\sqrt{11}}{64}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | $-\frac{5\sqrt{77}}{2112}$ | 0 | $\frac{9\sqrt{154}}{704}$ | 0 | $-\frac{\sqrt{385}}{64}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $\frac{\sqrt{1155}}{2112}$ | 0 | $\frac{5\sqrt{462}}{2112}$ | 0 | $-\frac{9\sqrt{231}}{704}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | $-\frac{5\sqrt{385}}{2112}$ | 0 | $-\frac{5\sqrt{770}}{2112}$ | 0 | $\frac{9\sqrt{77}}{704}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $-\frac{9\sqrt{77}}{704}$ | 0 | $\frac{5\sqrt{770}}{2112}$ | 0 | $\frac{5\sqrt{385}}{2112}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | $\frac{9\sqrt{231}}{704}$ | 0 | $-\frac{5\sqrt{462}}{2112}$ | 0 | $-\frac{\sqrt{1155}}{2112}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $\frac{\sqrt{385}}{64}$ | 0 | $-\frac{9\sqrt{154}}{704}$ | 0 | $\frac{5\sqrt{77}}{2112}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | $-\frac{5\sqrt{11}}{64}$ | 0 | $\frac{9\sqrt{22}}{704}$ | 0 | $-\frac{\sqrt{55}}{2112}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| No. | | |
|-----|---|---|
| 946 | symmetry | $\frac{\sqrt{210}xz\left(x^4-16x^2y^2+2x^2z^2+16y^4-16y^2z^2+z^4\right)}{16}$ |

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{55}i}{2112}$ | 0 | $\frac{\sqrt{1155}i}{2112}$ | 0 | $\frac{9\sqrt{77}i}{704}$ | 0 | $\frac{\sqrt{385}i}{64}$ | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{5\sqrt{77}i}{2112}$ | 0 | $-\frac{5\sqrt{385}i}{2112}$ | 0 | $-\frac{9\sqrt{231}i}{704}$ | 0 | $-\frac{5\sqrt{11}i}{64}$ |
| | | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{9\sqrt{22}i}{704}$ | 0 | $-\frac{5\sqrt{462}i}{2112}$ | 0 | $\frac{5\sqrt{770}i}{2112}$ | 0 | $\frac{9\sqrt{154}i}{704}$ | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{9\sqrt{154}i}{704}$ | 0 | $\frac{5\sqrt{770}i}{2112}$ | 0 | $-\frac{5\sqrt{462}i}{2112}$ | 0 | $-\frac{9\sqrt{22}i}{704}$ |
| | | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{5\sqrt{11}i}{64}$ | 0 | $-\frac{9\sqrt{231}i}{704}$ | 0 | $-\frac{5\sqrt{385}i}{2112}$ | 0 | $\frac{5\sqrt{77}i}{2112}$ | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{385}i}{64}$ | 0 | $\frac{9\sqrt{77}i}{704}$ | 0 | $\frac{\sqrt{1155}i}{2112}$ | 0 | $-\frac{\sqrt{55}i}{2112}$ |
| | $\mathbb{T}_{6,2}^{(1,0;a)}(E_g,3)$ | $\frac{\sqrt{55}i}{2112}$ | 0 | $\frac{9\sqrt{22}i}{704}$ | 0 | $\frac{5\sqrt{11}i}{64}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | $-\frac{5\sqrt{77}i}{2112}$ | 0 | $-\frac{9\sqrt{154}i}{704}$ | 0 | $-\frac{\sqrt{385}i}{64}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | $-\frac{\sqrt{1155}i}{2112}$ | 0 | $\frac{5\sqrt{462}i}{2112}$ | 0 | $\frac{9\sqrt{231}i}{704}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | $\frac{5\sqrt{385}i}{2112}$ | 0 | $-\frac{5\sqrt{770}i}{2112}$ | 0 | $-\frac{9\sqrt{77}i}{704}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | $-\frac{9\sqrt{77}i}{704}$ | 0 | $-\frac{5\sqrt{770}i}{2112}$ | 0 | $\frac{5\sqrt{385}i}{2112}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | $\frac{9\sqrt{231}i}{704}$ | 0 | $\frac{5\sqrt{462}i}{2112}$ | 0 | $-\frac{\sqrt{1155}i}{2112}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | $-\frac{\sqrt{385}i}{64}$ | 0 | $-\frac{9\sqrt{154}i}{704}$ | 0 | $-\frac{5\sqrt{77}i}{2112}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | $\frac{5\sqrt{11}i}{64}$ | 0 | $\frac{9\sqrt{22}i}{704}$ | 0 | $\frac{\sqrt{55}i}{2112}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| 947 | symmetry | $z$ |
|---|---|---|

*continued ...*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{M}_1^{(a)}(A_{2g})$ | $\frac{5\sqrt{14}}{49}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{21}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{3\sqrt{14}}{49}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{35}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{14}}{49}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{42}}{98}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{\sqrt{14}}{49}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{42}}{98}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{14}}{49}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{35}}{98}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{14}}{49}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{21}}{98}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{14}}{28}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $\frac{\sqrt{21}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{15\sqrt{14}}{196}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{35}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{9\sqrt{14}}{196}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{42}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{14}}{196}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{42}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{14}}{196}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{35}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{9\sqrt{14}}{196}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{21}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{15\sqrt{14}}{196}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{14}}{28}$ |

| 948 | symmetry | $x$ |

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{M}_{1,1}^{(a)}(E_g)$ | $0$ | $\frac{\sqrt{70}}{49}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{3}}{28}$ | $0$ | $\frac{\sqrt{7}}{196}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $\frac{\sqrt{70}}{49}$ | $0$ | $\frac{4\sqrt{7}}{49}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{105}}{196}$ | $0$ | $\frac{\sqrt{21}}{196}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{4\sqrt{7}}{49}$ | $0$ | $\frac{3\sqrt{14}}{49}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{70}}{196}$ | $0$ | $\frac{\sqrt{42}}{196}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $\frac{3\sqrt{14}}{49}$ | $0$ | $\frac{4\sqrt{7}}{49}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{42}}{196}$ | $0$ | $\frac{\sqrt{70}}{196}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{4\sqrt{7}}{49}$ | $0$ | $\frac{\sqrt{70}}{49}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{21}}{196}$ | $0$ | $\frac{\sqrt{105}}{196}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{70}}{49}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{7}}{196}$ | $0$ | $\frac{\sqrt{3}}{28}$ |
| | | $-\frac{\sqrt{3}}{28}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{2}}{28}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{105}}{196}$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{2}}{28}$ | $0$ | $\frac{3\sqrt{42}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $\frac{\sqrt{7}}{196}$ | $0$ | $-\frac{\sqrt{70}}{196}$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{42}}{98}$ | $0$ | $\frac{3\sqrt{210}}{196}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{21}}{196}$ | $0$ | $-\frac{\sqrt{42}}{196}$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{210}}{196}$ | $0$ | $\frac{3\sqrt{14}}{49}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{42}}{196}$ | $0$ | $-\frac{\sqrt{21}}{196}$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{14}}{49}$ | $0$ | $\frac{3\sqrt{210}}{196}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{70}}{196}$ | $0$ | $-\frac{\sqrt{7}}{196}$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{210}}{196}$ | $0$ | $\frac{3\sqrt{42}}{98}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{105}}{196}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{42}}{98}$ | $0$ | $\frac{3\sqrt{2}}{28}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{3}}{28}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{2}}{28}$ | $0$ |
| 949 | symmetry | $-y$ | | | | | | | | | | | | | |

*continued …*

Table 10

| No. | multipole | matrix |
| --- | --- | --- |

$\mathbb{M}_{1,2}^{(a)}(E_g)$

$$\begin{pmatrix}
0 & \frac{\sqrt{70}i}{49} & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{28} & 0 & \frac{\sqrt{7}i}{196} & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{70}i}{49} & 0 & \frac{4\sqrt{7}i}{49} & 0 & 0 & 0 & 0 & \frac{\sqrt{105}i}{196} & 0 & \frac{\sqrt{21}i}{196} & 0 & 0 & 0 & 0 \\
0 & -\frac{4\sqrt{7}i}{49} & 0 & \frac{3\sqrt{14}i}{49} & 0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{196} & 0 & \frac{\sqrt{42}i}{196} & 0 & 0 & 0 \\
0 & 0 & -\frac{3\sqrt{14}i}{49} & 0 & \frac{4\sqrt{7}i}{49} & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{196} & 0 & \frac{\sqrt{70}i}{196} & 0 & 0 \\
0 & 0 & 0 & -\frac{4\sqrt{7}i}{49} & 0 & \frac{\sqrt{70}i}{49} & 0 & 0 & 0 & 0 & \frac{\sqrt{21}i}{196} & 0 & \frac{\sqrt{105}i}{196} & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{70}i}{49} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{196} & 0 & \frac{\sqrt{3}i}{28} \\
-\frac{\sqrt{3}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{2}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{105}i}{196} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{2}i}{28} & 0 & \frac{3\sqrt{42}i}{98} & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{7}i}{196} & 0 & -\frac{\sqrt{70}i}{196} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{42}i}{98} & 0 & \frac{3\sqrt{210}i}{196} & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{21}i}{196} & 0 & -\frac{\sqrt{42}i}{196} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{210}i}{196} & 0 & \frac{3\sqrt{14}i}{49} & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{42}i}{196} & 0 & -\frac{\sqrt{21}i}{196} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{14}i}{49} & 0 & \frac{3\sqrt{210}i}{196} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{70}i}{196} & 0 & -\frac{\sqrt{7}i}{196} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{210}i}{196} & 0 & \frac{3\sqrt{42}i}{98} & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{105}i}{196} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{42}i}{98} & 0 & \frac{3\sqrt{2}i}{28} \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{2}i}{28} & 0
\end{pmatrix}$$

| 950 | symmetry | $-\frac{z\left(3x^2+3y^2-2z^2\right)}{2}$ |

Table 10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_3^{(a)}(A_{2g})$$

$$\begin{pmatrix}
-\frac{5\sqrt{3}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{7} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{3}}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{2\sqrt{3}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{7} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{2\sqrt{3}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{7} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{3}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{7} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{6} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{2}}{7} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{3}}{42} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{6} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{1}{7} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{14} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{1}{7} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{14} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{6} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{7} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{3}}{42} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{6}
\end{pmatrix}$$

| 951 | symmetry | $\sqrt{15}xyz$ |
|---|---|---|

*continued ...*

409

Table 10

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_3^{(a)}(B_{1g})$

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $0$ | $0$ | $\frac{5\sqrt{2}i}{28}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{6}i}{21}$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $\frac{\sqrt{10}i}{28}$ | $0$ | $0$ | $\frac{\sqrt{42}i}{42}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{30}i}{42}$ | $0$ | $0$ | $0$ |
| $-\frac{5\sqrt{2}i}{28}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{10}i}{28}$ | $0$ | $0$ | $\frac{\sqrt{3}i}{42}$ | $0$ | $0$ | $0$ | $\frac{i}{14}$ | $0$ | $0$ |
| $0$ | $-\frac{\sqrt{10}i}{28}$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{2}i}{28}$ | $0$ | $0$ | $-\frac{i}{14}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{3}i}{42}$ | $0$ |
| $0$ | $0$ | $\frac{\sqrt{10}i}{28}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{30}i}{42}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{42}i}{42}$ |
| $0$ | $0$ | $0$ | $\frac{5\sqrt{2}i}{28}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{6}i}{21}$ | $0$ | $0$ | $0$ |
| $0$ | $-\frac{\sqrt{42}i}{42}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{105}i}{42}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $-\frac{\sqrt{3}i}{42}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{3i}{14}$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $\frac{i}{14}$ | $0$ | $0$ | $-\frac{\sqrt{105}i}{42}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{3}i}{21}$ | $0$ | $0$ | $0$ |
| $-\frac{\sqrt{6}i}{21}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{30}i}{42}$ | $0$ | $0$ | $-\frac{3i}{14}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{3}i}{21}$ | $0$ | $0$ |
| $0$ | $-\frac{\sqrt{30}i}{42}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{6}i}{21}$ | $0$ | $0$ | $-\frac{\sqrt{3}i}{21}$ | $0$ | $0$ | $0$ | $-\frac{3i}{14}$ | $0$ |
| $0$ | $0$ | $-\frac{i}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{3}i}{21}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{105}i}{42}$ |
| $0$ | $0$ | $0$ | $\frac{\sqrt{3}i}{42}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{3i}{14}$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{42}i}{42}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{105}i}{42}$ | $0$ | $0$ |

| 952 | symmetry | $\frac{\sqrt{15}z(x-y)(x+y)}{2}$ |
|---|---|---|

410

Table 10

| No. | multipole | matrix |
|-----|-----------|--------|
| | $\mathbb{M}_3^{(a)}(B_{2g})$ | $\begin{pmatrix} 0 & 0 & -\frac{5\sqrt{2}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{21} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{10}}{28} & 0 & 0 & \frac{\sqrt{42}}{42} & 0 & 0 & 0 & -\frac{\sqrt{30}}{42} & 0 & 0 & 0 \\ -\frac{5\sqrt{2}}{28} & 0 & 0 & 0 & \frac{\sqrt{10}}{28} & 0 & 0 & \frac{\sqrt{3}}{42} & 0 & 0 & 0 & -\frac{1}{14} & 0 & 0 \\ 0 & -\frac{\sqrt{10}}{28} & 0 & 0 & 0 & \frac{5\sqrt{2}}{28} & 0 & 0 & -\frac{1}{14} & 0 & 0 & 0 & \frac{\sqrt{3}}{42} & 0 \\ 0 & 0 & \frac{\sqrt{10}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{42} & 0 & 0 & 0 & \frac{\sqrt{42}}{42} \\ 0 & 0 & 0 & \frac{5\sqrt{2}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{21} & 0 & 0 & 0 \\ 0 & \frac{\sqrt{42}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}}{42} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{3}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3}{14} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{1}{14} & 0 & 0 & -\frac{\sqrt{105}}{42} & 0 & 0 & 0 & -\frac{\sqrt{3}}{21} & 0 & 0 & 0 \\ -\frac{\sqrt{6}}{21} & 0 & 0 & 0 & -\frac{\sqrt{30}}{42} & 0 & 0 & -\frac{3}{14} & 0 & 0 & 0 & \frac{\sqrt{3}}{21} & 0 & 0 \\ 0 & -\frac{\sqrt{30}}{42} & 0 & 0 & 0 & -\frac{\sqrt{6}}{21} & 0 & 0 & -\frac{\sqrt{3}}{21} & 0 & 0 & 0 & \frac{3}{14} & 0 \\ 0 & 0 & -\frac{1}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{21} & 0 & 0 & 0 & \frac{\sqrt{105}}{42} \\ 0 & 0 & 0 & \frac{\sqrt{3}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3}{14} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{105}}{42} & 0 & 0 \end{pmatrix}$ |
| 953 | symmetry | $\frac{x\left(2x^2-3y^2-3z^2\right)}{2}$ |

Table 10

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_{3,1}^{(a)}(E_g,1)$

$$\begin{pmatrix}
0 & \frac{\sqrt{15}}{28} & 0 & -\frac{5\sqrt{30}}{168} & 0 & 0 & -\frac{\sqrt{14}}{56} & 0 & \frac{\sqrt{6}}{28} & 0 & -\frac{\sqrt{10}}{56} & 0 & 0 & 0 \\
\frac{\sqrt{15}}{28} & 0 & -\frac{\sqrt{6}}{56} & 0 & -\frac{5\sqrt{3}}{42} & 0 & 0 & \frac{\sqrt{10}}{56} & 0 & \frac{\sqrt{2}}{28} & 0 & -\frac{\sqrt{30}}{56} & 0 & 0 \\
0 & -\frac{\sqrt{6}}{56} & 0 & -\frac{\sqrt{3}}{14} & 0 & -\frac{5\sqrt{30}}{168} & \frac{\sqrt{35}}{56} & 0 & \frac{\sqrt{15}}{56} & 0 & -\frac{1}{56} & 0 & -\frac{3\sqrt{5}}{56} & 0 \\
-\frac{5\sqrt{30}}{168} & 0 & -\frac{\sqrt{3}}{14} & 0 & -\frac{\sqrt{6}}{56} & 0 & 0 & \frac{3\sqrt{5}}{56} & 0 & \frac{1}{56} & 0 & -\frac{\sqrt{15}}{56} & 0 & -\frac{\sqrt{35}}{56} \\
0 & -\frac{5\sqrt{3}}{42} & 0 & -\frac{\sqrt{6}}{56} & 0 & \frac{\sqrt{15}}{28} & 0 & 0 & \frac{\sqrt{30}}{56} & 0 & -\frac{\sqrt{2}}{28} & 0 & -\frac{\sqrt{10}}{56} & 0 \\
0 & 0 & -\frac{5\sqrt{30}}{168} & 0 & \frac{\sqrt{15}}{28} & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{56} & 0 & -\frac{\sqrt{6}}{28} & 0 & \frac{\sqrt{14}}{56} \\
-\frac{\sqrt{14}}{56} & 0 & \frac{\sqrt{35}}{56} & 0 & 0 & 0 & 0 & \frac{\sqrt{21}}{28} & 0 & -\frac{\sqrt{105}}{84} & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{10}}{56} & 0 & \frac{3\sqrt{5}}{56} & 0 & 0 & \frac{\sqrt{21}}{28} & 0 & \frac{1}{28} & 0 & -\frac{\sqrt{15}}{21} & 0 & 0 & 0 \\
\frac{\sqrt{6}}{28} & 0 & \frac{\sqrt{15}}{56} & 0 & \frac{\sqrt{30}}{56} & 0 & 0 & \frac{1}{28} & 0 & -\frac{\sqrt{5}}{28} & 0 & -\frac{5\sqrt{3}}{42} & 0 & 0 \\
0 & \frac{\sqrt{2}}{28} & 0 & \frac{1}{56} & 0 & \frac{\sqrt{10}}{56} & -\frac{\sqrt{105}}{84} & 0 & -\frac{\sqrt{5}}{28} & 0 & -\frac{\sqrt{3}}{14} & 0 & -\frac{\sqrt{15}}{21} & 0 \\
-\frac{\sqrt{10}}{56} & 0 & -\frac{1}{56} & 0 & -\frac{\sqrt{2}}{28} & 0 & 0 & -\frac{\sqrt{15}}{21} & 0 & -\frac{\sqrt{3}}{14} & 0 & -\frac{\sqrt{5}}{28} & 0 & -\frac{\sqrt{105}}{84} \\
0 & -\frac{\sqrt{30}}{56} & 0 & -\frac{\sqrt{15}}{56} & 0 & -\frac{\sqrt{6}}{28} & 0 & 0 & -\frac{5\sqrt{3}}{42} & 0 & -\frac{\sqrt{5}}{28} & 0 & \frac{1}{28} & 0 \\
0 & 0 & -\frac{3\sqrt{5}}{56} & 0 & -\frac{\sqrt{10}}{56} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{21} & 0 & \frac{1}{28} & 0 & \frac{\sqrt{21}}{28} \\
0 & 0 & 0 & -\frac{\sqrt{35}}{56} & 0 & \frac{\sqrt{14}}{56} & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}}{84} & 0 & \frac{\sqrt{21}}{28} & 0
\end{pmatrix}$$

| 954 | symmetry | $\frac{y(3x^2-2y^2+3z^2)}{2}$ |

*continued ...*

412

Table 10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_{3,2}^{(a)}(E_g,1)$$

$$
\begin{pmatrix}
0 & \frac{\sqrt{15}i}{28} & 0 & \frac{5\sqrt{30}i}{168} & 0 & 0 & \frac{\sqrt{14}i}{56} & 0 & \frac{\sqrt{6}i}{28} & 0 & \frac{\sqrt{10}i}{56} & 0 & 0 & 0 \\
-\frac{\sqrt{15}i}{28} & 0 & -\frac{\sqrt{6}i}{56} & 0 & \frac{5\sqrt{3}i}{42} & 0 & 0 & -\frac{\sqrt{10}i}{56} & 0 & \frac{\sqrt{2}i}{28} & 0 & \frac{\sqrt{30}i}{56} & 0 & 0 \\
0 & \frac{\sqrt{6}i}{56} & 0 & -\frac{\sqrt{3}i}{14} & 0 & \frac{5\sqrt{30}i}{168} & \frac{\sqrt{35}i}{56} & 0 & -\frac{\sqrt{15}i}{56} & 0 & -\frac{i}{56} & 0 & \frac{3\sqrt{5}i}{56} & 0 \\
-\frac{5\sqrt{30}i}{168} & 0 & \frac{\sqrt{3}i}{14} & 0 & -\frac{\sqrt{6}i}{56} & 0 & 0 & \frac{3\sqrt{5}i}{56} & 0 & -\frac{i}{56} & 0 & -\frac{\sqrt{15}i}{56} & 0 & \frac{\sqrt{35}i}{56} \\
0 & -\frac{5\sqrt{3}i}{42} & 0 & \frac{\sqrt{6}i}{56} & 0 & \frac{\sqrt{15}i}{28} & 0 & 0 & \frac{\sqrt{30}i}{56} & 0 & \frac{\sqrt{2}i}{28} & 0 & -\frac{\sqrt{10}i}{56} & 0 \\
0 & 0 & -\frac{5\sqrt{30}i}{168} & 0 & -\frac{\sqrt{15}i}{28} & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{56} & 0 & \frac{\sqrt{6}i}{28} & 0 & \frac{\sqrt{14}i}{56} \\
-\frac{\sqrt{14}i}{56} & 0 & -\frac{\sqrt{35}i}{56} & 0 & 0 & 0 & 0 & \frac{\sqrt{21}i}{28} & 0 & \frac{\sqrt{105}i}{84} & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{10}i}{56} & 0 & -\frac{3\sqrt{5}i}{56} & 0 & 0 & -\frac{\sqrt{21}i}{28} & 0 & \frac{i}{28} & 0 & \frac{\sqrt{15}i}{21} & 0 & 0 & 0 \\
-\frac{\sqrt{6}i}{28} & 0 & \frac{\sqrt{15}i}{56} & 0 & -\frac{\sqrt{30}i}{56} & 0 & 0 & -\frac{i}{28} & 0 & -\frac{\sqrt{5}i}{28} & 0 & \frac{5\sqrt{3}i}{42} & 0 & 0 \\
0 & -\frac{\sqrt{2}i}{28} & 0 & \frac{i}{56} & 0 & -\frac{\sqrt{10}i}{56} & -\frac{\sqrt{105}i}{84} & 0 & \frac{\sqrt{5}i}{28} & 0 & -\frac{\sqrt{3}i}{14} & 0 & \frac{\sqrt{15}i}{21} & 0 \\
-\frac{\sqrt{10}i}{56} & 0 & \frac{i}{56} & 0 & -\frac{\sqrt{2}i}{28} & 0 & 0 & -\frac{\sqrt{15}i}{21} & 0 & \frac{\sqrt{3}i}{14} & 0 & -\frac{\sqrt{5}i}{28} & 0 & \frac{\sqrt{105}i}{84} \\
0 & -\frac{\sqrt{30}i}{56} & 0 & \frac{\sqrt{15}i}{56} & 0 & -\frac{\sqrt{6}i}{28} & 0 & 0 & -\frac{5\sqrt{3}i}{42} & 0 & \frac{\sqrt{5}i}{28} & 0 & \frac{i}{28} & 0 \\
0 & 0 & -\frac{3\sqrt{5}i}{56} & 0 & \frac{\sqrt{10}i}{56} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{21} & 0 & -\frac{i}{28} & 0 & \frac{\sqrt{21}i}{28} \\
0 & 0 & 0 & -\frac{\sqrt{35}i}{56} & 0 & -\frac{\sqrt{14}i}{56} & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}i}{84} & 0 & -\frac{\sqrt{21}i}{28} & 0
\end{pmatrix}
$$

| 955 | symmetry | $\frac{\sqrt{15}x(y-z)(y+z)}{2}$ |

Table 10

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{M}_{3,1}^{(a)}(E_g,2)$ | $\begin{bmatrix} 0 & \frac{5}{28} & 0 & \frac{5\sqrt{2}}{56} & 0 & 0 & -\frac{\sqrt{210}}{168} & 0 & \frac{\sqrt{10}}{28} & 0 & \frac{\sqrt{6}}{56} & 0 & 0 & 0 \\ \frac{5}{28} & 0 & -\frac{\sqrt{10}}{56} & 0 & \frac{\sqrt{5}}{14} & 0 & 0 & \frac{5\sqrt{6}}{168} & 0 & \frac{\sqrt{30}}{84} & 0 & \frac{3\sqrt{2}}{56} & 0 & 0 \\ 0 & -\frac{\sqrt{10}}{56} & 0 & -\frac{\sqrt{5}}{14} & 0 & \frac{5\sqrt{2}}{56} & -\frac{\sqrt{21}}{56} & 0 & \frac{5}{56} & 0 & -\frac{\sqrt{15}}{168} & 0 & \frac{3\sqrt{3}}{56} & 0 \\ \frac{5\sqrt{2}}{56} & 0 & -\frac{\sqrt{5}}{14} & 0 & -\frac{\sqrt{10}}{56} & 0 & 0 & -\frac{3\sqrt{3}}{56} & 0 & \frac{\sqrt{15}}{168} & 0 & -\frac{5}{56} & 0 & \frac{\sqrt{21}}{56} \\ 0 & \frac{\sqrt{5}}{14} & 0 & -\frac{\sqrt{10}}{56} & 0 & \frac{5}{28} & 0 & 0 & -\frac{3\sqrt{2}}{56} & 0 & -\frac{\sqrt{30}}{84} & 0 & -\frac{5\sqrt{6}}{168} & 0 \\ 0 & 0 & \frac{5\sqrt{2}}{56} & 0 & \frac{5}{28} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{56} & 0 & -\frac{\sqrt{10}}{28} & 0 & \frac{\sqrt{210}}{168} \\ -\frac{\sqrt{210}}{168} & 0 & -\frac{\sqrt{21}}{56} & 0 & 0 & 0 & 0 & \frac{\sqrt{35}}{28} & 0 & \frac{\sqrt{7}}{28} & 0 & 0 & 0 & 0 \\ 0 & \frac{5\sqrt{6}}{168} & 0 & -\frac{3\sqrt{3}}{56} & 0 & 0 & \frac{\sqrt{35}}{28} & 0 & \frac{\sqrt{15}}{84} & 0 & \frac{1}{7} & 0 & 0 & 0 \\ \frac{\sqrt{10}}{28} & 0 & \frac{5}{56} & 0 & -\frac{3\sqrt{2}}{56} & 0 & 0 & \frac{\sqrt{15}}{84} & 0 & -\frac{5\sqrt{3}}{84} & 0 & \frac{\sqrt{5}}{14} & 0 & 0 \\ 0 & \frac{\sqrt{30}}{84} & 0 & \frac{\sqrt{15}}{168} & 0 & -\frac{\sqrt{6}}{56} & \frac{\sqrt{7}}{28} & 0 & -\frac{5\sqrt{3}}{84} & 0 & -\frac{\sqrt{5}}{14} & 0 & \frac{1}{7} & 0 \\ \frac{\sqrt{6}}{56} & 0 & -\frac{\sqrt{15}}{168} & 0 & -\frac{\sqrt{30}}{84} & 0 & 0 & \frac{1}{7} & 0 & -\frac{\sqrt{5}}{14} & 0 & -\frac{5\sqrt{3}}{84} & 0 & \frac{\sqrt{7}}{28} \\ 0 & \frac{3\sqrt{2}}{56} & 0 & -\frac{5}{56} & 0 & -\frac{\sqrt{10}}{28} & 0 & 0 & \frac{\sqrt{5}}{14} & 0 & -\frac{5\sqrt{3}}{84} & 0 & \frac{\sqrt{15}}{84} & 0 \\ 0 & 0 & \frac{3\sqrt{3}}{56} & 0 & -\frac{5\sqrt{6}}{168} & 0 & 0 & 0 & 0 & \frac{1}{7} & 0 & \frac{\sqrt{15}}{84} & 0 & \frac{\sqrt{35}}{28} \\ 0 & 0 & 0 & \frac{\sqrt{21}}{56} & 0 & \frac{\sqrt{210}}{168} & 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{28} & 0 & \frac{\sqrt{35}}{28} & 0 \end{bmatrix}$ |
| 956 | symmetry | $-\frac{\sqrt{15}\,y(x-z)(x+z)}{2}$ |

*continued ...*

Table 10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}^{(a)}_{3,2}(E_g,2)$$

$$
\begin{pmatrix}
0 & \frac{5i}{28} & 0 & -\frac{5\sqrt{2}i}{56} & 0 & 0 & \frac{\sqrt{210}i}{168} & 0 & \frac{\sqrt{10}i}{28} & 0 & -\frac{\sqrt{6}i}{56} & 0 & 0 & 0 \\
-\frac{5i}{28} & 0 & -\frac{\sqrt{10}i}{56} & 0 & -\frac{\sqrt{5}i}{14} & 0 & 0 & -\frac{5\sqrt{6}i}{168} & 0 & \frac{\sqrt{30}i}{84} & 0 & -\frac{3\sqrt{2}i}{56} & 0 & 0 \\
0 & \frac{\sqrt{10}i}{56} & 0 & -\frac{\sqrt{5}i}{14} & 0 & -\frac{5\sqrt{2}i}{56} & -\frac{\sqrt{21}i}{56} & 0 & -\frac{5i}{56} & 0 & -\frac{\sqrt{15}i}{168} & 0 & -\frac{3\sqrt{3}i}{56} & 0 \\
\frac{5\sqrt{2}i}{56} & 0 & \frac{\sqrt{5}i}{14} & 0 & -\frac{\sqrt{10}i}{56} & 0 & 0 & -\frac{3\sqrt{3}i}{56} & 0 & -\frac{\sqrt{15}i}{168} & 0 & -\frac{5i}{56} & 0 & -\frac{\sqrt{21}i}{56} \\
0 & \frac{\sqrt{5}i}{14} & 0 & \frac{\sqrt{10}i}{56} & 0 & \frac{5i}{28} & 0 & 0 & -\frac{3\sqrt{2}i}{56} & 0 & \frac{\sqrt{30}i}{84} & 0 & -\frac{5\sqrt{6}i}{168} & 0 \\
0 & 0 & \frac{5\sqrt{2}i}{56} & 0 & -\frac{5i}{28} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{56} & 0 & \frac{\sqrt{10}i}{28} & 0 & \frac{\sqrt{210}i}{168} \\
-\frac{\sqrt{210}i}{168} & 0 & \frac{\sqrt{21}i}{56} & 0 & 0 & 0 & 0 & \frac{\sqrt{35}i}{28} & 0 & -\frac{\sqrt{7}i}{28} & 0 & 0 & 0 & 0 \\
0 & \frac{5\sqrt{6}i}{168} & 0 & \frac{3\sqrt{3}i}{56} & 0 & 0 & -\frac{\sqrt{35}i}{28} & 0 & \frac{\sqrt{15}i}{84} & 0 & -\frac{i}{7} & 0 & 0 & 0 \\
-\frac{\sqrt{10}i}{28} & 0 & \frac{5i}{56} & 0 & \frac{3\sqrt{2}i}{56} & 0 & 0 & -\frac{\sqrt{15}i}{84} & 0 & -\frac{5\sqrt{3}i}{84} & 0 & -\frac{\sqrt{5}i}{14} & 0 & 0 \\
0 & -\frac{\sqrt{30}i}{84} & 0 & \frac{\sqrt{15}i}{168} & 0 & \frac{\sqrt{6}i}{56} & \frac{\sqrt{7}i}{28} & 0 & \frac{5\sqrt{3}i}{84} & 0 & -\frac{\sqrt{5}i}{14} & 0 & -\frac{i}{7} & 0 \\
\frac{\sqrt{6}i}{56} & 0 & \frac{\sqrt{15}i}{168} & 0 & -\frac{\sqrt{30}i}{84} & 0 & 0 & \frac{i}{7} & 0 & \frac{\sqrt{5}i}{14} & 0 & -\frac{5\sqrt{3}i}{84} & 0 & -\frac{\sqrt{7}i}{28} \\
0 & \frac{3\sqrt{2}i}{56} & 0 & \frac{5i}{56} & 0 & -\frac{\sqrt{10}i}{28} & 0 & 0 & \frac{\sqrt{5}i}{14} & 0 & \frac{5\sqrt{3}i}{84} & 0 & \frac{\sqrt{15}i}{84} & 0 \\
0 & 0 & \frac{3\sqrt{3}i}{56} & 0 & \frac{5\sqrt{6}i}{168} & 0 & 0 & 0 & 0 & \frac{i}{7} & 0 & -\frac{\sqrt{15}i}{84} & 0 & \frac{\sqrt{35}i}{28} \\
0 & 0 & 0 & \frac{\sqrt{21}i}{56} & 0 & -\frac{\sqrt{210}i}{168} & 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{28} & 0 & -\frac{\sqrt{35}i}{28} & 0
\end{pmatrix}
$$

| 957 | symmetry | $\frac{3\sqrt{35}xyz(x-y)(x+y)}{2}$ |

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{M}_5^{(a)}(A_{1g})$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{6}i}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{15}i}{14}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{6}i}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{i}{14}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{14}i}{14}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{14}i}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $\frac{\sqrt{6}i}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{i}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{6}i}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{15}i}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{14}i}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{42}i}{28}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $-\frac{i}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{10}i}{28}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{15}i}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{10}i}{28}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{42}i}{28}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{42}i}{28}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $\frac{\sqrt{15}i}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{10}i}{28}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{i}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{10}i}{28}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{14}i}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{42}i}{28}$ | $0$ | $0$ | $0$ | $0$ |
| 958 | symmetry | $\frac{z\left(15x^4+30x^2y^2-40x^2z^2+15y^4-40y^2z^2+8z^4\right)}{8}$ | | | | | | | | | | | | | | |

416

Table 10

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_5^{(a)}(A_{2g},1)$

| $\frac{\sqrt{42}}{294}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{7}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $0$ | $-\frac{5\sqrt{42}}{294}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{105}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $\frac{5\sqrt{42}}{147}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{14}}{98}$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $-\frac{5\sqrt{42}}{147}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{14}}{98}$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{42}}{294}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{105}}{98}$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{42}}{294}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{7}}{98}$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{42}}{84}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $\frac{5\sqrt{7}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{23\sqrt{42}}{588}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $-\frac{3\sqrt{105}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{17\sqrt{42}}{588}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $\frac{5\sqrt{14}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{42}}{196}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $\frac{5\sqrt{14}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{42}}{196}$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{105}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{17\sqrt{42}}{588}$ | $0$ | $0$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{7}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{23\sqrt{42}}{588}$ | $0$ |
| $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{42}}{84}$ |

| 959 | symmetry | $\frac{3\sqrt{35}z\left(x^2-2xy-y^2\right)\left(x^2+2xy-y^2\right)}{8}$ |
|---|---|---|

*continued …*

Table  10

| No. | multipole | matrix |
|-----|-----------|--------|

$$\mathbb{M}_5^{(a)}(A_{2g},2)$$

$$
\begin{pmatrix}
0 & 0 & 0 & 0 & \frac{\sqrt{6}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{14} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{14} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{14} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{6}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{6}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{14} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{14}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{28} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{1}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{28} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{28} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}}{28} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{15}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{28} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{1}{14} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{28} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{14}}{14} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{42}}{28} & 0 & 0 & 0 & 0
\end{pmatrix}
$$

| 960 | symmetry | $\frac{\sqrt{105}xyz(x^2+y^2-2z^2)}{2}$ |

*continued ...*

418

Table 10

| No. | multipole | matrix |
|-----|-----------|--------|
| | $\mathbb{M}_5^{(a)}(B_{1g})$ | $$\begin{pmatrix} 0 & 0 & \frac{i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{3}i}{42} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{5}i}{14} & 0 & 0 & \frac{\sqrt{21}i}{42} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{21} & 0 & 0 & 0 \\ -\frac{i}{14} & 0 & 0 & 0 & \frac{\sqrt{5}i}{14} & 0 & 0 & -\frac{2\sqrt{6}i}{21} & 0 & 0 & 0 & -\frac{\sqrt{2}i}{14} & 0 & 0 \\ 0 & \frac{\sqrt{5}i}{14} & 0 & 0 & 0 & -\frac{i}{14} & 0 & 0 & \frac{\sqrt{2}i}{14} & 0 & 0 & 0 & \frac{2\sqrt{6}i}{21} & 0 \\ 0 & 0 & -\frac{\sqrt{5}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{21} & 0 & 0 & 0 & -\frac{\sqrt{21}i}{42} \\ 0 & 0 & 0 & \frac{i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{3}i}{42} & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{21}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{84} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{2\sqrt{6}i}{21} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{2}i}{28} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{2}i}{14} & 0 & 0 & -\frac{\sqrt{210}i}{84} & 0 & 0 & 0 & -\frac{\sqrt{6}i}{21} & 0 & 0 & 0 \\ -\frac{5\sqrt{3}i}{42} & 0 & 0 & 0 & -\frac{\sqrt{15}i}{21} & 0 & 0 & \frac{3\sqrt{2}i}{28} & 0 & 0 & 0 & \frac{\sqrt{6}i}{21} & 0 & 0 \\ 0 & \frac{\sqrt{15}i}{21} & 0 & 0 & 0 & \frac{5\sqrt{3}i}{42} & 0 & 0 & \frac{\sqrt{6}i}{21} & 0 & 0 & 0 & \frac{3\sqrt{2}i}{28} & 0 \\ 0 & 0 & \frac{\sqrt{2}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{21} & 0 & 0 & 0 & -\frac{\sqrt{210}i}{84} \\ 0 & 0 & 0 & -\frac{2\sqrt{6}i}{21} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{2}i}{28} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{21}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{84} & 0 & 0 \end{pmatrix}$$ |
| 961 | symmetry | $-\frac{\sqrt{105}z(x-y)(x+y)\left(x^2+y^2-2z^2\right)}{4}$ |

*continued ...*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{M}_5^{(a)}(B_{2g})$ | $0$ | $0$ | $\frac{1}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{3}}{42}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{\sqrt{5}}{14}$ | $0$ | $0$ | $-\frac{\sqrt{21}}{42}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{15}}{21}$ | $0$ | $0$ | $0$ |
| | | $\frac{1}{14}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{5}}{14}$ | $0$ | $0$ | $\frac{2\sqrt{6}}{21}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2}}{14}$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{5}}{14}$ | $0$ | $0$ | $0$ | $-\frac{1}{14}$ | $0$ | $0$ | $-\frac{\sqrt{2}}{14}$ | $0$ | $0$ | $0$ | $\frac{2\sqrt{6}}{21}$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{5}}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{15}}{21}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{21}}{42}$ |
| | | $0$ | $0$ | $0$ | $-\frac{1}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{3}}{42}$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{21}}{42}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{210}}{84}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $\frac{2\sqrt{6}}{21}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{2}}{28}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{\sqrt{2}}{14}$ | $0$ | $0$ | $\frac{\sqrt{210}}{84}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{6}}{21}$ | $0$ | $0$ | $0$ |
| | | $\frac{5\sqrt{3}}{42}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{15}}{21}$ | $0$ | $0$ | $-\frac{3\sqrt{2}}{28}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{6}}{21}$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{15}}{21}$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{3}}{42}$ | $0$ | $0$ | $-\frac{\sqrt{6}}{21}$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{2}}{28}$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{2}}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{6}}{21}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{210}}{84}$ |
| | | $0$ | $0$ | $0$ | $\frac{2\sqrt{6}}{21}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{2}}{28}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{21}}{42}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{210}}{84}$ | $0$ | $0$ |
| 962 | symmetry | $\frac{x\left(8x^4-40x^2y^2-40x^2z^2+15y^4+30y^2z^2+15z^4\right)}{8}$ | | | | | | | | | | | | | |

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{M}_{5,1}^{(a)}(E_g,1)$ | $0$ | $\frac{\sqrt{210}}{784}$ | $0$ | $-\frac{\sqrt{105}}{168}$ | $0$ | $\frac{3\sqrt{42}}{112}$ | $-\frac{5}{224}$ | $0$ | $\frac{25\sqrt{21}}{1568}$ | $0$ | $-\frac{5\sqrt{35}}{224}$ | $0$ | $\frac{15\sqrt{7}}{224}$ | $0$ |
| | | $\frac{\sqrt{210}}{784}$ | $0$ | $-\frac{5\sqrt{21}}{392}$ | $0$ | $\frac{5\sqrt{42}}{336}$ | $0$ | $0$ | $\frac{23\sqrt{35}}{1568}$ | $0$ | $-\frac{65\sqrt{7}}{1568}$ | $0$ | $\frac{\sqrt{105}}{224}$ | $0$ | $\frac{3\sqrt{5}}{32}$ |
| | | $0$ | $-\frac{5\sqrt{21}}{392}$ | $0$ | $\frac{5\sqrt{42}}{392}$ | $0$ | $-\frac{\sqrt{105}}{168}$ | $\frac{\sqrt{10}}{32}$ | $0$ | $-\frac{11\sqrt{210}}{1568}$ | $0$ | $\frac{5\sqrt{14}}{1568}$ | $0$ | $\frac{3\sqrt{70}}{224}$ | $0$ |
| | | $-\frac{\sqrt{105}}{168}$ | $0$ | $\frac{5\sqrt{42}}{392}$ | $0$ | $-\frac{5\sqrt{21}}{392}$ | $0$ | $0$ | $-\frac{3\sqrt{70}}{224}$ | $0$ | $-\frac{5\sqrt{14}}{1568}$ | $0$ | $\frac{11\sqrt{210}}{1568}$ | $0$ | $-\frac{\sqrt{10}}{32}$ |
| | | $0$ | $\frac{5\sqrt{42}}{336}$ | $0$ | $-\frac{5\sqrt{21}}{392}$ | $0$ | $\frac{\sqrt{210}}{784}$ | $-\frac{3\sqrt{5}}{32}$ | $0$ | $-\frac{\sqrt{105}}{224}$ | $0$ | $\frac{65\sqrt{7}}{1568}$ | $0$ | $-\frac{23\sqrt{35}}{1568}$ | $0$ |
| | | $\frac{3\sqrt{42}}{112}$ | $0$ | $-\frac{\sqrt{105}}{168}$ | $0$ | $\frac{\sqrt{210}}{784}$ | $0$ | $0$ | $-\frac{15\sqrt{7}}{224}$ | $0$ | $\frac{5\sqrt{35}}{224}$ | $0$ | $-\frac{25\sqrt{21}}{1568}$ | $0$ | $\frac{5}{224}$ |
| | | $-\frac{5}{224}$ | $0$ | $\frac{\sqrt{10}}{32}$ | $0$ | $-\frac{3\sqrt{5}}{32}$ | $0$ | $0$ | $\frac{5\sqrt{6}}{224}$ | $0$ | $-\frac{\sqrt{30}}{48}$ | $0$ | $\frac{3\sqrt{2}}{32}$ | $0$ | $0$ |
| | | $0$ | $\frac{23\sqrt{35}}{1568}$ | $0$ | $-\frac{3\sqrt{70}}{224}$ | $0$ | $-\frac{15\sqrt{7}}{224}$ | $\frac{5\sqrt{6}}{224}$ | $0$ | $-\frac{5\sqrt{14}}{196}$ | $0$ | $\frac{\sqrt{210}}{672}$ | $0$ | $\frac{3\sqrt{42}}{112}$ | $0$ |
| | | $\frac{25\sqrt{21}}{1568}$ | $0$ | $-\frac{11\sqrt{210}}{1568}$ | $0$ | $-\frac{\sqrt{105}}{224}$ | $0$ | $0$ | $-\frac{5\sqrt{14}}{196}$ | $0$ | $\frac{\sqrt{70}}{1568}$ | $0$ | $\frac{5\sqrt{42}}{336}$ | $0$ | $\frac{3\sqrt{2}}{32}$ |
| | | $0$ | $-\frac{65\sqrt{7}}{1568}$ | $0$ | $-\frac{5\sqrt{14}}{1568}$ | $0$ | $\frac{5\sqrt{35}}{224}$ | $-\frac{\sqrt{30}}{48}$ | $0$ | $\frac{\sqrt{70}}{1568}$ | $0$ | $\frac{5\sqrt{42}}{392}$ | $0$ | $\frac{\sqrt{210}}{672}$ | $0$ |
| | | $-\frac{5\sqrt{35}}{224}$ | $0$ | $\frac{5\sqrt{14}}{1568}$ | $0$ | $\frac{65\sqrt{7}}{1568}$ | $0$ | $0$ | $\frac{\sqrt{210}}{672}$ | $0$ | $\frac{5\sqrt{42}}{392}$ | $0$ | $\frac{\sqrt{70}}{1568}$ | $0$ | $-\frac{\sqrt{30}}{48}$ |
| | | $0$ | $\frac{\sqrt{105}}{224}$ | $0$ | $\frac{11\sqrt{210}}{1568}$ | $0$ | $-\frac{25\sqrt{21}}{1568}$ | $\frac{3\sqrt{2}}{32}$ | $0$ | $\frac{5\sqrt{42}}{336}$ | $0$ | $\frac{\sqrt{70}}{1568}$ | $0$ | $-\frac{5\sqrt{14}}{196}$ | $0$ |
| | | $\frac{15\sqrt{7}}{224}$ | $0$ | $\frac{3\sqrt{70}}{224}$ | $0$ | $-\frac{23\sqrt{35}}{1568}$ | $0$ | $0$ | $\frac{3\sqrt{42}}{112}$ | $0$ | $\frac{\sqrt{210}}{672}$ | $0$ | $-\frac{5\sqrt{14}}{196}$ | $0$ | $\frac{5\sqrt{6}}{224}$ |
| | | $0$ | $\frac{3\sqrt{5}}{32}$ | $0$ | $-\frac{\sqrt{10}}{32}$ | $0$ | $\frac{5}{224}$ | $0$ | $0$ | $\frac{3\sqrt{2}}{32}$ | $0$ | $-\frac{\sqrt{30}}{48}$ | $0$ | $\frac{5\sqrt{6}}{224}$ | $0$ |
| 963 | symmetry | $-\frac{y\left(15x^4-40x^2y^2+30x^2z^2+8y^4-40y^2z^2+15z^4\right)}{8}$ | | | | | | | | | | | | | |

*continued ...*

Table  10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{M}_{5,2}^{(a)}(E_g,1)$ | $0$ | $\frac{\sqrt{210}i}{784}$ | $0$ | $\frac{\sqrt{105}i}{168}$ | $0$ | $\frac{3\sqrt{42}i}{112}$ | $\frac{5i}{224}$ | $0$ | $\frac{25\sqrt{21}i}{1568}$ | $0$ | $\frac{5\sqrt{35}i}{224}$ | $0$ | $\frac{15\sqrt{7}i}{224}$ | $0$ |
| | | $-\frac{\sqrt{210}i}{784}$ | $0$ | $-\frac{5\sqrt{21}i}{392}$ | $0$ | $-\frac{5\sqrt{42}i}{336}$ | $0$ | $0$ | $-\frac{23\sqrt{35}i}{1568}$ | $0$ | $-\frac{65\sqrt{7}i}{1568}$ | $0$ | $-\frac{\sqrt{105}i}{224}$ | $0$ | $\frac{3\sqrt{5}i}{32}$ |
| | | $0$ | $\frac{5\sqrt{21}i}{392}$ | $0$ | $\frac{5\sqrt{42}i}{392}$ | $0$ | $\frac{\sqrt{105}i}{168}$ | $\frac{\sqrt{10}i}{32}$ | $0$ | $\frac{11\sqrt{210}i}{1568}$ | $0$ | $\frac{5\sqrt{14}i}{1568}$ | $0$ | $-\frac{3\sqrt{70}i}{224}$ | $0$ |
| | | $-\frac{\sqrt{105}i}{168}$ | $0$ | $-\frac{5\sqrt{42}i}{392}$ | $0$ | $-\frac{5\sqrt{21}i}{392}$ | $0$ | $0$ | $-\frac{3\sqrt{70}i}{224}$ | $0$ | $\frac{5\sqrt{14}i}{1568}$ | $0$ | $\frac{11\sqrt{210}i}{1568}$ | $0$ | $\frac{\sqrt{10}i}{32}$ |
| | | $0$ | $\frac{5\sqrt{42}i}{336}$ | $0$ | $\frac{5\sqrt{21}i}{392}$ | $0$ | $\frac{\sqrt{210}i}{784}$ | $\frac{3\sqrt{5}i}{32}$ | $0$ | $-\frac{\sqrt{105}i}{224}$ | $0$ | $-\frac{65\sqrt{7}i}{1568}$ | $0$ | $-\frac{23\sqrt{35}i}{1568}$ | $0$ |
| | | $-\frac{3\sqrt{42}i}{112}$ | $0$ | $-\frac{\sqrt{105}i}{168}$ | $0$ | $-\frac{\sqrt{210}i}{784}$ | $0$ | $0$ | $\frac{15\sqrt{7}i}{224}$ | $0$ | $\frac{5\sqrt{35}i}{224}$ | $0$ | $\frac{25\sqrt{21}i}{1568}$ | $0$ | $\frac{5i}{224}$ |
| | | $-\frac{5i}{224}$ | $0$ | $-\frac{\sqrt{10}i}{32}$ | $0$ | $-\frac{3\sqrt{5}i}{32}$ | $0$ | $0$ | $\frac{5\sqrt{6}i}{224}$ | $0$ | $\frac{\sqrt{30}i}{48}$ | $0$ | $\frac{3\sqrt{2}i}{32}$ | $0$ | $0$ |
| | | $0$ | $\frac{23\sqrt{35}i}{1568}$ | $0$ | $\frac{3\sqrt{70}i}{224}$ | $0$ | $-\frac{15\sqrt{7}i}{224}$ | $-\frac{5\sqrt{6}i}{224}$ | $0$ | $-\frac{5\sqrt{14}i}{196}$ | $0$ | $-\frac{\sqrt{210}i}{672}$ | $0$ | $\frac{3\sqrt{42}i}{112}$ | $0$ |
| | | $-\frac{25\sqrt{21}i}{1568}$ | $0$ | $-\frac{11\sqrt{210}i}{1568}$ | $0$ | $\frac{\sqrt{105}i}{224}$ | $0$ | $0$ | $\frac{5\sqrt{14}i}{196}$ | $0$ | $\frac{\sqrt{70}i}{1568}$ | $0$ | $-\frac{5\sqrt{42}i}{336}$ | $0$ | $\frac{3\sqrt{2}i}{32}$ |
| | | $0$ | $\frac{65\sqrt{7}i}{1568}$ | $0$ | $-\frac{5\sqrt{14}i}{1568}$ | $0$ | $-\frac{5\sqrt{35}i}{224}$ | $-\frac{\sqrt{30}i}{48}$ | $0$ | $-\frac{\sqrt{70}i}{1568}$ | $0$ | $\frac{5\sqrt{42}i}{392}$ | $0$ | $-\frac{\sqrt{210}i}{672}$ | $0$ |
| | | $-\frac{5\sqrt{35}i}{224}$ | $0$ | $-\frac{5\sqrt{14}i}{1568}$ | $0$ | $\frac{65\sqrt{7}i}{1568}$ | $0$ | $0$ | $\frac{\sqrt{210}i}{672}$ | $0$ | $-\frac{5\sqrt{42}i}{392}$ | $0$ | $\frac{\sqrt{70}i}{1568}$ | $0$ | $\frac{\sqrt{30}i}{48}$ |
| | | $0$ | $\frac{\sqrt{105}i}{224}$ | $0$ | $-\frac{11\sqrt{210}i}{1568}$ | $0$ | $-\frac{25\sqrt{21}i}{1568}$ | $-\frac{3\sqrt{2}i}{32}$ | $0$ | $\frac{5\sqrt{42}i}{336}$ | $0$ | $-\frac{\sqrt{70}i}{1568}$ | $0$ | $-\frac{5\sqrt{14}i}{196}$ | $0$ |
| | | $-\frac{15\sqrt{7}i}{224}$ | $0$ | $\frac{3\sqrt{70}i}{224}$ | $0$ | $\frac{23\sqrt{35}i}{1568}$ | $0$ | $0$ | $-\frac{3\sqrt{42}i}{112}$ | $0$ | $\frac{\sqrt{210}i}{672}$ | $0$ | $\frac{5\sqrt{14}i}{196}$ | $0$ | $\frac{5\sqrt{6}i}{224}$ |
| | | $0$ | $-\frac{3\sqrt{5}i}{32}$ | $0$ | $-\frac{\sqrt{10}i}{32}$ | $0$ | $-\frac{5i}{224}$ | $0$ | $0$ | $-\frac{3\sqrt{2}i}{32}$ | $0$ | $-\frac{\sqrt{30}i}{48}$ | $0$ | $-\frac{5\sqrt{6}i}{224}$ | $0$ |

| 964 | symmetry | $\frac{3\sqrt{35}x\left(y^2-2yz-z^2\right)\left(y^2+2yz-z^2\right)}{8}$ |

*continued ...*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|-----|-----------|--------|--|--|--|--|--|--|--|--|--|--|--|--|--|
| | $\mathbb{M}_{5,1}^{(a)}(E_g,2)$ | $0$ | $\frac{\sqrt{6}}{112}$ | $0$ | $\frac{3\sqrt{3}}{56}$ | $0$ | $\frac{\sqrt{30}}{112}$ | $-\frac{\sqrt{35}}{224}$ | $0$ | $\frac{5\sqrt{15}}{224}$ | $0$ | $\frac{45}{224}$ | $0$ | $\frac{5\sqrt{5}}{224}$ | $0$ |
| | | $\frac{\sqrt{6}}{112}$ | $0$ | $-\frac{\sqrt{15}}{56}$ | $0$ | $-\frac{3\sqrt{30}}{112}$ | $0$ | $0$ | $\frac{23}{224}$ | $0$ | $-\frac{13\sqrt{5}}{224}$ | $0$ | $-\frac{9\sqrt{3}}{224}$ | $0$ | $\frac{5\sqrt{7}}{224}$ |
| | | $0$ | $-\frac{\sqrt{15}}{56}$ | $0$ | $\frac{\sqrt{30}}{56}$ | $0$ | $\frac{3\sqrt{3}}{56}$ | $-\frac{9\sqrt{14}}{224}$ | $0$ | $-\frac{11\sqrt{6}}{224}$ | $0$ | $\frac{\sqrt{10}}{224}$ | $0$ | $-\frac{27\sqrt{2}}{224}$ | $0$ |
| | | $\frac{3\sqrt{3}}{56}$ | $0$ | $\frac{\sqrt{30}}{56}$ | $0$ | $-\frac{\sqrt{15}}{56}$ | $0$ | $0$ | $\frac{27\sqrt{2}}{224}$ | $0$ | $-\frac{\sqrt{10}}{224}$ | $0$ | $\frac{11\sqrt{6}}{224}$ | $0$ | $\frac{9\sqrt{14}}{224}$ |
| | | $0$ | $-\frac{3\sqrt{30}}{112}$ | $0$ | $-\frac{\sqrt{15}}{56}$ | $0$ | $\frac{\sqrt{6}}{112}$ | $-\frac{5\sqrt{7}}{224}$ | $0$ | $\frac{9\sqrt{3}}{224}$ | $0$ | $\frac{13\sqrt{5}}{224}$ | $0$ | $-\frac{23}{224}$ | $0$ |
| | | $\frac{\sqrt{30}}{112}$ | $0$ | $\frac{3\sqrt{3}}{56}$ | $0$ | $\frac{\sqrt{6}}{112}$ | $0$ | $0$ | $-\frac{5\sqrt{5}}{224}$ | $0$ | $-\frac{45}{224}$ | $0$ | $-\frac{5\sqrt{15}}{224}$ | $0$ | $\frac{\sqrt{35}}{224}$ |
| | | $-\frac{\sqrt{35}}{224}$ | $0$ | $-\frac{9\sqrt{14}}{224}$ | $0$ | $-\frac{5\sqrt{7}}{224}$ | $0$ | $0$ | $\frac{\sqrt{210}}{224}$ | $0$ | $\frac{3\sqrt{42}}{112}$ | $0$ | $\frac{\sqrt{70}}{224}$ | $0$ | $0$ |
| | | $0$ | $\frac{23}{224}$ | $0$ | $\frac{27\sqrt{2}}{224}$ | $0$ | $-\frac{5\sqrt{5}}{224}$ | $\frac{\sqrt{210}}{224}$ | $0$ | $-\frac{\sqrt{10}}{28}$ | $0$ | $-\frac{3\sqrt{6}}{224}$ | $0$ | $\frac{\sqrt{30}}{112}$ | $0$ |
| | | $\frac{5\sqrt{15}}{224}$ | $0$ | $-\frac{11\sqrt{6}}{224}$ | $0$ | $\frac{9\sqrt{3}}{224}$ | $0$ | $0$ | $-\frac{\sqrt{10}}{28}$ | $0$ | $\frac{\sqrt{2}}{224}$ | $0$ | $-\frac{3\sqrt{30}}{112}$ | $0$ | $\frac{\sqrt{70}}{224}$ |
| | | $0$ | $-\frac{13\sqrt{5}}{224}$ | $0$ | $-\frac{\sqrt{10}}{224}$ | $0$ | $-\frac{45}{224}$ | $\frac{3\sqrt{42}}{112}$ | $0$ | $\frac{\sqrt{2}}{224}$ | $0$ | $\frac{\sqrt{30}}{56}$ | $0$ | $-\frac{3\sqrt{6}}{224}$ | $0$ |
| | | $\frac{45}{224}$ | $0$ | $\frac{\sqrt{10}}{224}$ | $0$ | $\frac{13\sqrt{5}}{224}$ | $0$ | $0$ | $-\frac{3\sqrt{6}}{224}$ | $0$ | $\frac{\sqrt{30}}{56}$ | $0$ | $\frac{\sqrt{2}}{224}$ | $0$ | $\frac{3\sqrt{42}}{112}$ |
| | | $0$ | $-\frac{9\sqrt{3}}{224}$ | $0$ | $\frac{11\sqrt{6}}{224}$ | $0$ | $-\frac{5\sqrt{15}}{224}$ | $\frac{\sqrt{70}}{224}$ | $0$ | $-\frac{3\sqrt{30}}{112}$ | $0$ | $\frac{\sqrt{2}}{224}$ | $0$ | $-\frac{\sqrt{10}}{28}$ | $0$ |
| | | $\frac{5\sqrt{5}}{224}$ | $0$ | $-\frac{27\sqrt{2}}{224}$ | $0$ | $-\frac{23}{224}$ | $0$ | $0$ | $\frac{\sqrt{30}}{112}$ | $0$ | $-\frac{3\sqrt{6}}{224}$ | $0$ | $-\frac{\sqrt{10}}{28}$ | $0$ | $\frac{\sqrt{210}}{224}$ |
| | | $0$ | $\frac{5\sqrt{7}}{224}$ | $0$ | $\frac{9\sqrt{14}}{224}$ | $0$ | $\frac{\sqrt{35}}{224}$ | $0$ | $0$ | $\frac{\sqrt{70}}{224}$ | $0$ | $\frac{3\sqrt{42}}{112}$ | $0$ | $\frac{\sqrt{210}}{224}$ | $0$ |

| 965 | symmetry | $-\frac{3\sqrt{35}\,y\left(x^2-2xz-z^2\right)\left(x^2+2xz-z^2\right)}{8}$ |

*continued …*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{M}_{5,2}^{(a)}(E_g,2)$ | $0$ | $\frac{\sqrt{6}i}{112}$ | $0$ | $-\frac{3\sqrt{3}i}{56}$ | $0$ | $\frac{\sqrt{30}i}{112}$ | $\frac{\sqrt{35}i}{224}$ | $0$ | $\frac{5\sqrt{15}i}{224}$ | $0$ | $-\frac{45i}{224}$ | $0$ | $\frac{5\sqrt{5}i}{224}$ | $0$ |
| | | $-\frac{\sqrt{6}i}{112}$ | $0$ | $-\frac{\sqrt{15}i}{56}$ | $0$ | $\frac{3\sqrt{30}i}{112}$ | $0$ | $0$ | $-\frac{23i}{224}$ | $0$ | $-\frac{13\sqrt{5}i}{224}$ | $0$ | $\frac{9\sqrt{3}i}{224}$ | $0$ | $\frac{5\sqrt{7}i}{224}$ |
| | | $0$ | $\frac{\sqrt{15}i}{56}$ | $0$ | $\frac{\sqrt{30}i}{56}$ | $0$ | $-\frac{3\sqrt{3}i}{56}$ | $-\frac{9\sqrt{14}i}{224}$ | $0$ | $\frac{11\sqrt{6}i}{224}$ | $0$ | $\frac{\sqrt{10}i}{224}$ | $0$ | $\frac{27\sqrt{2}i}{224}$ | $0$ |
| | | $\frac{3\sqrt{3}i}{56}$ | $0$ | $-\frac{\sqrt{30}i}{56}$ | $0$ | $-\frac{\sqrt{15}i}{56}$ | $0$ | $0$ | $\frac{27\sqrt{2}i}{224}$ | $0$ | $\frac{\sqrt{10}i}{224}$ | $0$ | $\frac{11\sqrt{6}i}{224}$ | $0$ | $-\frac{9\sqrt{14}i}{224}$ |
| | | $0$ | $-\frac{3\sqrt{30}i}{112}$ | $0$ | $\frac{\sqrt{15}i}{56}$ | $0$ | $\frac{\sqrt{6}i}{112}$ | $\frac{5\sqrt{7}i}{224}$ | $0$ | $\frac{9\sqrt{3}i}{224}$ | $0$ | $-\frac{13\sqrt{5}i}{224}$ | $0$ | $-\frac{23i}{224}$ | $0$ |
| | | $-\frac{\sqrt{30}i}{112}$ | $0$ | $\frac{3\sqrt{3}i}{56}$ | $0$ | $-\frac{\sqrt{6}i}{112}$ | $0$ | $0$ | $\frac{5\sqrt{5}i}{224}$ | $0$ | $-\frac{45i}{224}$ | $0$ | $\frac{5\sqrt{15}i}{224}$ | $0$ | $\frac{\sqrt{35}i}{224}$ |
| | | $-\frac{\sqrt{35}i}{224}$ | $0$ | $\frac{9\sqrt{14}i}{224}$ | $0$ | $-\frac{5\sqrt{7}i}{224}$ | $0$ | $0$ | $\frac{\sqrt{210}i}{224}$ | $0$ | $-\frac{3\sqrt{42}i}{112}$ | $0$ | $\frac{\sqrt{70}i}{224}$ | $0$ | $0$ |
| | | $0$ | $\frac{23i}{224}$ | $0$ | $-\frac{27\sqrt{2}i}{224}$ | $0$ | $-\frac{5\sqrt{5}i}{224}$ | $-\frac{\sqrt{210}i}{224}$ | $0$ | $-\frac{\sqrt{10}i}{28}$ | $0$ | $\frac{3\sqrt{6}i}{224}$ | $0$ | $\frac{\sqrt{30}i}{112}$ | $0$ |
| | | $-\frac{5\sqrt{15}i}{224}$ | $0$ | $-\frac{11\sqrt{6}i}{224}$ | $0$ | $-\frac{9\sqrt{3}i}{224}$ | $0$ | $0$ | $\frac{\sqrt{10}i}{28}$ | $0$ | $\frac{\sqrt{2}i}{224}$ | $0$ | $\frac{3\sqrt{30}i}{112}$ | $0$ | $\frac{\sqrt{70}i}{224}$ |
| | | $0$ | $\frac{13\sqrt{5}i}{224}$ | $0$ | $-\frac{\sqrt{10}i}{224}$ | $0$ | $\frac{45i}{224}$ | $\frac{3\sqrt{42}i}{112}$ | $0$ | $-\frac{\sqrt{2}i}{224}$ | $0$ | $\frac{\sqrt{30}i}{56}$ | $0$ | $\frac{3\sqrt{6}i}{224}$ | $0$ |
| | | $\frac{45i}{224}$ | $0$ | $-\frac{\sqrt{10}i}{224}$ | $0$ | $\frac{13\sqrt{5}i}{224}$ | $0$ | $0$ | $-\frac{3\sqrt{6}i}{224}$ | $0$ | $-\frac{\sqrt{30}i}{56}$ | $0$ | $\frac{\sqrt{2}i}{224}$ | $0$ | $-\frac{3\sqrt{42}i}{112}$ |
| | | $0$ | $-\frac{9\sqrt{3}i}{224}$ | $0$ | $-\frac{11\sqrt{6}i}{224}$ | $0$ | $-\frac{5\sqrt{15}i}{224}$ | $-\frac{\sqrt{70}i}{224}$ | $0$ | $-\frac{3\sqrt{30}i}{112}$ | $0$ | $-\frac{\sqrt{2}i}{224}$ | $0$ | $-\frac{\sqrt{10}i}{28}$ | $0$ |
| | | $-\frac{5\sqrt{5}i}{224}$ | $0$ | $-\frac{27\sqrt{2}i}{224}$ | $0$ | $\frac{23i}{224}$ | $0$ | $0$ | $-\frac{\sqrt{30}i}{112}$ | $0$ | $-\frac{3\sqrt{6}i}{224}$ | $0$ | $\frac{\sqrt{10}i}{28}$ | $0$ | $\frac{\sqrt{210}i}{224}$ |
| | | $0$ | $-\frac{5\sqrt{7}i}{224}$ | $0$ | $\frac{9\sqrt{14}i}{224}$ | $0$ | $-\frac{\sqrt{35}i}{224}$ | $0$ | $0$ | $-\frac{\sqrt{70}i}{224}$ | $0$ | $\frac{3\sqrt{42}i}{112}$ | $0$ | $-\frac{\sqrt{210}i}{224}$ | $0$ |

| 966 | symmetry | $\frac{\sqrt{105}x(y-z)(y+z)\left(2x^2-y^2-z^2\right)}{4}$ |

*continued ...*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|-----|-----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{M}_{5,1}^{(a)}(E_g,3)$ | $0$ | $\frac{\sqrt{2}}{56}$ | $0$ | $-\frac{1}{28}$ | $0$ | $-\frac{3\sqrt{10}}{56}$ | $-\frac{\sqrt{105}}{336}$ | $0$ | $\frac{5\sqrt{5}}{112}$ | $0$ | $-\frac{5\sqrt{3}}{112}$ | $0$ | $-\frac{5\sqrt{15}}{112}$ | $0$ |
| | | $\frac{\sqrt{2}}{56}$ | $0$ | $-\frac{\sqrt{5}}{28}$ | $0$ | $\frac{\sqrt{10}}{56}$ | $0$ | $0$ | $\frac{23\sqrt{3}}{336}$ | $0$ | $-\frac{13\sqrt{15}}{336}$ | $0$ | $\frac{3}{112}$ | $0$ | $-\frac{5\sqrt{21}}{112}$ |
| | | $0$ | $-\frac{\sqrt{5}}{28}$ | $0$ | $\frac{\sqrt{10}}{28}$ | $0$ | $-\frac{1}{28}$ | $\frac{\sqrt{42}}{112}$ | $0$ | $-\frac{11\sqrt{2}}{112}$ | $0$ | $\frac{\sqrt{30}}{336}$ | $0$ | $\frac{3\sqrt{6}}{112}$ | $0$ |
| | | $-\frac{1}{28}$ | $0$ | $\frac{\sqrt{10}}{28}$ | $0$ | $-\frac{\sqrt{5}}{28}$ | $0$ | $0$ | $-\frac{3\sqrt{6}}{112}$ | $0$ | $-\frac{\sqrt{30}}{336}$ | $0$ | $\frac{11\sqrt{2}}{112}$ | $0$ | $-\frac{\sqrt{42}}{112}$ |
| | | $0$ | $\frac{\sqrt{10}}{56}$ | $0$ | $-\frac{\sqrt{5}}{28}$ | $0$ | $\frac{\sqrt{2}}{56}$ | $\frac{5\sqrt{21}}{112}$ | $0$ | $-\frac{3}{112}$ | $0$ | $\frac{13\sqrt{15}}{336}$ | $0$ | $-\frac{23\sqrt{3}}{336}$ | $0$ |
| | | $-\frac{3\sqrt{10}}{56}$ | $0$ | $-\frac{1}{28}$ | $0$ | $\frac{\sqrt{2}}{56}$ | $0$ | $0$ | $\frac{5\sqrt{15}}{112}$ | $0$ | $\frac{5\sqrt{3}}{112}$ | $0$ | $-\frac{5\sqrt{5}}{112}$ | $0$ | $\frac{\sqrt{105}}{336}$ |
| | | $-\frac{\sqrt{105}}{336}$ | $0$ | $\frac{\sqrt{42}}{112}$ | $0$ | $\frac{5\sqrt{21}}{112}$ | $0$ | $0$ | $\frac{\sqrt{70}}{112}$ | $0$ | $-\frac{\sqrt{14}}{56}$ | $0$ | $-\frac{\sqrt{210}}{112}$ | $0$ | $0$ |
| | | $0$ | $\frac{23\sqrt{3}}{336}$ | $0$ | $-\frac{3\sqrt{6}}{112}$ | $0$ | $\frac{5\sqrt{15}}{112}$ | $\frac{\sqrt{70}}{112}$ | $0$ | $-\frac{\sqrt{30}}{42}$ | $0$ | $\frac{\sqrt{2}}{112}$ | $0$ | $-\frac{3\sqrt{10}}{56}$ | $0$ |
| | | $\frac{5\sqrt{5}}{112}$ | $0$ | $-\frac{11\sqrt{2}}{112}$ | $0$ | $-\frac{3}{112}$ | $0$ | $0$ | $-\frac{\sqrt{30}}{42}$ | $0$ | $\frac{\sqrt{6}}{336}$ | $0$ | $\frac{\sqrt{10}}{56}$ | $0$ | $-\frac{\sqrt{210}}{112}$ |
| | | $0$ | $-\frac{13\sqrt{15}}{336}$ | $0$ | $-\frac{\sqrt{30}}{336}$ | $0$ | $\frac{5\sqrt{3}}{112}$ | $-\frac{\sqrt{14}}{56}$ | $0$ | $\frac{\sqrt{6}}{336}$ | $0$ | $\frac{\sqrt{10}}{28}$ | $0$ | $\frac{\sqrt{2}}{112}$ | $0$ |
| | | $-\frac{5\sqrt{3}}{112}$ | $0$ | $\frac{\sqrt{30}}{336}$ | $0$ | $\frac{13\sqrt{15}}{336}$ | $0$ | $0$ | $\frac{\sqrt{2}}{112}$ | $0$ | $\frac{\sqrt{10}}{28}$ | $0$ | $\frac{\sqrt{6}}{336}$ | $0$ | $-\frac{\sqrt{14}}{56}$ |
| | | $0$ | $\frac{3}{112}$ | $0$ | $\frac{11\sqrt{2}}{112}$ | $0$ | $-\frac{5\sqrt{5}}{112}$ | $-\frac{\sqrt{210}}{112}$ | $0$ | $\frac{\sqrt{10}}{56}$ | $0$ | $\frac{\sqrt{6}}{336}$ | $0$ | $-\frac{\sqrt{30}}{42}$ | $0$ |
| | | $-\frac{5\sqrt{15}}{112}$ | $0$ | $\frac{3\sqrt{6}}{112}$ | $0$ | $-\frac{23\sqrt{3}}{336}$ | $0$ | $0$ | $-\frac{3\sqrt{10}}{56}$ | $0$ | $\frac{\sqrt{2}}{112}$ | $0$ | $-\frac{\sqrt{30}}{42}$ | $0$ | $\frac{\sqrt{70}}{112}$ |
| | | $0$ | $-\frac{5\sqrt{21}}{112}$ | $0$ | $-\frac{\sqrt{42}}{112}$ | $0$ | $\frac{\sqrt{105}}{336}$ | $0$ | $0$ | $-\frac{\sqrt{210}}{112}$ | $0$ | $-\frac{\sqrt{14}}{56}$ | $0$ | $\frac{\sqrt{70}}{112}$ | $0$ |
| 967 | symmetry | $\frac{\sqrt{105}\,y(x-z)(x+z)\left(x^2-2y^2+z^2\right)}{4}$ | | | | | | | | | | | | | |

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{M}_{5,2}^{(a)}(E_g,3)$

$$
\begin{pmatrix}
0 & \frac{\sqrt{2}i}{56} & 0 & \frac{i}{28} & 0 & -\frac{3\sqrt{10}i}{56} & \frac{\sqrt{105}i}{336} & 0 & \frac{5\sqrt{5}i}{112} & 0 & \frac{5\sqrt{3}i}{112} & 0 & -\frac{5\sqrt{15}i}{112} & 0 \\
-\frac{\sqrt{2}i}{56} & 0 & -\frac{\sqrt{5}i}{28} & 0 & -\frac{\sqrt{10}i}{56} & 0 & 0 & -\frac{23\sqrt{3}i}{336} & 0 & -\frac{13\sqrt{15}i}{336} & 0 & -\frac{3i}{112} & 0 & -\frac{5\sqrt{21}i}{112} \\
0 & \frac{\sqrt{5}i}{28} & 0 & \frac{\sqrt{10}i}{28} & 0 & \frac{i}{28} & \frac{\sqrt{42}i}{112} & 0 & \frac{11\sqrt{2}i}{112} & 0 & \frac{\sqrt{30}i}{336} & 0 & -\frac{3\sqrt{6}i}{112} & 0 \\
-\frac{i}{28} & 0 & -\frac{\sqrt{10}i}{28} & 0 & -\frac{\sqrt{5}i}{28} & 0 & 0 & -\frac{3\sqrt{6}i}{112} & 0 & \frac{\sqrt{30}i}{336} & 0 & \frac{11\sqrt{2}i}{112} & 0 & \frac{\sqrt{42}i}{112} \\
0 & \frac{\sqrt{10}i}{56} & 0 & \frac{\sqrt{5}i}{28} & 0 & \frac{\sqrt{2}i}{56} & -\frac{5\sqrt{21}i}{112} & 0 & -\frac{3i}{112} & 0 & -\frac{13\sqrt{15}i}{336} & 0 & -\frac{23\sqrt{3}i}{336} & 0 \\
\frac{3\sqrt{10}i}{56} & 0 & -\frac{i}{28} & 0 & -\frac{\sqrt{2}i}{56} & 0 & 0 & -\frac{5\sqrt{15}i}{112} & 0 & \frac{5\sqrt{3}i}{112} & 0 & \frac{5\sqrt{5}i}{112} & 0 & \frac{\sqrt{105}i}{336} \\
-\frac{\sqrt{105}i}{336} & 0 & -\frac{\sqrt{42}i}{112} & 0 & \frac{5\sqrt{21}i}{112} & 0 & 0 & \frac{\sqrt{70}i}{112} & 0 & \frac{\sqrt{14}i}{56} & 0 & -\frac{\sqrt{210}i}{112} & 0 & 0 \\
0 & \frac{23\sqrt{3}i}{336} & 0 & \frac{3\sqrt{6}i}{112} & 0 & \frac{5\sqrt{15}i}{112} & -\frac{\sqrt{70}i}{112} & 0 & -\frac{\sqrt{30}i}{42} & 0 & -\frac{\sqrt{2}i}{112} & 0 & -\frac{3\sqrt{10}i}{56} & 0 \\
-\frac{5\sqrt{5}i}{112} & 0 & -\frac{11\sqrt{2}i}{112} & 0 & \frac{3i}{112} & 0 & 0 & \frac{\sqrt{30}i}{42} & 0 & \frac{\sqrt{6}i}{336} & 0 & -\frac{\sqrt{10}i}{56} & 0 & -\frac{\sqrt{210}i}{112} \\
0 & \frac{13\sqrt{15}i}{336} & 0 & -\frac{\sqrt{30}i}{336} & 0 & -\frac{5\sqrt{3}i}{112} & -\frac{\sqrt{14}i}{56} & 0 & -\frac{\sqrt{6}i}{336} & 0 & \frac{\sqrt{10}i}{28} & 0 & -\frac{\sqrt{2}i}{112} & 0 \\
-\frac{5\sqrt{3}i}{112} & 0 & -\frac{\sqrt{30}i}{336} & 0 & \frac{13\sqrt{15}i}{336} & 0 & 0 & \frac{\sqrt{2}i}{112} & 0 & -\frac{\sqrt{10}i}{28} & 0 & \frac{\sqrt{6}i}{336} & 0 & \frac{\sqrt{14}i}{56} \\
0 & \frac{3i}{112} & 0 & -\frac{11\sqrt{2}i}{112} & 0 & -\frac{5\sqrt{5}i}{112} & \frac{\sqrt{210}i}{112} & 0 & \frac{\sqrt{10}i}{56} & 0 & -\frac{\sqrt{6}i}{336} & 0 & -\frac{\sqrt{30}i}{42} & 0 \\
\frac{5\sqrt{15}i}{112} & 0 & \frac{3\sqrt{6}i}{112} & 0 & \frac{23\sqrt{3}i}{336} & 0 & 0 & \frac{3\sqrt{10}i}{56} & 0 & \frac{\sqrt{2}i}{112} & 0 & \frac{\sqrt{30}i}{42} & 0 & \frac{\sqrt{70}i}{112} \\
0 & \frac{5\sqrt{21}i}{112} & 0 & -\frac{\sqrt{42}i}{112} & 0 & -\frac{\sqrt{105}i}{336} & 0 & 0 & \frac{\sqrt{210}i}{112} & 0 & -\frac{\sqrt{14}i}{56} & 0 & -\frac{\sqrt{70}i}{112} & 0
\end{pmatrix}
$$

| 968 | symmetry | $z$ |
|-----|----------|-----|

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{M}_1^{(1,-1;a)}(A_{2g})$ | $-\frac{5\sqrt{14}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{21}}{49}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{3\sqrt{14}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{35}}{49}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{14}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{42}}{49}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{14}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{42}}{49}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{14}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{35}}{49}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{14}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{21}}{49}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{14}}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $-\frac{2\sqrt{21}}{49}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{14}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{2\sqrt{35}}{49}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{14}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $-\frac{2\sqrt{42}}{49}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{14}}{98}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{2\sqrt{42}}{49}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{14}}{98}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{35}}{49}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{14}}{98}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{21}}{49}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{14}}{98}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{14}}{14}$ |

| 969 | symmetry | $x$ |
|---|---|---|

| No. | multipole | matrix |
|-----|-----------|--------|

$$\mathbb{M}_{1,1}^{(1,-1;a)}(E_g)$$

$$
\begin{pmatrix}
0 & -\frac{\sqrt{70}}{98} & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{7} & 0 & -\frac{\sqrt{7}}{49} & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{70}}{98} & 0 & -\frac{2\sqrt{7}}{49} & 0 & 0 & 0 & 0 & \frac{\sqrt{105}}{49} & 0 & -\frac{\sqrt{21}}{49} & 0 & 0 & 0 & 0 \\
0 & -\frac{2\sqrt{7}}{49} & 0 & -\frac{3\sqrt{14}}{98} & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{49} & 0 & -\frac{\sqrt{42}}{49} & 0 & 0 & 0 \\
0 & 0 & -\frac{3\sqrt{14}}{98} & 0 & -\frac{2\sqrt{7}}{49} & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{49} & 0 & -\frac{\sqrt{70}}{49} & 0 & 0 \\
0 & 0 & 0 & -\frac{2\sqrt{7}}{49} & 0 & -\frac{\sqrt{70}}{98} & 0 & 0 & 0 & 0 & \frac{\sqrt{21}}{49} & 0 & -\frac{\sqrt{105}}{49} & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{49} & 0 & -\frac{\sqrt{3}}{7} \\
\frac{\sqrt{3}}{7} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{105}}{49} & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{14} & 0 & \frac{\sqrt{42}}{49} & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{7}}{49} & 0 & \frac{\sqrt{70}}{49} & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{49} & 0 & \frac{\sqrt{210}}{98} & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{21}}{49} & 0 & \frac{\sqrt{42}}{49} & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{98} & 0 & \frac{2\sqrt{14}}{49} & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{42}}{49} & 0 & \frac{\sqrt{21}}{49} & 0 & 0 & 0 & 0 & \frac{2\sqrt{14}}{49} & 0 & \frac{\sqrt{210}}{98} & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{70}}{49} & 0 & \frac{\sqrt{7}}{49} & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{98} & 0 & \frac{\sqrt{42}}{49} & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{105}}{49} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{49} & 0 & \frac{\sqrt{2}}{14} \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{7} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{14} & 0
\end{pmatrix}
$$

| 970 | symmetry | $-y$ |
|-----|----------|------|

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $0$ | $-\frac{\sqrt{70}i}{98}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{3}i}{7}$ | $0$ | $-\frac{\sqrt{7}i}{49}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $\frac{\sqrt{70}i}{98}$ | $0$ | $-\frac{2\sqrt{7}i}{49}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{105}i}{49}$ | $0$ | $-\frac{\sqrt{21}i}{49}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{2\sqrt{7}i}{49}$ | $0$ | $-\frac{3\sqrt{14}i}{98}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{70}i}{49}$ | $0$ | $-\frac{\sqrt{42}i}{49}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $\frac{3\sqrt{14}i}{98}$ | $0$ | $-\frac{2\sqrt{7}i}{49}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{42}i}{49}$ | $0$ | $-\frac{\sqrt{70}i}{49}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{2\sqrt{7}i}{49}$ | $0$ | $-\frac{\sqrt{70}i}{98}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{21}i}{49}$ | $0$ | $-\frac{\sqrt{105}i}{49}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{70}i}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{7}i}{49}$ | $0$ | $-\frac{\sqrt{3}i}{7}$ |
| | $\mathbb{M}_{1,2}^{(1,-1;a)}(E_g)$ | $\frac{\sqrt{3}i}{7}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{2}i}{14}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{105}i}{49}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2}i}{14}$ | $0$ | $\frac{\sqrt{42}i}{49}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $\frac{\sqrt{7}i}{49}$ | $0$ | $\frac{\sqrt{70}i}{49}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{42}i}{49}$ | $0$ | $\frac{\sqrt{210}i}{98}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{21}i}{49}$ | $0$ | $\frac{\sqrt{42}i}{49}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{210}i}{98}$ | $0$ | $\frac{2\sqrt{14}i}{49}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{42}i}{49}$ | $0$ | $\frac{\sqrt{21}i}{49}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{14}i}{49}$ | $0$ | $\frac{\sqrt{210}i}{98}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{70}i}{49}$ | $0$ | $\frac{\sqrt{7}i}{49}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{210}i}{98}$ | $0$ | $\frac{\sqrt{42}i}{49}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{105}i}{49}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{42}i}{49}$ | $0$ | $\frac{\sqrt{2}i}{14}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{3}i}{7}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2}i}{14}$ | $0$ |

| 971 | symmetry | $-\frac{z\left(3x^2+3y^2-2z^2\right)}{2}$ |

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_3^{(1,-1;a)}(A_{2g}) =
\begin{pmatrix}
\frac{\sqrt{70}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{4\sqrt{105}}{147} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{70}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{2\sqrt{70}}{245} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{210}}{147} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{2\sqrt{70}}{245} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{210}}{147} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{70}}{70} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{4\sqrt{105}}{147} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{4\sqrt{105}}{147} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{70}}{196} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{28} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{2\sqrt{210}}{147} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{70}}{196} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{2\sqrt{210}}{147} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{70}}{196} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{70}}{28} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{4\sqrt{105}}{147} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{70}}{196} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{28}
\end{pmatrix}$$

| 972 | symmetry | $\sqrt{15}\,xyz$ |
|---|---|---|

*continued ...*

Table 10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_3^{(1,-1;a)}(B_{1g})$$

$$
\begin{pmatrix}
0 & 0 & -\frac{\sqrt{105}i}{98} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{4\sqrt{35}i}{147} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{21}i}{98} & 0 & 0 & -\frac{2\sqrt{5}i}{21} & 0 & 0 & 0 & -\frac{10\sqrt{7}i}{147} & 0 & 0 & 0 \\
\frac{\sqrt{105}i}{98} & 0 & 0 & 0 & \frac{\sqrt{21}i}{98} & 0 & 0 & -\frac{\sqrt{70}i}{147} & 0 & 0 & 0 & -\frac{\sqrt{210}i}{147} & 0 & 0 \\
0 & \frac{\sqrt{21}i}{98} & 0 & 0 & 0 & \frac{\sqrt{105}i}{98} & 0 & 0 & \frac{\sqrt{210}i}{147} & 0 & 0 & 0 & \frac{\sqrt{70}i}{147} & 0 \\
0 & 0 & -\frac{\sqrt{21}i}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{10\sqrt{7}i}{147} & 0 & 0 & 0 & \frac{2\sqrt{5}i}{21} \\
0 & 0 & 0 & -\frac{\sqrt{105}i}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{4\sqrt{35}i}{147} & 0 & 0 & 0 \\
0 & \frac{2\sqrt{5}i}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{2}i}{28} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{70}i}{147} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{210}i}{196} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{210}i}{147} & 0 & 0 & -\frac{5\sqrt{2}i}{28} & 0 & 0 & 0 & \frac{\sqrt{70}i}{98} & 0 & 0 & 0 \\
\frac{4\sqrt{35}i}{147} & 0 & 0 & 0 & -\frac{10\sqrt{7}i}{147} & 0 & 0 & -\frac{3\sqrt{210}i}{196} & 0 & 0 & 0 & -\frac{\sqrt{70}i}{98} & 0 & 0 \\
0 & \frac{10\sqrt{7}i}{147} & 0 & 0 & 0 & -\frac{4\sqrt{35}i}{147} & 0 & 0 & -\frac{\sqrt{70}i}{98} & 0 & 0 & 0 & -\frac{3\sqrt{210}i}{196} & 0 \\
0 & 0 & \frac{\sqrt{210}i}{147} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}i}{98} & 0 & 0 & 0 & -\frac{5\sqrt{2}i}{28} \\
0 & 0 & 0 & -\frac{\sqrt{70}i}{147} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{210}i}{196} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{2\sqrt{5}i}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{2}i}{28} & 0 & 0 \\
\end{pmatrix}
$$

| 973 | symmetry | $\frac{\sqrt{15}z(x-y)(x+y)}{2}$ |
|---|---|---|

*continued ...*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

$\mathbb{M}_3^{(1,-1;a)}(B_{2g})$

$$
\begin{pmatrix}
0 & 0 & \frac{\sqrt{105}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{4\sqrt{35}}{147} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{21}}{98} & 0 & 0 & -\frac{2\sqrt{5}}{21} & 0 & 0 & 0 & \frac{10\sqrt{7}}{147} & 0 & 0 & 0 \\
\frac{\sqrt{105}}{98} & 0 & 0 & 0 & -\frac{\sqrt{21}}{98} & 0 & 0 & -\frac{\sqrt{70}}{147} & 0 & 0 & 0 & \frac{\sqrt{210}}{147} & 0 & 0 \\
0 & \frac{\sqrt{21}}{98} & 0 & 0 & 0 & -\frac{\sqrt{105}}{98} & 0 & 0 & \frac{\sqrt{210}}{147} & 0 & 0 & 0 & -\frac{\sqrt{70}}{147} & 0 \\
0 & 0 & -\frac{\sqrt{21}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{10\sqrt{7}}{147} & 0 & 0 & 0 & -\frac{2\sqrt{5}}{21} \\
0 & 0 & 0 & -\frac{\sqrt{105}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{4\sqrt{35}}{147} & 0 & 0 & 0 \\
0 & -\frac{2\sqrt{5}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{2}}{28} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{70}}{147} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{210}}{196} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{210}}{147} & 0 & 0 & -\frac{5\sqrt{2}}{28} & 0 & 0 & 0 & -\frac{\sqrt{70}}{98} & 0 & 0 & 0 \\
\frac{4\sqrt{35}}{147} & 0 & 0 & 0 & \frac{10\sqrt{7}}{147} & 0 & 0 & -\frac{3\sqrt{210}}{196} & 0 & 0 & 0 & \frac{\sqrt{70}}{98} & 0 & 0 \\
0 & \frac{10\sqrt{7}}{147} & 0 & 0 & 0 & \frac{4\sqrt{35}}{147} & 0 & 0 & -\frac{\sqrt{70}}{98} & 0 & 0 & 0 & \frac{3\sqrt{210}}{196} & 0 \\
0 & 0 & \frac{\sqrt{210}}{147} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{98} & 0 & 0 & 0 & \frac{5\sqrt{2}}{28} \\
0 & 0 & 0 & -\frac{\sqrt{70}}{147} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{210}}{196} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{2\sqrt{5}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{2}}{28} & 0 & 0 \\
\end{pmatrix}
$$

| 974 | symmetry | $\frac{x\left(2x^2-3y^2-3z^2\right)}{2}$ |
|---|---|---|

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|-----|-----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{M}_{3,1}^{(1,-1;a)}(E_g,1)$ | $0$ | $-\frac{3\sqrt{14}}{196}$ | $0$ | $\frac{5\sqrt{7}}{196}$ | $0$ | $0$ | $\frac{\sqrt{15}}{42}$ | $0$ | $-\frac{\sqrt{35}}{49}$ | $0$ | $\frac{5\sqrt{21}}{294}$ | $0$ | $0$ | $0$ |
| | | $-\frac{3\sqrt{14}}{196}$ | $0$ | $\frac{3\sqrt{35}}{980}$ | $0$ | $\frac{\sqrt{70}}{98}$ | $0$ | $0$ | $-\frac{5\sqrt{21}}{294}$ | $0$ | $-\frac{\sqrt{105}}{147}$ | $0$ | $\frac{5\sqrt{7}}{98}$ | $0$ | $0$ |
| | | $0$ | $\frac{3\sqrt{35}}{980}$ | $0$ | $\frac{3\sqrt{70}}{490}$ | $0$ | $\frac{5\sqrt{7}}{196}$ | $-\frac{5\sqrt{6}}{84}$ | $0$ | $-\frac{5\sqrt{14}}{196}$ | $0$ | $\frac{\sqrt{210}}{588}$ | $0$ | $\frac{5\sqrt{42}}{196}$ | $0$ |
| | | $\frac{5\sqrt{7}}{196}$ | $0$ | $\frac{3\sqrt{70}}{490}$ | $0$ | $\frac{3\sqrt{35}}{980}$ | $0$ | $0$ | $-\frac{5\sqrt{42}}{196}$ | $0$ | $-\frac{\sqrt{210}}{588}$ | $0$ | $\frac{5\sqrt{14}}{196}$ | $0$ | $\frac{5\sqrt{6}}{84}$ |
| | | $0$ | $\frac{\sqrt{70}}{98}$ | $0$ | $\frac{3\sqrt{35}}{980}$ | $0$ | $-\frac{3\sqrt{14}}{196}$ | $0$ | $0$ | $-\frac{5\sqrt{7}}{98}$ | $0$ | $\frac{\sqrt{105}}{147}$ | $0$ | $\frac{5\sqrt{21}}{294}$ | $0$ |
| | | $0$ | $0$ | $\frac{5\sqrt{7}}{196}$ | $0$ | $-\frac{3\sqrt{14}}{196}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{21}}{294}$ | $0$ | $\frac{\sqrt{35}}{49}$ | $0$ | $-\frac{\sqrt{15}}{42}$ |
| | | $\frac{\sqrt{15}}{42}$ | $0$ | $-\frac{5\sqrt{6}}{84}$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{10}}{56}$ | $0$ | $-\frac{5\sqrt{2}}{56}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{5\sqrt{21}}{294}$ | $0$ | $-\frac{5\sqrt{42}}{196}$ | $0$ | $0$ | $\frac{3\sqrt{10}}{56}$ | $0$ | $\frac{\sqrt{210}}{392}$ | $0$ | $-\frac{5\sqrt{14}}{98}$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{35}}{49}$ | $0$ | $-\frac{5\sqrt{14}}{196}$ | $0$ | $-\frac{5\sqrt{7}}{98}$ | $0$ | $0$ | $\frac{\sqrt{210}}{392}$ | $0$ | $-\frac{5\sqrt{42}}{392}$ | $0$ | $-\frac{5\sqrt{70}}{196}$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{105}}{147}$ | $0$ | $-\frac{\sqrt{210}}{588}$ | $0$ | $-\frac{5\sqrt{21}}{294}$ | $-\frac{5\sqrt{2}}{56}$ | $0$ | $-\frac{5\sqrt{42}}{392}$ | $0$ | $-\frac{3\sqrt{70}}{196}$ | $0$ | $-\frac{5\sqrt{14}}{98}$ | $0$ |
| | | $\frac{5\sqrt{21}}{294}$ | $0$ | $\frac{\sqrt{210}}{588}$ | $0$ | $\frac{\sqrt{105}}{147}$ | $0$ | $0$ | $-\frac{5\sqrt{14}}{98}$ | $0$ | $-\frac{3\sqrt{70}}{196}$ | $0$ | $-\frac{5\sqrt{42}}{392}$ | $0$ | $-\frac{5\sqrt{2}}{56}$ |
| | | $0$ | $\frac{5\sqrt{7}}{98}$ | $0$ | $\frac{5\sqrt{14}}{196}$ | $0$ | $\frac{\sqrt{35}}{49}$ | $0$ | $0$ | $-\frac{5\sqrt{70}}{196}$ | $0$ | $-\frac{5\sqrt{42}}{392}$ | $0$ | $\frac{\sqrt{210}}{392}$ | $0$ |
| | | $0$ | $0$ | $\frac{5\sqrt{42}}{196}$ | $0$ | $\frac{5\sqrt{21}}{294}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{14}}{98}$ | $0$ | $\frac{\sqrt{210}}{392}$ | $0$ | $\frac{3\sqrt{10}}{56}$ |
| | | $0$ | $0$ | $0$ | $\frac{5\sqrt{6}}{84}$ | $0$ | $-\frac{\sqrt{15}}{42}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{2}}{56}$ | $0$ | $\frac{3\sqrt{10}}{56}$ | $0$ |
| 975 | symmetry | $\frac{y(3x^2-2y^2+3z^2)}{2}$ | | | | | | | | | | | | | |

*continued …*

Table 10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_{3,2}^{(1,-1;a)}(E_g,1)$$

$$
\begin{pmatrix}
0 & -\frac{3\sqrt{14}i}{196} & 0 & -\frac{5\sqrt{7}i}{196} & 0 & 0 & -\frac{\sqrt{15}i}{42} & 0 & -\frac{\sqrt{35}i}{49} & 0 & -\frac{5\sqrt{21}i}{294} & 0 & 0 & 0 \\
\frac{3\sqrt{14}i}{196} & 0 & \frac{3\sqrt{35}i}{980} & 0 & -\frac{\sqrt{70}i}{98} & 0 & 0 & \frac{5\sqrt{21}i}{294} & 0 & -\frac{\sqrt{105}i}{147} & 0 & -\frac{5\sqrt{7}i}{98} & 0 & 0 \\
0 & -\frac{3\sqrt{35}i}{980} & 0 & \frac{3\sqrt{70}i}{490} & 0 & -\frac{5\sqrt{7}i}{196} & -\frac{5\sqrt{6}i}{84} & 0 & \frac{5\sqrt{14}i}{196} & 0 & \frac{\sqrt{210}i}{588} & 0 & -\frac{5\sqrt{42}i}{196} & 0 \\
\frac{5\sqrt{7}i}{196} & 0 & -\frac{3\sqrt{70}i}{490} & 0 & \frac{3\sqrt{35}i}{980} & 0 & 0 & -\frac{5\sqrt{42}i}{196} & 0 & \frac{\sqrt{210}i}{588} & 0 & \frac{5\sqrt{14}i}{196} & 0 & -\frac{5\sqrt{6}i}{84} \\
0 & \frac{\sqrt{70}i}{98} & 0 & -\frac{3\sqrt{35}i}{980} & 0 & -\frac{3\sqrt{14}i}{196} & 0 & 0 & -\frac{5\sqrt{7}i}{98} & 0 & -\frac{\sqrt{105}i}{147} & 0 & \frac{5\sqrt{21}i}{294} & 0 \\
0 & 0 & \frac{5\sqrt{7}i}{196} & 0 & \frac{3\sqrt{14}i}{196} & 0 & 0 & 0 & 0 & -\frac{5\sqrt{21}i}{294} & 0 & -\frac{\sqrt{35}i}{49} & 0 & -\frac{\sqrt{15}i}{42} \\
\frac{\sqrt{15}i}{42} & 0 & \frac{5\sqrt{6}i}{84} & 0 & 0 & 0 & 0 & \frac{3\sqrt{10}i}{56} & 0 & \frac{5\sqrt{2}i}{56} & 0 & 0 & 0 & 0 \\
0 & -\frac{5\sqrt{21}i}{294} & 0 & \frac{5\sqrt{42}i}{196} & 0 & 0 & -\frac{3\sqrt{10}i}{56} & 0 & \frac{\sqrt{210}i}{392} & 0 & \frac{5\sqrt{14}i}{98} & 0 & 0 & 0 \\
\frac{\sqrt{35}i}{49} & 0 & -\frac{5\sqrt{14}i}{196} & 0 & \frac{5\sqrt{7}i}{98} & 0 & 0 & -\frac{\sqrt{210}i}{392} & 0 & -\frac{5\sqrt{42}i}{392} & 0 & \frac{5\sqrt{70}i}{196} & 0 & 0 \\
0 & \frac{\sqrt{105}i}{147} & 0 & -\frac{\sqrt{210}i}{588} & 0 & \frac{5\sqrt{21}i}{294} & -\frac{5\sqrt{2}i}{56} & 0 & \frac{5\sqrt{42}i}{392} & 0 & -\frac{3\sqrt{70}i}{196} & 0 & \frac{5\sqrt{14}i}{98} & 0 \\
\frac{5\sqrt{21}i}{294} & 0 & -\frac{\sqrt{210}i}{588} & 0 & \frac{\sqrt{105}i}{147} & 0 & 0 & -\frac{5\sqrt{14}i}{98} & 0 & \frac{3\sqrt{70}i}{196} & 0 & -\frac{5\sqrt{42}i}{392} & 0 & \frac{5\sqrt{2}i}{56} \\
0 & \frac{5\sqrt{7}i}{98} & 0 & -\frac{5\sqrt{14}i}{196} & 0 & \frac{\sqrt{35}i}{49} & 0 & 0 & -\frac{5\sqrt{70}i}{196} & 0 & \frac{5\sqrt{42}i}{392} & 0 & \frac{\sqrt{210}i}{392} & 0 \\
0 & 0 & \frac{5\sqrt{42}i}{196} & 0 & -\frac{5\sqrt{21}i}{294} & 0 & 0 & 0 & 0 & -\frac{5\sqrt{14}i}{98} & 0 & -\frac{\sqrt{210}i}{392} & 0 & \frac{3\sqrt{10}i}{56} \\
0 & 0 & 0 & \frac{5\sqrt{6}i}{84} & 0 & \frac{\sqrt{15}i}{42} & 0 & 0 & 0 & 0 & -\frac{5\sqrt{2}i}{56} & 0 & -\frac{3\sqrt{10}i}{56} & 0
\end{pmatrix}
$$

| 976 | symmetry | $\frac{\sqrt{15}x(y-z)(y+z)}{2}$ |
|---|---|---|

*continued ...*

Table 10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_{3,1}^{(1,-1;a)}(E_g,2)$$

$$
\begin{pmatrix}
0 & -\frac{\sqrt{210}}{196} & 0 & -\frac{\sqrt{105}}{196} & 0 & 0 & \frac{5}{42} & 0 & -\frac{5\sqrt{21}}{147} & 0 & -\frac{\sqrt{35}}{98} & 0 & 0 & 0 \\
-\frac{\sqrt{210}}{196} & 0 & \frac{\sqrt{21}}{196} & 0 & -\frac{\sqrt{42}}{98} & 0 & 0 & -\frac{5\sqrt{35}}{294} & 0 & -\frac{5\sqrt{7}}{147} & 0 & -\frac{\sqrt{105}}{98} & 0 & 0 \\
0 & \frac{\sqrt{21}}{196} & 0 & \frac{\sqrt{42}}{98} & 0 & -\frac{\sqrt{105}}{196} & \frac{\sqrt{10}}{28} & 0 & -\frac{5\sqrt{210}}{588} & 0 & \frac{5\sqrt{14}}{588} & 0 & -\frac{3\sqrt{70}}{196} & 0 \\
-\frac{\sqrt{105}}{196} & 0 & \frac{\sqrt{42}}{98} & 0 & \frac{\sqrt{21}}{196} & 0 & 0 & \frac{3\sqrt{70}}{196} & 0 & -\frac{5\sqrt{14}}{588} & 0 & \frac{5\sqrt{210}}{588} & 0 & -\frac{\sqrt{10}}{28} \\
0 & -\frac{\sqrt{42}}{98} & 0 & \frac{\sqrt{21}}{196} & 0 & -\frac{\sqrt{210}}{196} & 0 & 0 & \frac{\sqrt{105}}{98} & 0 & \frac{5\sqrt{7}}{147} & 0 & \frac{5\sqrt{35}}{294} & 0 \\
0 & 0 & -\frac{\sqrt{105}}{196} & 0 & -\frac{\sqrt{210}}{196} & 0 & 0 & 0 & 0 & \frac{\sqrt{35}}{98} & 0 & \frac{5\sqrt{21}}{147} & 0 & -\frac{5}{42} \\
\frac{5}{42} & 0 & \frac{\sqrt{10}}{28} & 0 & 0 & 0 & 0 & \frac{5\sqrt{6}}{56} & 0 & \frac{\sqrt{30}}{56} & 0 & 0 & 0 & 0 \\
0 & -\frac{5\sqrt{35}}{294} & 0 & \frac{3\sqrt{70}}{196} & 0 & 0 & \frac{5\sqrt{6}}{56} & 0 & \frac{5\sqrt{14}}{392} & 0 & \frac{\sqrt{210}}{98} & 0 & 0 & 0 \\
-\frac{5\sqrt{21}}{147} & 0 & -\frac{5\sqrt{210}}{588} & 0 & \frac{\sqrt{105}}{98} & 0 & 0 & \frac{5\sqrt{14}}{392} & 0 & -\frac{5\sqrt{70}}{392} & 0 & \frac{5\sqrt{42}}{196} & 0 & 0 \\
0 & -\frac{5\sqrt{7}}{147} & 0 & -\frac{5\sqrt{14}}{588} & 0 & \frac{\sqrt{35}}{98} & \frac{\sqrt{30}}{56} & 0 & -\frac{5\sqrt{70}}{392} & 0 & -\frac{5\sqrt{42}}{196} & 0 & \frac{\sqrt{210}}{98} & 0 \\
-\frac{\sqrt{35}}{98} & 0 & \frac{5\sqrt{14}}{588} & 0 & \frac{5\sqrt{7}}{147} & 0 & 0 & \frac{\sqrt{210}}{98} & 0 & -\frac{5\sqrt{42}}{196} & 0 & -\frac{5\sqrt{70}}{392} & 0 & \frac{\sqrt{30}}{56} \\
0 & -\frac{\sqrt{105}}{98} & 0 & \frac{5\sqrt{210}}{588} & 0 & \frac{5\sqrt{21}}{147} & 0 & 0 & \frac{5\sqrt{42}}{196} & 0 & -\frac{5\sqrt{70}}{392} & 0 & \frac{5\sqrt{14}}{392} & 0 \\
0 & 0 & -\frac{3\sqrt{70}}{196} & 0 & \frac{5\sqrt{35}}{294} & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{98} & 0 & \frac{5\sqrt{14}}{392} & 0 & \frac{5\sqrt{6}}{56} \\
0 & 0 & 0 & -\frac{\sqrt{10}}{28} & 0 & -\frac{5}{42} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{56} & 0 & \frac{5\sqrt{6}}{56} & 0
\end{pmatrix}
$$

| 977 | symmetry | $-\frac{\sqrt{15}\,y(x-z)(x+z)}{2}$ |

*continued …*

Table 10

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_{3,2}^{(1,-1;a)}(E_g,2)$

$$
\begin{bmatrix}
0 & -\frac{\sqrt{210}i}{196} & 0 & \frac{\sqrt{105}i}{196} & 0 & 0 & -\frac{5i}{42} & 0 & -\frac{5\sqrt{21}i}{147} & 0 & \frac{\sqrt{35}i}{98} & 0 & 0 & 0 \\
\frac{\sqrt{210}i}{196} & 0 & \frac{\sqrt{21}i}{196} & 0 & \frac{\sqrt{42}i}{98} & 0 & 0 & \frac{5\sqrt{35}i}{294} & 0 & -\frac{5\sqrt{7}i}{147} & 0 & \frac{\sqrt{105}i}{98} & 0 & 0 \\
0 & -\frac{\sqrt{21}i}{196} & 0 & \frac{\sqrt{42}i}{98} & 0 & \frac{\sqrt{105}i}{196} & \frac{\sqrt{10}i}{28} & 0 & \frac{5\sqrt{210}i}{588} & 0 & \frac{5\sqrt{14}i}{588} & 0 & \frac{3\sqrt{70}i}{196} & 0 \\
-\frac{\sqrt{105}i}{196} & 0 & -\frac{\sqrt{42}i}{98} & 0 & \frac{\sqrt{21}i}{196} & 0 & 0 & \frac{3\sqrt{70}i}{196} & 0 & \frac{5\sqrt{14}i}{588} & 0 & \frac{5\sqrt{210}i}{588} & 0 & \frac{\sqrt{10}i}{28} \\
0 & -\frac{\sqrt{42}i}{98} & 0 & -\frac{\sqrt{21}i}{196} & 0 & -\frac{\sqrt{210}i}{196} & 0 & 0 & \frac{\sqrt{105}i}{98} & 0 & -\frac{5\sqrt{7}i}{147} & 0 & \frac{5\sqrt{35}i}{294} & 0 \\
0 & 0 & -\frac{\sqrt{105}i}{196} & 0 & \frac{\sqrt{210}i}{196} & 0 & 0 & 0 & 0 & \frac{\sqrt{35}i}{98} & 0 & -\frac{5\sqrt{21}i}{147} & 0 & -\frac{5i}{42} \\
\frac{5i}{42} & 0 & -\frac{\sqrt{10}i}{28} & 0 & 0 & 0 & 0 & \frac{5\sqrt{6}i}{56} & 0 & -\frac{\sqrt{30}i}{56} & 0 & 0 & 0 & 0 \\
0 & -\frac{5\sqrt{35}i}{294} & 0 & -\frac{3\sqrt{70}i}{196} & 0 & 0 & -\frac{5\sqrt{6}i}{56} & 0 & \frac{5\sqrt{14}i}{392} & 0 & -\frac{\sqrt{210}i}{98} & 0 & 0 & 0 \\
\frac{5\sqrt{21}i}{147} & 0 & -\frac{5\sqrt{210}i}{588} & 0 & -\frac{\sqrt{105}i}{98} & 0 & 0 & -\frac{5\sqrt{14}i}{392} & 0 & -\frac{5\sqrt{70}i}{392} & 0 & -\frac{5\sqrt{42}i}{196} & 0 & 0 \\
0 & \frac{5\sqrt{7}i}{147} & 0 & -\frac{5\sqrt{14}i}{588} & 0 & -\frac{\sqrt{35}i}{98} & \frac{\sqrt{30}i}{56} & 0 & \frac{5\sqrt{70}i}{392} & 0 & -\frac{5\sqrt{42}i}{196} & 0 & -\frac{\sqrt{210}i}{98} & 0 \\
-\frac{\sqrt{35}i}{98} & 0 & -\frac{5\sqrt{14}i}{588} & 0 & \frac{5\sqrt{7}i}{147} & 0 & 0 & \frac{\sqrt{210}i}{98} & 0 & \frac{5\sqrt{42}i}{196} & 0 & -\frac{5\sqrt{70}i}{392} & 0 & -\frac{\sqrt{30}i}{56} \\
0 & -\frac{\sqrt{105}i}{98} & 0 & -\frac{5\sqrt{210}i}{588} & 0 & \frac{5\sqrt{21}i}{147} & 0 & 0 & \frac{5\sqrt{42}i}{196} & 0 & \frac{5\sqrt{70}i}{392} & 0 & \frac{5\sqrt{14}i}{392} & 0 \\
0 & 0 & -\frac{3\sqrt{70}i}{196} & 0 & -\frac{5\sqrt{35}i}{294} & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{98} & 0 & -\frac{5\sqrt{14}i}{392} & 0 & \frac{5\sqrt{6}i}{56} \\
0 & 0 & 0 & -\frac{\sqrt{10}i}{28} & 0 & \frac{5i}{42} & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{56} & 0 & -\frac{5\sqrt{6}i}{56} & 0
\end{bmatrix}
$$

| 978 | symmetry | $\frac{3\sqrt{35}xyz(x-y)(x+y)}{2}$ |
|---|---|---|

*continued …*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

$\mathbb{M}_5^{(1,-1;a)}(A_{1g})$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & \frac{\sqrt{55}i}{154} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{22}i}{77} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{55}i}{154} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{330}i}{385} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{1155}i}{385} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt{1155}i}{385} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{55}i}{154} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{330}i}{385} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{55}i}{154} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{22}i}{77} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{2\sqrt{1155}i}{385} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{385}i}{154} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{330}i}{385} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{33}i}{154} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{22}i}{77} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{33}i}{154} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{385}i}{154} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{385}i}{154} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{3\sqrt{22}i}{77} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{33}i}{154} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{330}i}{385} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{33}i}{154} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{2\sqrt{1155}i}{385} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{385}i}{154} & 0 & 0 & 0 & 0
\end{pmatrix}$$

| 979 | symmetry | $\dfrac{z\left(15x^4+30x^2y^2-40x^2z^2+15y^4-40y^2z^2+8z^4\right)}{8}$ |
|---|---|---|

*continued ...*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{M}_5^{(1,-1;a)}(A_{2g},1)$ | $-\frac{\sqrt{385}}{3234}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2310}}{539}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{5\sqrt{385}}{3234}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{9\sqrt{154}}{539}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $-\frac{5\sqrt{385}}{1617}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{1155}}{539}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{5\sqrt{385}}{1617}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{1155}}{539}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{385}}{3234}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{9\sqrt{154}}{539}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{385}}{3234}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2310}}{539}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{385}}{154}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{2310}}{539}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{23\sqrt{385}}{1078}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{9\sqrt{154}}{539}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{17\sqrt{385}}{1078}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $-\frac{2\sqrt{1155}}{539}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{15\sqrt{385}}{1078}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{2\sqrt{1155}}{539}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{15\sqrt{385}}{1078}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $\frac{9\sqrt{154}}{539}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{17\sqrt{385}}{1078}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2310}}{539}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{23\sqrt{385}}{1078}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{385}}{154}$ |

| 980 | symmetry | $\frac{3\sqrt{35}z\left(x^2-2xy-y^2\right)\left(x^2+2xy-y^2\right)}{8}$ |

438

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{M}_5^{(1,-1;a)}(A_{2g},2)$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{55}}{154}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{22}}{77}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{55}}{154}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{330}}{385}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{2\sqrt{1155}}{385}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{2\sqrt{1155}}{385}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{55}}{154}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{330}}{385}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{55}}{154}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{22}}{77}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{2\sqrt{1155}}{385}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{385}}{154}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{330}}{385}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{33}}{154}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{22}}{77}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{33}}{154}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{385}}{154}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{385}}{154}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $-\frac{3\sqrt{22}}{77}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{33}}{154}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{330}}{385}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{33}}{154}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $\frac{2\sqrt{1155}}{385}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{385}}{154}$ | $0$ | $0$ | $0$ | $0$ |
| 981 | symmetry | $\frac{\sqrt{105}xyz\left(x^2+y^2-2z^2\right)}{2}$ | | | | | | | | | | | | | | |

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{M}_5^{(1,-1;a)}(B_{1g})$ | $0$ | $0$ | $-\frac{\sqrt{330}i}{924}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{110}i}{77}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{5\sqrt{66}i}{924}$ | $0$ | $0$ | $-\frac{\sqrt{770}i}{385}$ | $0$ | $0$ | $0$ | $\frac{2\sqrt{22}i}{77}$ | $0$ | $0$ | $0$ |
| | | $\frac{\sqrt{330}i}{924}$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{66}i}{924}$ | $0$ | $0$ | $\frac{8\sqrt{55}i}{385}$ | $0$ | $0$ | $0$ | $\frac{2\sqrt{165}i}{385}$ | $0$ | $0$ |
| | | $0$ | $-\frac{5\sqrt{66}i}{924}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{330}i}{924}$ | $0$ | $0$ | $-\frac{2\sqrt{165}i}{385}$ | $0$ | $0$ | $0$ | $-\frac{8\sqrt{55}i}{385}$ | $0$ |
| | | $0$ | $0$ | $\frac{5\sqrt{66}i}{924}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{22}i}{77}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{770}i}{385}$ |
| | | $0$ | $0$ | $0$ | $-\frac{\sqrt{330}i}{924}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{110}i}{77}$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{770}i}{385}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{77}i}{154}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $-\frac{8\sqrt{55}i}{385}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{165}i}{154}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{2\sqrt{165}i}{385}$ | $0$ | $0$ | $-\frac{5\sqrt{77}i}{154}$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{55}i}{77}$ | $0$ | $0$ | $0$ |
| | | $\frac{\sqrt{110}i}{77}$ | $0$ | $0$ | $0$ | $\frac{2\sqrt{22}i}{77}$ | $0$ | $0$ | $\frac{3\sqrt{165}i}{154}$ | $0$ | $0$ | $0$ | $\frac{2\sqrt{55}i}{77}$ | $0$ | $0$ |
| | | $0$ | $-\frac{2\sqrt{22}i}{77}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{110}i}{77}$ | $0$ | $0$ | $\frac{2\sqrt{55}i}{77}$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{165}i}{154}$ | $0$ |
| | | $0$ | $0$ | $-\frac{2\sqrt{165}i}{385}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{55}i}{77}$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{77}i}{154}$ |
| | | $0$ | $0$ | $0$ | $\frac{8\sqrt{55}i}{385}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{165}i}{154}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{770}i}{385}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{77}i}{154}$ | $0$ | $0$ |
| 982 | symmetry | $-\frac{\sqrt{105}z(x-y)(x+y)\left(x^2+y^2-2z^2\right)}{4}$ | | | | | | | | | | | | | | |

Table 10

| No. | multipole | matrix | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

$\mathbb{M}_5^{(1,-1;a)}(B_{2g})$

$$\begin{pmatrix}
0 & 0 & -\frac{\sqrt{330}}{924} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{110}}{77} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{5\sqrt{66}}{924} & 0 & 0 & \frac{\sqrt{770}}{385} & 0 & 0 & 0 & \frac{2\sqrt{22}}{77} & 0 & 0 & 0 \\
-\frac{\sqrt{330}}{924} & 0 & 0 & 0 & -\frac{5\sqrt{66}}{924} & 0 & 0 & -\frac{8\sqrt{55}}{385} & 0 & 0 & 0 & \frac{2\sqrt{165}}{385} & 0 & 0 \\
0 & \frac{5\sqrt{66}}{924} & 0 & 0 & 0 & \frac{\sqrt{330}}{924} & 0 & 0 & \frac{2\sqrt{165}}{385} & 0 & 0 & 0 & -\frac{8\sqrt{55}}{385} & 0 \\
0 & 0 & -\frac{5\sqrt{66}}{924} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt{22}}{77} & 0 & 0 & 0 & \frac{\sqrt{770}}{385} \\
0 & 0 & 0 & \frac{\sqrt{330}}{924} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{110}}{77} & 0 & 0 & 0 \\
0 & \frac{\sqrt{770}}{385} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{77}}{154} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{8\sqrt{55}}{385} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{165}}{154} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{2\sqrt{165}}{385} & 0 & 0 & \frac{5\sqrt{77}}{154} & 0 & 0 & 0 & -\frac{2\sqrt{55}}{77} & 0 & 0 & 0 \\
-\frac{\sqrt{110}}{77} & 0 & 0 & 0 & \frac{2\sqrt{22}}{77} & 0 & 0 & -\frac{3\sqrt{165}}{154} & 0 & 0 & 0 & \frac{2\sqrt{55}}{77} & 0 & 0 \\
0 & \frac{2\sqrt{22}}{77} & 0 & 0 & 0 & -\frac{\sqrt{110}}{77} & 0 & 0 & -\frac{2\sqrt{55}}{77} & 0 & 0 & 0 & \frac{3\sqrt{165}}{154} & 0 \\
0 & 0 & \frac{2\sqrt{165}}{385} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt{55}}{77} & 0 & 0 & 0 & -\frac{5\sqrt{77}}{154} \\
0 & 0 & 0 & -\frac{8\sqrt{55}}{385} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{165}}{154} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{770}}{385} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{77}}{154} & 0 & 0
\end{pmatrix}$$

| 983 | symmetry | $\dfrac{x\left(8x^4-40x^2y^2-40x^2z^2+15y^4+30y^2z^2+15z^4\right)}{8}$ |
|---|---|---|

Table 10

| No. | multipole | matrix |
|---|---|---|

$$
\mathbb{M}_{5,1}^{(1,-1;a)}(E_g,1)
$$

$$
\begin{pmatrix}
0 & -\frac{5\sqrt{77}}{8624} & 0 & \frac{5\sqrt{154}}{3696} & 0 & -\frac{3\sqrt{385}}{1232} & \frac{\sqrt{330}}{1232} & 0 & -\frac{15\sqrt{770}}{8624} & 0 & \frac{5\sqrt{462}}{1232} & 0 & -\frac{3\sqrt{2310}}{1232} & 0 \\
-\frac{5\sqrt{77}}{8624} & 0 & \frac{5\sqrt{770}}{8624} & 0 & -\frac{5\sqrt{385}}{3696} & 0 & 0 & -\frac{23\sqrt{462}}{8624} & 0 & \frac{13\sqrt{2310}}{8624} & 0 & -\frac{3\sqrt{154}}{1232} & 0 & -\frac{3\sqrt{66}}{176} \\
0 & \frac{5\sqrt{770}}{8624} & 0 & -\frac{5\sqrt{385}}{4312} & 0 & \frac{5\sqrt{154}}{3696} & -\frac{\sqrt{33}}{88} & 0 & \frac{3\sqrt{77}}{392} & 0 & -\frac{\sqrt{1155}}{4312} & 0 & -\frac{3\sqrt{231}}{616} & 0 \\
\frac{5\sqrt{154}}{3696} & 0 & -\frac{5\sqrt{385}}{4312} & 0 & \frac{5\sqrt{770}}{8624} & 0 & 0 & \frac{3\sqrt{231}}{616} & 0 & \frac{\sqrt{1155}}{4312} & 0 & -\frac{3\sqrt{77}}{392} & 0 & \frac{\sqrt{33}}{88} \\
0 & -\frac{5\sqrt{385}}{3696} & 0 & \frac{5\sqrt{770}}{8624} & 0 & -\frac{5\sqrt{77}}{8624} & \frac{3\sqrt{66}}{176} & 0 & \frac{3\sqrt{154}}{1232} & 0 & -\frac{13\sqrt{2310}}{8624} & 0 & \frac{23\sqrt{462}}{8624} & 0 \\
-\frac{3\sqrt{385}}{1232} & 0 & \frac{5\sqrt{154}}{3696} & 0 & -\frac{5\sqrt{77}}{8624} & 0 & 0 & \frac{3\sqrt{2310}}{1232} & 0 & -\frac{5\sqrt{462}}{1232} & 0 & \frac{15\sqrt{770}}{8624} & 0 & -\frac{\sqrt{330}}{1232} \\
\frac{\sqrt{330}}{1232} & 0 & -\frac{\sqrt{33}}{88} & 0 & \frac{3\sqrt{66}}{176} & 0 & 0 & \frac{15\sqrt{55}}{1232} & 0 & -\frac{5\sqrt{11}}{88} & 0 & \frac{3\sqrt{165}}{176} & 0 & 0 \\
0 & -\frac{23\sqrt{462}}{8624} & 0 & \frac{3\sqrt{231}}{616} & 0 & \frac{3\sqrt{2310}}{1232} & \frac{15\sqrt{55}}{1232} & 0 & -\frac{5\sqrt{1155}}{1078} & 0 & \frac{5\sqrt{77}}{1232} & 0 & \frac{9\sqrt{385}}{616} & 0 \\
-\frac{15\sqrt{770}}{8624} & 0 & \frac{3\sqrt{77}}{392} & 0 & \frac{3\sqrt{154}}{1232} & 0 & 0 & -\frac{5\sqrt{1155}}{1078} & 0 & \frac{5\sqrt{231}}{8624} & 0 & \frac{5\sqrt{385}}{616} & 0 & \frac{3\sqrt{165}}{176} \\
0 & \frac{13\sqrt{2310}}{8624} & 0 & \frac{\sqrt{1155}}{4312} & 0 & -\frac{5\sqrt{462}}{1232} & -\frac{5\sqrt{11}}{88} & 0 & \frac{5\sqrt{231}}{8624} & 0 & \frac{15\sqrt{385}}{2156} & 0 & \frac{5\sqrt{77}}{1232} & 0 \\
\frac{5\sqrt{462}}{1232} & 0 & -\frac{\sqrt{1155}}{4312} & 0 & -\frac{13\sqrt{2310}}{8624} & 0 & 0 & \frac{5\sqrt{77}}{1232} & 0 & \frac{15\sqrt{385}}{2156} & 0 & \frac{5\sqrt{231}}{8624} & 0 & -\frac{5\sqrt{11}}{88} \\
0 & -\frac{3\sqrt{154}}{1232} & 0 & -\frac{3\sqrt{77}}{392} & 0 & \frac{15\sqrt{770}}{8624} & \frac{3\sqrt{165}}{176} & 0 & \frac{5\sqrt{385}}{616} & 0 & \frac{5\sqrt{231}}{8624} & 0 & -\frac{5\sqrt{1155}}{1078} & 0 \\
-\frac{3\sqrt{2310}}{1232} & 0 & -\frac{3\sqrt{231}}{616} & 0 & \frac{23\sqrt{462}}{8624} & 0 & 0 & \frac{9\sqrt{385}}{616} & 0 & \frac{5\sqrt{77}}{1232} & 0 & -\frac{5\sqrt{1155}}{1078} & 0 & \frac{15\sqrt{55}}{1232} \\
0 & -\frac{3\sqrt{66}}{176} & 0 & \frac{\sqrt{33}}{88} & 0 & -\frac{\sqrt{330}}{1232} & 0 & 0 & \frac{3\sqrt{165}}{176} & 0 & -\frac{5\sqrt{11}}{88} & 0 & \frac{15\sqrt{55}}{1232} & 0
\end{pmatrix}
$$

| 984 | symmetry | $-\dfrac{y\left(15x^4-40x^2y^2+30x^2z^2+8y^4-40y^2z^2+15z^4\right)}{8}$ |

Table 10

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{M}_{5,2}^{(1,-1;a)}(E_g,1)$ | $\begin{pmatrix} 0 & -\frac{5\sqrt{77}i}{8624} & 0 & -\frac{5\sqrt{154}i}{3696} & 0 & -\frac{3\sqrt{385}i}{1232} & -\frac{\sqrt{330}i}{1232} & 0 & -\frac{15\sqrt{770}i}{8624} & 0 & -\frac{5\sqrt{462}i}{1232} & 0 & -\frac{3\sqrt{2310}i}{1232} & 0 \\ \frac{5\sqrt{77}i}{8624} & 0 & \frac{5\sqrt{770}i}{8624} & 0 & \frac{5\sqrt{385}i}{3696} & 0 & 0 & \frac{23\sqrt{462}i}{8624} & 0 & \frac{13\sqrt{2310}i}{8624} & 0 & \frac{3\sqrt{154}i}{1232} & 0 & -\frac{3\sqrt{66}i}{176} \\ 0 & -\frac{5\sqrt{770}i}{8624} & 0 & -\frac{5\sqrt{385}i}{4312} & 0 & -\frac{5\sqrt{154}i}{3696} & -\frac{\sqrt{33}i}{88} & 0 & -\frac{3\sqrt{77}i}{392} & 0 & -\frac{\sqrt{1155}i}{4312} & 0 & \frac{3\sqrt{231}i}{616} & 0 \\ \frac{5\sqrt{154}i}{3696} & 0 & \frac{5\sqrt{385}i}{4312} & 0 & \frac{5\sqrt{770}i}{8624} & 0 & 0 & \frac{3\sqrt{231}i}{616} & 0 & -\frac{\sqrt{1155}i}{4312} & 0 & -\frac{3\sqrt{77}i}{392} & 0 & -\frac{\sqrt{33}i}{88} \\ 0 & -\frac{5\sqrt{385}i}{3696} & 0 & -\frac{5\sqrt{770}i}{8624} & 0 & -\frac{5\sqrt{77}i}{8624} & -\frac{3\sqrt{66}i}{176} & 0 & \frac{3\sqrt{154}i}{1232} & 0 & \frac{13\sqrt{2310}i}{8624} & 0 & \frac{23\sqrt{462}i}{8624} & 0 \\ \frac{3\sqrt{385}i}{1232} & 0 & \frac{5\sqrt{154}i}{3696} & 0 & \frac{5\sqrt{77}i}{8624} & 0 & 0 & -\frac{3\sqrt{2310}i}{1232} & 0 & -\frac{5\sqrt{462}i}{1232} & 0 & -\frac{15\sqrt{770}i}{8624} & 0 & -\frac{\sqrt{330}i}{1232} \\ \frac{\sqrt{330}i}{1232} & 0 & \frac{\sqrt{33}i}{88} & 0 & \frac{3\sqrt{66}i}{176} & 0 & 0 & \frac{15\sqrt{55}i}{1232} & 0 & \frac{5\sqrt{11}i}{88} & 0 & \frac{3\sqrt{165}i}{176} & 0 & 0 \\ 0 & -\frac{23\sqrt{462}i}{8624} & 0 & -\frac{3\sqrt{231}i}{616} & 0 & \frac{3\sqrt{2310}i}{1232} & -\frac{15\sqrt{55}i}{1232} & 0 & -\frac{5\sqrt{1155}i}{1078} & 0 & -\frac{5\sqrt{77}i}{1232} & 0 & \frac{9\sqrt{385}i}{616} & 0 \\ \frac{15\sqrt{770}i}{8624} & 0 & \frac{3\sqrt{77}i}{392} & 0 & -\frac{3\sqrt{154}i}{1232} & 0 & 0 & \frac{5\sqrt{1155}i}{1078} & 0 & \frac{5\sqrt{231}i}{8624} & 0 & -\frac{5\sqrt{385}i}{616} & 0 & \frac{3\sqrt{165}i}{176} \\ 0 & -\frac{13\sqrt{2310}i}{8624} & 0 & \frac{\sqrt{1155}i}{4312} & 0 & \frac{5\sqrt{462}i}{1232} & -\frac{5\sqrt{11}i}{88} & 0 & -\frac{5\sqrt{231}i}{8624} & 0 & \frac{15\sqrt{385}i}{2156} & 0 & -\frac{5\sqrt{77}i}{1232} & 0 \\ \frac{5\sqrt{462}i}{1232} & 0 & \frac{\sqrt{1155}i}{4312} & 0 & -\frac{13\sqrt{2310}i}{8624} & 0 & 0 & \frac{5\sqrt{77}i}{1232} & 0 & -\frac{15\sqrt{385}i}{2156} & 0 & \frac{5\sqrt{231}i}{8624} & 0 & \frac{5\sqrt{11}i}{88} \\ 0 & -\frac{3\sqrt{154}i}{1232} & 0 & \frac{3\sqrt{77}i}{392} & 0 & \frac{15\sqrt{770}i}{8624} & -\frac{3\sqrt{165}i}{176} & 0 & \frac{5\sqrt{385}i}{616} & 0 & -\frac{5\sqrt{231}i}{8624} & 0 & -\frac{5\sqrt{1155}i}{1078} & 0 \\ \frac{3\sqrt{2310}i}{1232} & 0 & -\frac{3\sqrt{231}i}{616} & 0 & -\frac{23\sqrt{462}i}{8624} & 0 & 0 & -\frac{9\sqrt{385}i}{616} & 0 & \frac{5\sqrt{77}i}{1232} & 0 & \frac{5\sqrt{1155}i}{1078} & 0 & \frac{15\sqrt{55}i}{1232} \\ 0 & \frac{3\sqrt{66}i}{176} & 0 & \frac{\sqrt{33}i}{88} & 0 & \frac{\sqrt{330}i}{1232} & 0 & 0 & -\frac{3\sqrt{165}i}{176} & 0 & -\frac{5\sqrt{11}i}{88} & 0 & -\frac{15\sqrt{55}i}{1232} & 0 \end{pmatrix}$ |
| 985 | symmetry | $\dfrac{3\sqrt{35}x\left(y^2-2yz-z^2\right)\left(y^2+2yz-z^2\right)}{8}$ |

Table 10

| No. | multipole | matrix |
| --- | --- | --- |

$\mathbb{M}_{5,1}^{(1,-1;a)}(E_g,2)$

| $0$ | $-\frac{\sqrt{55}}{1232}$ | $0$ | $-\frac{3\sqrt{110}}{1232}$ | $0$ | $-\frac{5\sqrt{11}}{1232}$ | $\frac{\sqrt{462}}{1232}$ | $0$ | $-\frac{15\sqrt{22}}{1232}$ | $0$ | $-\frac{9\sqrt{330}}{1232}$ | $0$ | $-\frac{5\sqrt{66}}{1232}$ | $0$ |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| $-\frac{\sqrt{55}}{1232}$ | $0$ | $\frac{5\sqrt{22}}{1232}$ | $0$ | $\frac{15\sqrt{11}}{1232}$ | $0$ | $0$ | $-\frac{23\sqrt{330}}{6160}$ | $0$ | $\frac{13\sqrt{66}}{1232}$ | $0$ | $\frac{27\sqrt{110}}{6160}$ | $0$ | $-\frac{\sqrt{2310}}{1232}$ |
| $0$ | $\frac{5\sqrt{22}}{1232}$ | $0$ | $-\frac{5\sqrt{11}}{616}$ | $0$ | $-\frac{3\sqrt{110}}{1232}$ | $\frac{9\sqrt{1155}}{3080}$ | $0$ | $\frac{3\sqrt{55}}{280}$ | $0$ | $-\frac{\sqrt{33}}{616}$ | $0$ | $\frac{27\sqrt{165}}{3080}$ | $0$ |
| $-\frac{3\sqrt{110}}{1232}$ | $0$ | $-\frac{5\sqrt{11}}{616}$ | $0$ | $\frac{5\sqrt{22}}{1232}$ | $0$ | $0$ | $-\frac{27\sqrt{165}}{3080}$ | $0$ | $\frac{\sqrt{33}}{616}$ | $0$ | $-\frac{3\sqrt{55}}{280}$ | $0$ | $-\frac{9\sqrt{1155}}{3080}$ |
| $0$ | $\frac{15\sqrt{11}}{1232}$ | $0$ | $\frac{5\sqrt{22}}{1232}$ | $0$ | $-\frac{\sqrt{55}}{1232}$ | $\frac{\sqrt{2310}}{1232}$ | $0$ | $-\frac{27\sqrt{110}}{6160}$ | $0$ | $-\frac{13\sqrt{66}}{1232}$ | $0$ | $\frac{23\sqrt{330}}{6160}$ | $0$ |
| $-\frac{5\sqrt{11}}{1232}$ | $0$ | $-\frac{3\sqrt{110}}{1232}$ | $0$ | $-\frac{\sqrt{55}}{1232}$ | $0$ | $0$ | $\frac{5\sqrt{66}}{1232}$ | $0$ | $\frac{9\sqrt{330}}{1232}$ | $0$ | $\frac{15\sqrt{22}}{1232}$ | $0$ | $-\frac{\sqrt{462}}{1232}$ |
| $\frac{\sqrt{462}}{1232}$ | $0$ | $\frac{9\sqrt{1155}}{3080}$ | $0$ | $\frac{\sqrt{2310}}{1232}$ | $0$ | $0$ | $\frac{15\sqrt{77}}{1232}$ | $0$ | $\frac{9\sqrt{385}}{616}$ | $0$ | $\frac{5\sqrt{231}}{1232}$ | $0$ | $0$ |
| $0$ | $-\frac{23\sqrt{330}}{6160}$ | $0$ | $-\frac{27\sqrt{165}}{3080}$ | $0$ | $\frac{5\sqrt{66}}{1232}$ | $\frac{15\sqrt{77}}{1232}$ | $0$ | $-\frac{5\sqrt{33}}{154}$ | $0$ | $-\frac{9\sqrt{55}}{1232}$ | $0$ | $\frac{15\sqrt{11}}{616}$ | $0$ |
| $-\frac{15\sqrt{22}}{1232}$ | $0$ | $\frac{3\sqrt{55}}{280}$ | $0$ | $-\frac{27\sqrt{110}}{6160}$ | $0$ | $0$ | $-\frac{5\sqrt{33}}{154}$ | $0$ | $\frac{\sqrt{165}}{1232}$ | $0$ | $-\frac{45\sqrt{11}}{616}$ | $0$ | $\frac{5\sqrt{231}}{1232}$ |
| $0$ | $\frac{13\sqrt{66}}{1232}$ | $0$ | $\frac{\sqrt{33}}{616}$ | $0$ | $\frac{9\sqrt{330}}{1232}$ | $\frac{9\sqrt{385}}{616}$ | $0$ | $\frac{\sqrt{165}}{1232}$ | $0$ | $\frac{15\sqrt{11}}{308}$ | $0$ | $-\frac{9\sqrt{55}}{1232}$ | $0$ |
| $-\frac{9\sqrt{330}}{1232}$ | $0$ | $-\frac{\sqrt{33}}{616}$ | $0$ | $-\frac{13\sqrt{66}}{1232}$ | $0$ | $0$ | $-\frac{9\sqrt{55}}{1232}$ | $0$ | $\frac{15\sqrt{11}}{308}$ | $0$ | $\frac{\sqrt{165}}{1232}$ | $0$ | $\frac{9\sqrt{385}}{616}$ |
| $0$ | $\frac{27\sqrt{110}}{6160}$ | $0$ | $-\frac{3\sqrt{55}}{280}$ | $0$ | $\frac{15\sqrt{22}}{1232}$ | $\frac{5\sqrt{231}}{1232}$ | $0$ | $-\frac{45\sqrt{11}}{616}$ | $0$ | $\frac{\sqrt{165}}{1232}$ | $0$ | $-\frac{5\sqrt{33}}{154}$ | $0$ |
| $-\frac{5\sqrt{66}}{1232}$ | $0$ | $\frac{27\sqrt{165}}{3080}$ | $0$ | $\frac{23\sqrt{330}}{6160}$ | $0$ | $0$ | $\frac{15\sqrt{11}}{616}$ | $0$ | $-\frac{9\sqrt{55}}{1232}$ | $0$ | $-\frac{5\sqrt{33}}{154}$ | $0$ | $\frac{15\sqrt{77}}{1232}$ |
| $0$ | $-\frac{\sqrt{2310}}{1232}$ | $0$ | $-\frac{9\sqrt{1155}}{3080}$ | $0$ | $-\frac{\sqrt{462}}{1232}$ | $0$ | $0$ | $\frac{5\sqrt{231}}{1232}$ | $0$ | $\frac{9\sqrt{385}}{616}$ | $0$ | $\frac{15\sqrt{77}}{1232}$ | $0$ |

| 986 | symmetry | $-\frac{3\sqrt{35}\,y\left(x^2-2xz-z^2\right)\left(x^2+2xz-z^2\right)}{8}$ |
| --- | --- | --- |

444

Table  10

| No. | multipole | matrix |
| --- | --- | --- |

$\mathbb{M}_{5,2}^{(1,-1;a)}(E_g,2)$

$$\begin{array}{cccccccccccccc}
0 & -\frac{\sqrt{55}i}{1232} & 0 & \frac{3\sqrt{110}i}{1232} & 0 & -\frac{5\sqrt{11}i}{1232} & -\frac{\sqrt{462}i}{1232} & 0 & -\frac{15\sqrt{22}i}{1232} & 0 & \frac{9\sqrt{330}i}{1232} & 0 & -\frac{5\sqrt{66}i}{1232} & 0 \\[4pt]
\frac{\sqrt{55}i}{1232} & 0 & \frac{5\sqrt{22}i}{1232} & 0 & -\frac{15\sqrt{11}i}{1232} & 0 & 0 & \frac{23\sqrt{330}i}{6160} & 0 & \frac{13\sqrt{66}i}{1232} & 0 & -\frac{27\sqrt{110}i}{6160} & 0 & -\frac{\sqrt{2310}i}{1232} \\[4pt]
0 & -\frac{5\sqrt{22}i}{1232} & 0 & -\frac{5\sqrt{11}i}{616} & 0 & \frac{3\sqrt{110}i}{1232} & \frac{9\sqrt{1155}i}{3080} & 0 & -\frac{3\sqrt{55}i}{280} & 0 & -\frac{\sqrt{33}i}{616} & 0 & -\frac{27\sqrt{165}i}{3080} & 0 \\[4pt]
-\frac{3\sqrt{110}i}{1232} & 0 & \frac{5\sqrt{11}i}{616} & 0 & \frac{5\sqrt{22}i}{1232} & 0 & 0 & -\frac{27\sqrt{165}i}{3080} & 0 & -\frac{\sqrt{33}i}{616} & 0 & -\frac{3\sqrt{55}i}{280} & 0 & \frac{9\sqrt{1155}i}{3080} \\[4pt]
0 & \frac{15\sqrt{11}i}{1232} & 0 & -\frac{5\sqrt{22}i}{1232} & 0 & -\frac{\sqrt{55}i}{1232} & -\frac{\sqrt{2310}i}{1232} & 0 & -\frac{27\sqrt{110}i}{6160} & 0 & \frac{13\sqrt{66}i}{1232} & 0 & \frac{23\sqrt{330}i}{6160} & 0 \\[4pt]
\frac{5\sqrt{11}i}{1232} & 0 & -\frac{3\sqrt{110}i}{1232} & 0 & \frac{\sqrt{55}i}{1232} & 0 & 0 & -\frac{5\sqrt{66}i}{1232} & 0 & \frac{9\sqrt{330}i}{1232} & 0 & -\frac{15\sqrt{22}i}{1232} & 0 & -\frac{\sqrt{462}i}{1232} \\[4pt]
\frac{\sqrt{462}i}{1232} & 0 & -\frac{9\sqrt{1155}i}{3080} & 0 & \frac{\sqrt{2310}i}{1232} & 0 & 0 & \frac{15\sqrt{77}i}{1232} & 0 & -\frac{9\sqrt{385}i}{616} & 0 & \frac{5\sqrt{231}i}{1232} & 0 & 0 \\[4pt]
0 & -\frac{23\sqrt{330}i}{6160} & 0 & \frac{27\sqrt{165}i}{3080} & 0 & \frac{5\sqrt{66}i}{1232} & -\frac{15\sqrt{77}i}{1232} & 0 & -\frac{5\sqrt{33}i}{154} & 0 & \frac{9\sqrt{55}i}{1232} & 0 & \frac{15\sqrt{11}i}{616} & 0 \\[4pt]
\frac{15\sqrt{22}i}{1232} & 0 & \frac{3\sqrt{55}i}{280} & 0 & \frac{27\sqrt{110}i}{6160} & 0 & 0 & \frac{5\sqrt{33}i}{154} & 0 & \frac{\sqrt{165}i}{1232} & 0 & \frac{45\sqrt{11}i}{616} & 0 & \frac{5\sqrt{231}i}{1232} \\[4pt]
0 & -\frac{13\sqrt{66}i}{1232} & 0 & \frac{\sqrt{33}i}{616} & 0 & -\frac{9\sqrt{330}i}{1232} & \frac{9\sqrt{385}i}{616} & 0 & -\frac{\sqrt{165}i}{1232} & 0 & \frac{15\sqrt{11}i}{308} & 0 & \frac{9\sqrt{55}i}{1232} & 0 \\[4pt]
-\frac{9\sqrt{330}i}{1232} & 0 & \frac{\sqrt{33}i}{616} & 0 & -\frac{13\sqrt{66}i}{1232} & 0 & 0 & -\frac{9\sqrt{55}i}{1232} & 0 & -\frac{15\sqrt{11}i}{308} & 0 & \frac{\sqrt{165}i}{1232} & 0 & -\frac{9\sqrt{385}i}{616} \\[4pt]
0 & \frac{27\sqrt{110}i}{6160} & 0 & \frac{3\sqrt{55}i}{280} & 0 & \frac{15\sqrt{22}i}{1232} & -\frac{5\sqrt{231}i}{1232} & 0 & -\frac{45\sqrt{11}i}{616} & 0 & -\frac{\sqrt{165}i}{1232} & 0 & -\frac{5\sqrt{33}i}{154} & 0 \\[4pt]
\frac{5\sqrt{66}i}{1232} & 0 & \frac{27\sqrt{165}i}{3080} & 0 & -\frac{23\sqrt{330}i}{6160} & 0 & 0 & -\frac{15\sqrt{11}i}{616} & 0 & -\frac{9\sqrt{55}i}{1232} & 0 & \frac{5\sqrt{33}i}{154} & 0 & \frac{15\sqrt{77}i}{1232} \\[4pt]
0 & \frac{\sqrt{2310}i}{1232} & 0 & -\frac{9\sqrt{1155}i}{3080} & 0 & \frac{\sqrt{462}i}{1232} & 0 & 0 & -\frac{5\sqrt{231}i}{1232} & 0 & \frac{9\sqrt{385}i}{616} & 0 & -\frac{15\sqrt{77}i}{1232} & 0
\end{array}$$

| 987 | symmetry | $\dfrac{\sqrt{105}x(y-z)(y+z)\left(2x^2-y^2-z^2\right)}{4}$ |
| --- | --- | --- |

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|-----|-----------|--------|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{M}_{5,1}^{(1,-1;a)}(E_g,3)$ | $0$ | $-\frac{\sqrt{165}}{1848}$ | $0$ | $\frac{\sqrt{330}}{1848}$ | $0$ | $\frac{5\sqrt{33}}{616}$ | $\frac{\sqrt{154}}{616}$ | $0$ | $-\frac{5\sqrt{66}}{616}$ | $0$ | $\frac{3\sqrt{110}}{616}$ | $0$ | $\frac{15\sqrt{22}}{616}$ | $0$ |
| | | $-\frac{\sqrt{165}}{1848}$ | $0$ | $\frac{5\sqrt{66}}{1848}$ | $0$ | $-\frac{5\sqrt{33}}{1848}$ | $0$ | $0$ | $-\frac{23\sqrt{110}}{3080}$ | $0$ | $\frac{13\sqrt{22}}{616}$ | $0$ | $-\frac{3\sqrt{330}}{3080}$ | $0$ | $\frac{3\sqrt{770}}{616}$ |
| | | $0$ | $\frac{5\sqrt{66}}{1848}$ | $0$ | $-\frac{5\sqrt{33}}{924}$ | $0$ | $\frac{\sqrt{330}}{1848}$ | $-\frac{3\sqrt{385}}{1540}$ | $0$ | $\frac{\sqrt{165}}{140}$ | $0$ | $-\frac{\sqrt{11}}{308}$ | $0$ | $-\frac{9\sqrt{55}}{1540}$ | $0$ |
| | | $\frac{\sqrt{330}}{1848}$ | $0$ | $-\frac{5\sqrt{33}}{924}$ | $0$ | $\frac{5\sqrt{66}}{1848}$ | $0$ | $0$ | $\frac{9\sqrt{55}}{1540}$ | $0$ | $\frac{\sqrt{11}}{308}$ | $0$ | $-\frac{\sqrt{165}}{140}$ | $0$ | $\frac{3\sqrt{385}}{1540}$ |
| | | $0$ | $-\frac{5\sqrt{33}}{1848}$ | $0$ | $\frac{5\sqrt{66}}{1848}$ | $0$ | $-\frac{\sqrt{165}}{1848}$ | $-\frac{3\sqrt{770}}{616}$ | $0$ | $\frac{3\sqrt{330}}{3080}$ | $0$ | $-\frac{13\sqrt{22}}{616}$ | $0$ | $\frac{23\sqrt{110}}{3080}$ | $0$ |
| | | $\frac{5\sqrt{33}}{616}$ | $0$ | $\frac{\sqrt{330}}{1848}$ | $0$ | $-\frac{\sqrt{165}}{1848}$ | $0$ | $0$ | $-\frac{15\sqrt{22}}{616}$ | $0$ | $-\frac{3\sqrt{110}}{616}$ | $0$ | $\frac{5\sqrt{66}}{616}$ | $0$ | $-\frac{\sqrt{154}}{616}$ |
| | | $\frac{\sqrt{154}}{616}$ | $0$ | $-\frac{3\sqrt{385}}{1540}$ | $0$ | $-\frac{3\sqrt{770}}{616}$ | $0$ | $0$ | $\frac{5\sqrt{231}}{616}$ | $0$ | $-\frac{\sqrt{1155}}{308}$ | $0$ | $-\frac{15\sqrt{77}}{616}$ | $0$ | $0$ |
| | | $0$ | $-\frac{23\sqrt{110}}{3080}$ | $0$ | $\frac{9\sqrt{55}}{1540}$ | $0$ | $-\frac{15\sqrt{22}}{616}$ | $\frac{5\sqrt{231}}{616}$ | $0$ | $-\frac{5\sqrt{11}}{77}$ | $0$ | $\frac{\sqrt{165}}{616}$ | $0$ | $-\frac{15\sqrt{33}}{308}$ | $0$ |
| | | $-\frac{5\sqrt{66}}{616}$ | $0$ | $\frac{\sqrt{165}}{140}$ | $0$ | $\frac{3\sqrt{330}}{3080}$ | $0$ | $0$ | $-\frac{5\sqrt{11}}{77}$ | $0$ | $\frac{\sqrt{55}}{616}$ | $0$ | $\frac{5\sqrt{33}}{308}$ | $0$ | $-\frac{15\sqrt{77}}{616}$ |
| | | $0$ | $\frac{13\sqrt{22}}{616}$ | $0$ | $\frac{\sqrt{11}}{308}$ | $0$ | $-\frac{3\sqrt{110}}{616}$ | $-\frac{\sqrt{1155}}{308}$ | $0$ | $\frac{\sqrt{55}}{616}$ | $0$ | $\frac{5\sqrt{33}}{154}$ | $0$ | $\frac{\sqrt{165}}{616}$ | $0$ |
| | | $\frac{3\sqrt{110}}{616}$ | $0$ | $-\frac{\sqrt{11}}{308}$ | $0$ | $-\frac{13\sqrt{22}}{616}$ | $0$ | $0$ | $\frac{\sqrt{165}}{616}$ | $0$ | $\frac{5\sqrt{33}}{154}$ | $0$ | $\frac{\sqrt{55}}{616}$ | $0$ | $-\frac{\sqrt{1155}}{308}$ |
| | | $0$ | $-\frac{3\sqrt{330}}{3080}$ | $0$ | $-\frac{\sqrt{165}}{140}$ | $0$ | $\frac{5\sqrt{66}}{616}$ | $-\frac{15\sqrt{77}}{616}$ | $0$ | $\frac{5\sqrt{33}}{308}$ | $0$ | $\frac{\sqrt{55}}{616}$ | $0$ | $-\frac{5\sqrt{11}}{77}$ | $0$ |
| | | $\frac{15\sqrt{22}}{616}$ | $0$ | $-\frac{9\sqrt{55}}{1540}$ | $0$ | $\frac{23\sqrt{110}}{3080}$ | $0$ | $0$ | $-\frac{15\sqrt{33}}{308}$ | $0$ | $\frac{\sqrt{165}}{616}$ | $0$ | $-\frac{5\sqrt{11}}{77}$ | $0$ | $\frac{5\sqrt{231}}{616}$ |
| | | $0$ | $\frac{3\sqrt{770}}{616}$ | $0$ | $\frac{3\sqrt{385}}{1540}$ | $0$ | $-\frac{\sqrt{154}}{616}$ | $0$ | $0$ | $-\frac{15\sqrt{77}}{616}$ | $0$ | $-\frac{\sqrt{1155}}{308}$ | $0$ | $\frac{5\sqrt{231}}{616}$ | $0$ |

| 988 | symmetry | $\frac{\sqrt{105}\,y(x-z)(x+z)\left(x^2-2y^2+z^2\right)}{4}$ |

Table 10

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{M}_{5,2}^{(1,-1;a)}(E_g,3)$ | $\begin{pmatrix} 0 & -\frac{\sqrt{165}i}{1848} & 0 & -\frac{\sqrt{330}i}{1848} & 0 & \frac{5\sqrt{33}i}{616} & -\frac{\sqrt{154}i}{616} & 0 & -\frac{5\sqrt{66}i}{616} & 0 & -\frac{3\sqrt{110}i}{616} & 0 & \frac{15\sqrt{22}i}{616} & 0 \\ \frac{\sqrt{165}i}{1848} & 0 & \frac{5\sqrt{66}i}{1848} & 0 & \frac{5\sqrt{33}i}{1848} & 0 & 0 & \frac{23\sqrt{110}i}{3080} & 0 & \frac{13\sqrt{22}i}{616} & 0 & \frac{3\sqrt{330}i}{3080} & 0 & \frac{3\sqrt{770}i}{616} \\ 0 & -\frac{5\sqrt{66}i}{1848} & 0 & -\frac{5\sqrt{33}i}{924} & 0 & -\frac{\sqrt{330}i}{1848} & -\frac{3\sqrt{385}i}{1540} & 0 & -\frac{\sqrt{165}i}{140} & 0 & -\frac{\sqrt{11}i}{308} & 0 & \frac{9\sqrt{55}i}{1540} & 0 \\ \frac{\sqrt{330}i}{1848} & 0 & \frac{5\sqrt{33}i}{924} & 0 & \frac{5\sqrt{66}i}{1848} & 0 & 0 & \frac{9\sqrt{55}i}{1540} & 0 & -\frac{\sqrt{11}i}{308} & 0 & -\frac{\sqrt{165}i}{140} & 0 & -\frac{3\sqrt{385}i}{1540} \\ 0 & -\frac{5\sqrt{33}i}{1848} & 0 & -\frac{5\sqrt{66}i}{1848} & 0 & -\frac{\sqrt{165}i}{1848} & \frac{3\sqrt{770}i}{616} & 0 & \frac{3\sqrt{330}i}{3080} & 0 & \frac{13\sqrt{22}i}{616} & 0 & \frac{23\sqrt{110}i}{3080} & 0 \\ -\frac{5\sqrt{33}i}{616} & 0 & \frac{\sqrt{330}i}{1848} & 0 & \frac{\sqrt{165}i}{1848} & 0 & 0 & \frac{15\sqrt{22}i}{616} & 0 & -\frac{3\sqrt{110}i}{616} & 0 & -\frac{5\sqrt{66}i}{616} & 0 & -\frac{\sqrt{154}i}{616} \\ \frac{\sqrt{154}i}{616} & 0 & \frac{3\sqrt{385}i}{1540} & 0 & -\frac{3\sqrt{770}i}{616} & 0 & 0 & \frac{5\sqrt{231}i}{616} & 0 & \frac{\sqrt{1155}i}{308} & 0 & -\frac{15\sqrt{77}i}{616} & 0 & 0 \\ 0 & -\frac{23\sqrt{110}i}{3080} & 0 & -\frac{9\sqrt{55}i}{1540} & 0 & -\frac{15\sqrt{22}i}{616} & -\frac{5\sqrt{231}i}{616} & 0 & -\frac{5\sqrt{11}i}{77} & 0 & -\frac{\sqrt{165}i}{616} & 0 & -\frac{15\sqrt{33}i}{308} & 0 \\ \frac{5\sqrt{66}i}{616} & 0 & \frac{\sqrt{165}i}{140} & 0 & -\frac{3\sqrt{330}i}{3080} & 0 & 0 & \frac{5\sqrt{11}i}{77} & 0 & \frac{\sqrt{55}i}{616} & 0 & -\frac{5\sqrt{33}i}{308} & 0 & -\frac{15\sqrt{77}i}{616} \\ 0 & -\frac{13\sqrt{22}i}{616} & 0 & \frac{\sqrt{11}i}{308} & 0 & \frac{3\sqrt{110}i}{616} & -\frac{\sqrt{1155}i}{308} & 0 & -\frac{\sqrt{55}i}{616} & 0 & \frac{5\sqrt{33}i}{154} & 0 & -\frac{\sqrt{165}i}{616} & 0 \\ \frac{3\sqrt{110}i}{616} & 0 & \frac{\sqrt{11}i}{308} & 0 & -\frac{13\sqrt{22}i}{616} & 0 & 0 & \frac{\sqrt{165}i}{616} & 0 & -\frac{5\sqrt{33}i}{154} & 0 & \frac{\sqrt{55}i}{616} & 0 & \frac{\sqrt{1155}i}{308} \\ 0 & -\frac{3\sqrt{330}i}{3080} & 0 & \frac{\sqrt{165}i}{140} & 0 & \frac{5\sqrt{66}i}{616} & \frac{15\sqrt{77}i}{616} & 0 & \frac{5\sqrt{33}i}{308} & 0 & -\frac{\sqrt{55}i}{616} & 0 & -\frac{5\sqrt{11}i}{77} & 0 \\ -\frac{15\sqrt{22}i}{616} & 0 & -\frac{9\sqrt{55}i}{1540} & 0 & -\frac{23\sqrt{110}i}{3080} & 0 & 0 & \frac{15\sqrt{33}i}{308} & 0 & \frac{\sqrt{165}i}{616} & 0 & \frac{5\sqrt{11}i}{77} & 0 & \frac{5\sqrt{231}i}{616} \\ 0 & -\frac{3\sqrt{770}i}{616} & 0 & \frac{3\sqrt{385}i}{1540} & 0 & \frac{\sqrt{154}i}{616} & 0 & 0 & \frac{15\sqrt{77}i}{616} & 0 & -\frac{\sqrt{1155}i}{308} & 0 & -\frac{5\sqrt{231}i}{616} & 0 \end{pmatrix}$ |
| 989 | symmetry | $-\frac{\sqrt{231}xyz(x-y)(x+y)\left(3x^2+3y^2-10z^2\right)}{4}$ |

Table  10

| No. | multipole | matrix |
|---|---|---|
|  | $\mathbb{M}_7^{(1,-1;a)}(A_{1g})$ | (matrix below) |
| 990 | symmetry | $-\dfrac{z\left(35x^6+105x^4y^2-210x^4z^2+105x^2y^4-420x^2y^2z^2+168x^2z^4+35y^6-210y^4z^2+168y^2z^4-16z^6\right)}{16}$ |

$$
\mathbb{M}_7^{(1,-1;a)}(A_{1g}) =
\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \tfrac{\sqrt{130}i}{52} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\tfrac{\sqrt{546}i}{52} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \tfrac{\sqrt{546}i}{52} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\tfrac{\sqrt{130}i}{52} \\
0 & 0 & 0 & 0 & 0 & 0 & -\tfrac{\sqrt{130}i}{52} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \tfrac{\sqrt{546}i}{52} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\tfrac{\sqrt{546}i}{52} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \tfrac{\sqrt{130}i}{52} & 0 & 0 & 0 & 0
\end{pmatrix}
$$

448

Table 10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_7^{(1,-1;a)}(A_{2g},1)$$

$$
\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{858}}{1716} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{7\sqrt{858}}{1716} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{7\sqrt{858}}{572} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{35\sqrt{858}}{1716} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{35\sqrt{858}}{1716} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{7\sqrt{858}}{572} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{7\sqrt{858}}{1716} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{858}}{1716}
\end{pmatrix}
$$

| 991 | symmetry | $-\frac{\sqrt{231}z\left(x^2-2xy-y^2\right)\left(x^2+2xy-y^2\right)\left(3x^2+3y^2-10z^2\right)}{16}$ |

*continued …*

449

Table 10

| No. | multipole | matrix |
|---|---|---|
| | $\mathbb{M}_7^{(1,-1;a)}(A_{2g},2)$ | $$\begin{pmatrix} 0&0&0&0&0&0&0&0&0&0&0&0&0&0\\ 0&0&0&0&0&0&0&0&0&0&0&0&0&0\\ 0&0&0&0&0&0&0&0&0&0&0&0&0&0\\ 0&0&0&0&0&0&0&0&0&0&0&0&0&0\\ 0&0&0&0&0&0&0&0&0&0&0&0&0&0\\ 0&0&0&0&0&0&0&0&0&0&0&0&0&0\\ 0&0&0&0&0&0&0&0&0&0&-\frac{\sqrt{130}}{52}&0&0&0\\ 0&0&0&0&0&0&0&0&0&0&0&\frac{\sqrt{546}}{52}&0&0\\ 0&0&0&0&0&0&0&0&0&0&0&0&-\frac{\sqrt{546}}{52}&0\\ 0&0&0&0&0&0&0&0&0&0&0&0&0&\frac{\sqrt{130}}{52}\\ 0&0&0&0&0&0&-\frac{\sqrt{130}}{52}&0&0&0&0&0&0&0\\ 0&0&0&0&0&0&0&\frac{\sqrt{546}}{52}&0&0&0&0&0&0\\ 0&0&0&0&0&0&0&0&-\frac{\sqrt{546}}{52}&0&0&0&0&0\\ 0&0&0&0&0&0&0&0&0&\frac{\sqrt{130}}{52}&0&0&0&0 \end{pmatrix}$$ |
| 992 | symmetry | $\frac{\sqrt{91}\,xyz\left(3x^4-5x^2y^2-5x^2z^2+3y^4-5y^2z^2+3z^4\right)}{2}$ |

Table 10

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_7^{(1,-1;a)}(B_{1g},1)$

$$
\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{22}i}{88} & 0 & 0 & 0 & \frac{\sqrt{66}i}{24} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2310}i}{264} & 0 & 0 & 0 & -\frac{\sqrt{66}i}{24} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{22}i}{88} & 0 & 0 & 0 & \frac{\sqrt{770}i}{88} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2310}i}{264} & 0 & 0 & 0 & -\frac{\sqrt{770}i}{88} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{770}i}{88} & 0 & 0 & 0 & \frac{\sqrt{2310}i}{264} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{770}i}{88} & 0 & 0 & 0 & -\frac{\sqrt{22}i}{88} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{66}i}{24} & 0 & 0 & 0 & -\frac{\sqrt{2310}i}{264} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{66}i}{24} & 0 & 0 & 0 & \frac{\sqrt{22}i}{88} & 0 & 0
\end{pmatrix}
$$

| 993 | symmetry | $-\frac{\sqrt{77}xyz\left(3x^4-20x^2y^2+10x^2z^2+3y^4+10y^2z^2-6z^4\right)}{4}$ |

Table 10

| No. | multipole | matrix |
|-----|-----------|--------|

$$\mathbb{M}_7^{(1,-1;a)}(B_{1g}, 2)$$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{26}i}{104} & 0 & 0 & 0 & -\frac{\sqrt{78}i}{24} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2730}i}{312} & 0 & 0 & 0 & \frac{\sqrt{78}i}{24} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{26}i}{104} & 0 & 0 & 0 & \frac{\sqrt{910}i}{104} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2730}i}{312} & 0 & 0 & 0 & -\frac{\sqrt{910}i}{104} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{910}i}{104} & 0 & 0 & 0 & \frac{\sqrt{2730}i}{312} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{910}i}{104} & 0 & 0 & 0 & -\frac{\sqrt{26}i}{104} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{78}i}{24} & 0 & 0 & 0 & -\frac{\sqrt{2730}i}{312} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{78}i}{24} & 0 & 0 & 0 & \frac{\sqrt{26}i}{104} & 0 & 0
\end{pmatrix}$$

| 994 | symmetry | $\dfrac{\sqrt{6006}z(x-y)(x+y)\left(x^2-4xy+y^2\right)\left(x^2+4xy+y^2\right)}{32}$ |

Table 10

| No. | multipole | matrix |
|-----|-----------|--------|
| | $\mathbb{M}_7^{(1,-1;a)}(B_{2g},1)$ | $\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{2} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{2} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{2} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{2} & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$ |
| 995 | symmetry | $\dfrac{\sqrt{42}z(x-y)(x+y)\left(15x^4+30x^2y^2-80x^2z^2+15y^4-80y^2z^2+48z^4\right)}{32}$ |

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | $\mathbb{M}_7^{(1,-1;a)}(B_{2g},2)$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{429}}{286}$ | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{5005}}{286}$ | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{429}}{286}$ | 0 | 0 | 0 | $-\frac{\sqrt{15015}}{286}$ | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{5005}}{286}$ | 0 | 0 | 0 | $\frac{\sqrt{15015}}{286}$ | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{15015}}{286}$ | 0 | 0 | 0 | $-\frac{\sqrt{5005}}{286}$ | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{15015}}{286}$ | 0 | 0 | 0 | $\frac{\sqrt{429}}{286}$ |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{5005}}{286}$ | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{429}}{286}$ | 0 | 0 |

| 996 | symmetry | $\dfrac{x\left(16x^6-168x^4y^2-168x^4z^2+210x^2y^4+420x^2y^2z^2+210x^2z^4-35y^6-105y^4z^2-105y^2z^4-35z^6\right)}{16}$ |

454

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{M}_{7,1}^{(1,-1;a)}(E_g,1)$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{5\sqrt{6006}}{27456}$ | 0 | $-\frac{3\sqrt{30030}}{9152}$ | 0 | $\frac{3\sqrt{2002}}{832}$ | 0 | $-\frac{\sqrt{858}}{64}$ |
| | | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{5\sqrt{6006}}{27456}$ | 0 | $-\frac{35\sqrt{286}}{9152}$ | 0 | $\frac{21\sqrt{4290}}{9152}$ | 0 | $-\frac{7\sqrt{858}}{832}$ | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{35\sqrt{286}}{9152}$ | 0 | $\frac{35\sqrt{1430}}{9152}$ | 0 | $-\frac{63\sqrt{858}}{9152}$ | 0 | $\frac{3\sqrt{2002}}{832}$ |
| | | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{3\sqrt{30030}}{9152}$ | 0 | $\frac{35\sqrt{1430}}{9152}$ | 0 | $-\frac{175\sqrt{858}}{27456}$ | 0 | $\frac{21\sqrt{4290}}{9152}$ | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{21\sqrt{4290}}{9152}$ | 0 | $-\frac{175\sqrt{858}}{27456}$ | 0 | $\frac{35\sqrt{1430}}{9152}$ | 0 | $-\frac{3\sqrt{30030}}{9152}$ |
| | | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{3\sqrt{2002}}{832}$ | 0 | $-\frac{63\sqrt{858}}{9152}$ | 0 | $\frac{35\sqrt{1430}}{9152}$ | 0 | $-\frac{35\sqrt{286}}{9152}$ | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{7\sqrt{858}}{832}$ | 0 | $\frac{21\sqrt{4290}}{9152}$ | 0 | $-\frac{35\sqrt{286}}{9152}$ | 0 | $\frac{5\sqrt{6006}}{27456}$ |
| | | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{\sqrt{858}}{64}$ | 0 | $\frac{3\sqrt{2002}}{832}$ | 0 | $-\frac{3\sqrt{30030}}{9152}$ | 0 | $\frac{5\sqrt{6006}}{27456}$ | 0 |

| 997 | symmetry | $\frac{y\left(35x^6-210x^4y^2+105x^4z^2+168x^2y^4-420x^2y^2z^2+105x^2z^4-16y^6+168y^4z^2-210y^2z^4+35z^6\right)}{16}$ |

455

| No. | multipole | matrix |
|-----|-----------|--------|
| | $\mathbb{M}_{7,2}^{(1,-1;a)}(E_g,1)$ | (see matrix below) |

$$\mathbb{M}_{7,2}^{(1,-1;a)}(E_g,1) = \begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{6006}i}{27456} & 0 & \frac{3\sqrt{30030}i}{9152} & 0 & \frac{3\sqrt{2002}i}{832} & 0 & \frac{\sqrt{858}i}{64} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{6006}i}{27456} & 0 & -\frac{35\sqrt{286}i}{9152} & 0 & -\frac{21\sqrt{4290}i}{9152} & 0 & -\frac{7\sqrt{858}i}{832} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{35\sqrt{286}i}{9152} & 0 & \frac{35\sqrt{1430}i}{9152} & 0 & \frac{63\sqrt{858}i}{9152} & 0 & \frac{3\sqrt{2002}i}{832} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{30030}i}{9152} & 0 & -\frac{35\sqrt{1430}i}{9152} & 0 & -\frac{175\sqrt{858}i}{27456} & 0 & -\frac{21\sqrt{4290}i}{9152} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{21\sqrt{4290}i}{9152} & 0 & \frac{175\sqrt{858}i}{27456} & 0 & \frac{35\sqrt{1430}i}{9152} & 0 & \frac{3\sqrt{30030}i}{9152} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{2002}i}{832} & 0 & -\frac{63\sqrt{858}i}{9152} & 0 & -\frac{35\sqrt{1430}i}{9152} & 0 & -\frac{35\sqrt{286}i}{9152} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{7\sqrt{858}i}{832} & 0 & \frac{21\sqrt{4290}i}{9152} & 0 & \frac{35\sqrt{286}i}{9152} & 0 & \frac{5\sqrt{6006}i}{27456} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{858}i}{64} & 0 & -\frac{3\sqrt{2002}i}{832} & 0 & -\frac{3\sqrt{30030}i}{9152} & 0 & -\frac{5\sqrt{6006}i}{27456} & 0
\end{pmatrix}$$

| 998 | symmetry | $\frac{\sqrt{231}\,x\left(10x^2-3y^2-3z^2\right)\left(y^2-2yz-z^2\right)\left(y^2+2yz-z^2\right)}{16}$ |

456

Table 10

| No. | multipole | matrix |
|-----|-----------|--------|

$$\mathbb{M}_{7,1}^{(1,-1;a)}(E_g,2)$$

$$
\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{26}}{832} & 0 & \frac{\sqrt{130}}{832} & 0 & -\frac{25\sqrt{78}}{832} & 0 & -\frac{\sqrt{182}}{64} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{26}}{832} & 0 & -\frac{3\sqrt{546}}{832} & 0 & -\frac{\sqrt{910}}{832} & 0 & \frac{25\sqrt{182}}{832} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{546}}{832} & 0 & \frac{3\sqrt{2730}}{832} & 0 & \frac{3\sqrt{182}}{832} & 0 & -\frac{25\sqrt{78}}{832} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{130}}{832} & 0 & \frac{3\sqrt{2730}}{832} & 0 & -\frac{15\sqrt{182}}{832} & 0 & -\frac{\sqrt{910}}{832} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{910}}{832} & 0 & -\frac{15\sqrt{182}}{832} & 0 & \frac{3\sqrt{2730}}{832} & 0 & \frac{\sqrt{130}}{832} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{25\sqrt{78}}{832} & 0 & \frac{3\sqrt{182}}{832} & 0 & \frac{3\sqrt{2730}}{832} & 0 & -\frac{3\sqrt{546}}{832} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{25\sqrt{182}}{832} & 0 & -\frac{\sqrt{910}}{832} & 0 & -\frac{3\sqrt{546}}{832} & 0 & \frac{3\sqrt{26}}{832} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{182}}{64} & 0 & -\frac{25\sqrt{78}}{832} & 0 & \frac{\sqrt{130}}{832} & 0 & \frac{3\sqrt{26}}{832} & 0 \\
\end{pmatrix}
$$

| 999 | symmetry | $\dfrac{\sqrt{231}\,y\left(x^2-2xz-z^2\right)\left(x^2+2xz-z^2\right)\left(3x^2-10y^2+3z^2\right)}{16}$ |

Table 10

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{M}_{7,2}^{(1,-1;a)}(E_g,2)$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{26}i}{832} & 0 & -\frac{\sqrt{130}i}{832} & 0 & -\frac{25\sqrt{78}i}{832} & 0 & \frac{\sqrt{182}i}{64} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{26}i}{832} & 0 & -\frac{3\sqrt{546}i}{832} & 0 & \frac{\sqrt{910}i}{832} & 0 & \frac{25\sqrt{182}i}{832} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{546}i}{832} & 0 & \frac{3\sqrt{2730}i}{832} & 0 & -\frac{3\sqrt{182}i}{832} & 0 & -\frac{25\sqrt{78}i}{832} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{130}i}{832} & 0 & -\frac{3\sqrt{2730}i}{832} & 0 & -\frac{15\sqrt{182}i}{832} & 0 & \frac{\sqrt{910}i}{832} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{910}i}{832} & 0 & \frac{15\sqrt{182}i}{832} & 0 & \frac{3\sqrt{2730}i}{832} & 0 & -\frac{\sqrt{130}i}{832} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{25\sqrt{78}i}{832} & 0 & \frac{3\sqrt{182}i}{832} & 0 & -\frac{3\sqrt{2730}i}{832} & 0 & -\frac{3\sqrt{546}i}{832} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{25\sqrt{182}i}{832} & 0 & -\frac{\sqrt{910}i}{832} & 0 & \frac{3\sqrt{546}i}{832} & 0 & \frac{3\sqrt{26}i}{832} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{182}i}{64} & 0 & \frac{25\sqrt{78}i}{832} & 0 & \frac{\sqrt{130}i}{832} & 0 & -\frac{3\sqrt{26}i}{832} & 0
\end{pmatrix}$$

| 1000 | symmetry | $\dfrac{\sqrt{6006}x(y-z)(y+z)\left(y^2-4yz+z^2\right)\left(y^2+4yz+z^2\right)}{32}$ |

458

| No. | multipole | matrix |
|-----|-----------|--------|

Table 10

| No. | multipole | matrix |
|-----|-----------|--------|
| | $\mathbb{M}_{7,1}^{(1,-1;a)}(E_g,3)$ | $\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{64} & 0 & \frac{3\sqrt{5}}{64} & 0 & \frac{5\sqrt{3}}{64} & 0 & \frac{\sqrt{7}}{64} \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{64} & 0 & -\frac{\sqrt{21}}{64} & 0 & -\frac{3\sqrt{35}}{64} & 0 & -\frac{5\sqrt{7}}{64} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{21}}{64} & 0 & \frac{\sqrt{105}}{64} & 0 & \frac{9\sqrt{7}}{64} & 0 & \frac{5\sqrt{3}}{64} \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{5}}{64} & 0 & \frac{\sqrt{105}}{64} & 0 & -\frac{5\sqrt{7}}{64} & 0 & -\frac{3\sqrt{35}}{64} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{35}}{64} & 0 & -\frac{5\sqrt{7}}{64} & 0 & \frac{\sqrt{105}}{64} & 0 & \frac{3\sqrt{5}}{64} \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{3}}{64} & 0 & \frac{9\sqrt{7}}{64} & 0 & \frac{\sqrt{105}}{64} & 0 & -\frac{\sqrt{21}}{64} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{7}}{64} & 0 & -\frac{3\sqrt{35}}{64} & 0 & -\frac{\sqrt{21}}{64} & 0 & \frac{1}{64} \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{64} & 0 & \frac{5\sqrt{3}}{64} & 0 & \frac{3\sqrt{5}}{64} & 0 & \frac{1}{64} & 0 \end{pmatrix}$ |
| 1001 | symmetry | $-\frac{\sqrt{6006}\,y(x-z)(x+z)\left(x^2-4xz+z^2\right)\left(x^2+4xz+z^2\right)}{32}$ |

*continued ...*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|-----|-----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{M}_{7,2}^{(1,-1;a)}(E_g,3)$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{i}{64}$ | 0 | $-\frac{3\sqrt{5}i}{64}$ | 0 | $\frac{5\sqrt{3}i}{64}$ | 0 | $-\frac{\sqrt{7}i}{64}$ |
| | | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{i}{64}$ | 0 | $-\frac{\sqrt{21}i}{64}$ | 0 | $\frac{3\sqrt{35}i}{64}$ | 0 | $-\frac{5\sqrt{7}i}{64}$ | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{21}i}{64}$ | 0 | $\frac{\sqrt{105}i}{64}$ | 0 | $-\frac{9\sqrt{7}i}{64}$ | 0 | $\frac{5\sqrt{3}i}{64}$ |
| | | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{3\sqrt{5}i}{64}$ | 0 | $-\frac{\sqrt{105}i}{64}$ | 0 | $-\frac{5\sqrt{7}i}{64}$ | 0 | $\frac{3\sqrt{35}i}{64}$ | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{3\sqrt{35}i}{64}$ | 0 | $\frac{5\sqrt{7}i}{64}$ | 0 | $\frac{\sqrt{105}i}{64}$ | 0 | $-\frac{3\sqrt{5}i}{64}$ |
| | | 0 | 0 | 0 | 0 | 0 | 0 | $-\frac{5\sqrt{3}i}{64}$ | 0 | $\frac{9\sqrt{7}i}{64}$ | 0 | $-\frac{\sqrt{105}i}{64}$ | 0 | $-\frac{\sqrt{21}i}{64}$ | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{5\sqrt{7}i}{64}$ | 0 | $-\frac{3\sqrt{35}i}{64}$ | 0 | $\frac{\sqrt{21}i}{64}$ | 0 | $\frac{i}{64}$ |
| | | 0 | 0 | 0 | 0 | 0 | 0 | $\frac{\sqrt{7}i}{64}$ | 0 | $-\frac{5\sqrt{3}i}{64}$ | 0 | $\frac{3\sqrt{5}i}{64}$ | 0 | $-\frac{i}{64}$ | 0 |

| 1002 | symmetry | $\frac{\sqrt{42}x(y-z)(y+z)\left(48x^4-80x^2y^2-80x^2z^2+15y^4+30y^2z^2+15z^4\right)}{32}$ |

*continued ...*

Table 10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_{7,1}^{(1,-1;a)}(E_g,4)$$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{15\sqrt{143}}{9152} & 0 & -\frac{19\sqrt{715}}{9152} & 0 & \frac{\sqrt{429}}{832} & 0 & \frac{\sqrt{1001}}{64} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{15\sqrt{143}}{9152} & 0 & -\frac{15\sqrt{3003}}{9152} & 0 & \frac{19\sqrt{5005}}{9152} & 0 & -\frac{\sqrt{1001}}{832} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{15\sqrt{3003}}{9152} & 0 & \frac{15\sqrt{15015}}{9152} & 0 & -\frac{57\sqrt{1001}}{9152} & 0 & \frac{\sqrt{429}}{832} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{19\sqrt{715}}{9152} & 0 & \frac{15\sqrt{15015}}{9152} & 0 & -\frac{75\sqrt{1001}}{9152} & 0 & \frac{19\sqrt{5005}}{9152} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{19\sqrt{5005}}{9152} & 0 & -\frac{75\sqrt{1001}}{9152} & 0 & \frac{15\sqrt{15015}}{9152} & 0 & -\frac{19\sqrt{715}}{9152} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{429}}{832} & 0 & -\frac{57\sqrt{1001}}{9152} & 0 & \frac{15\sqrt{15015}}{9152} & 0 & -\frac{15\sqrt{3003}}{9152} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{1001}}{832} & 0 & \frac{19\sqrt{5005}}{9152} & 0 & -\frac{15\sqrt{3003}}{9152} & 0 & \frac{15\sqrt{143}}{9152} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{1001}}{64} & 0 & \frac{\sqrt{429}}{832} & 0 & -\frac{19\sqrt{715}}{9152} & 0 & \frac{15\sqrt{143}}{9152} & 0
\end{pmatrix}$$

| 1003 | symmetry | $-\dfrac{\sqrt{42}\,y(x-z)(x+z)\left(15x^4-80x^2y^2+30x^2z^2+48y^4-80y^2z^2+15z^4\right)}{32}$ |

*continued …*

Table 10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_{7,2}^{(1,-1;a)}(E_g,4)$$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{15\sqrt{143}i}{9152} & 0 & \frac{19\sqrt{715}i}{9152} & 0 & \frac{\sqrt{429}i}{832} & 0 & -\frac{\sqrt{1001}i}{64} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{15\sqrt{143}i}{9152} & 0 & -\frac{15\sqrt{3003}i}{9152} & 0 & -\frac{19\sqrt{5005}i}{9152} & 0 & -\frac{\sqrt{1001}i}{832} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{15\sqrt{3003}i}{9152} & 0 & \frac{15\sqrt{15015}i}{9152} & 0 & \frac{57\sqrt{1001}i}{9152} & 0 & \frac{\sqrt{429}i}{832} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{19\sqrt{715}i}{9152} & 0 & -\frac{15\sqrt{15015}i}{9152} & 0 & -\frac{75\sqrt{1001}i}{9152} & 0 & -\frac{19\sqrt{5005}i}{9152} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{19\sqrt{5005}i}{9152} & 0 & \frac{75\sqrt{1001}i}{9152} & 0 & \frac{15\sqrt{15015}i}{9152} & 0 & \frac{19\sqrt{715}i}{9152} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{429}i}{832} & 0 & -\frac{57\sqrt{1001}i}{9152} & 0 & -\frac{15\sqrt{15015}i}{9152} & 0 & -\frac{15\sqrt{3003}i}{9152} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{1001}i}{832} & 0 & \frac{19\sqrt{5005}i}{9152} & 0 & \frac{15\sqrt{3003}i}{9152} & 0 & \frac{15\sqrt{143}i}{9152} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{1001}i}{64} & 0 & -\frac{\sqrt{429}i}{832} & 0 & -\frac{19\sqrt{715}i}{9152} & 0 & -\frac{15\sqrt{143}i}{9152} & 0
\end{pmatrix}$$

| 1004 | symmetry | $z$ |
|---|---|---|

*continued …*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{M}_1^{(1,1;a)}(A_{2g})$ | $\frac{2\sqrt{105}}{49}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{70}}{196}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{6\sqrt{105}}{245}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{42}}{196}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $\frac{2\sqrt{105}}{245}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{35}}{98}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{2\sqrt{105}}{245}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{35}}{98}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $-\frac{6\sqrt{105}}{245}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{42}}{196}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{105}}{49}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{70}}{196}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{105}}{42}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $-\frac{3\sqrt{70}}{196}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{105}}{294}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{5\sqrt{42}}{196}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{105}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $-\frac{3\sqrt{35}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{105}}{294}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{3\sqrt{35}}{98}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{105}}{294}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{42}}{196}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{105}}{98}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{70}}{196}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{105}}{294}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{105}}{42}$ |

| 1005 | symmetry | $x$ |
|---|---|---|

*continued ...*

| Table 10 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| No. | multipole | | | | | | matrix | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

$\mathbb{M}_{1,1}^{(1,1;a)}(E_g)$

$$
\begin{pmatrix}
0 & \frac{2\sqrt{21}}{49} & 0 & 0 & 0 & 0 & \frac{3\sqrt{10}}{56} & 0 & -\frac{\sqrt{210}}{392} & 0 & 0 & 0 & 0 & 0 \\
\frac{2\sqrt{21}}{49} & 0 & \frac{4\sqrt{210}}{245} & 0 & 0 & 0 & 0 & \frac{15\sqrt{14}}{392} & 0 & -\frac{3\sqrt{70}}{392} & 0 & 0 & 0 & 0 \\
0 & \frac{4\sqrt{210}}{245} & 0 & \frac{6\sqrt{105}}{245} & 0 & 0 & 0 & 0 & \frac{5\sqrt{21}}{196} & 0 & -\frac{3\sqrt{35}}{196} & 0 & 0 & 0 \\
0 & 0 & \frac{6\sqrt{105}}{245} & 0 & \frac{4\sqrt{210}}{245} & 0 & 0 & 0 & 0 & \frac{3\sqrt{35}}{196} & 0 & -\frac{5\sqrt{21}}{196} & 0 & 0 \\
0 & 0 & 0 & \frac{4\sqrt{210}}{245} & 0 & \frac{2\sqrt{21}}{49} & 0 & 0 & 0 & 0 & \frac{3\sqrt{70}}{392} & 0 & -\frac{15\sqrt{14}}{392} & 0 \\
0 & 0 & 0 & 0 & \frac{2\sqrt{21}}{49} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{392} & 0 & -\frac{3\sqrt{10}}{56} \\
\frac{3\sqrt{10}}{56} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{42} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{15\sqrt{14}}{392} & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{42} & 0 & -\frac{\sqrt{35}}{49} & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{210}}{392} & 0 & \frac{5\sqrt{21}}{196} & 0 & 0 & 0 & 0 & -\frac{\sqrt{35}}{49} & 0 & -\frac{5\sqrt{7}}{98} & 0 & 0 & 0 & 0 \\
0 & -\frac{3\sqrt{70}}{392} & 0 & \frac{3\sqrt{35}}{196} & 0 & 0 & 0 & 0 & -\frac{5\sqrt{7}}{98} & 0 & -\frac{2\sqrt{105}}{147} & 0 & 0 & 0 \\
0 & 0 & -\frac{3\sqrt{35}}{196} & 0 & \frac{3\sqrt{70}}{392} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{105}}{147} & 0 & -\frac{5\sqrt{7}}{98} & 0 & 0 \\
0 & 0 & 0 & -\frac{5\sqrt{21}}{196} & 0 & \frac{\sqrt{210}}{392} & 0 & 0 & 0 & 0 & -\frac{5\sqrt{7}}{98} & 0 & -\frac{\sqrt{35}}{49} & 0 \\
0 & 0 & 0 & 0 & -\frac{15\sqrt{14}}{392} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{35}}{49} & 0 & -\frac{\sqrt{15}}{42} \\
0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}}{56} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{42} & 0
\end{pmatrix}
$$

| 1006 | symmetry | $-y$ |
|---|---|---|

*continued ...*

Table 10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_{1,2}^{(1,1;a)}(E_g)$$

$$\begin{pmatrix}
0 & \frac{2\sqrt{21}i}{49} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{10}i}{56} & 0 & -\frac{\sqrt{210}i}{392} & 0 & 0 & 0 & 0 & 0 \\
-\frac{2\sqrt{21}i}{49} & 0 & \frac{4\sqrt{210}i}{245} & 0 & 0 & 0 & 0 & -\frac{15\sqrt{14}i}{392} & 0 & -\frac{3\sqrt{70}i}{392} & 0 & 0 & 0 & 0 \\
0 & -\frac{4\sqrt{210}i}{245} & 0 & \frac{6\sqrt{105}i}{245} & 0 & 0 & 0 & 0 & -\frac{5\sqrt{21}i}{196} & 0 & -\frac{3\sqrt{35}i}{196} & 0 & 0 & 0 \\
0 & 0 & -\frac{6\sqrt{105}i}{245} & 0 & \frac{4\sqrt{210}i}{245} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{35}i}{196} & 0 & -\frac{5\sqrt{21}i}{196} & 0 & 0 \\
0 & 0 & 0 & -\frac{4\sqrt{210}i}{245} & 0 & \frac{2\sqrt{21}i}{49} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{70}i}{392} & 0 & -\frac{15\sqrt{14}i}{392} & 0 \\
0 & 0 & 0 & 0 & -\frac{2\sqrt{21}i}{49} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}i}{392} & 0 & -\frac{3\sqrt{10}i}{56} \\
\frac{3\sqrt{10}i}{56} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{15\sqrt{14}i}{392} & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{42} & 0 & -\frac{\sqrt{35}i}{49} & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{210}i}{392} & 0 & \frac{5\sqrt{21}i}{196} & 0 & 0 & 0 & 0 & \frac{\sqrt{35}i}{49} & 0 & -\frac{5\sqrt{7}i}{98} & 0 & 0 & 0 & 0 \\
0 & \frac{3\sqrt{70}i}{392} & 0 & \frac{3\sqrt{35}i}{196} & 0 & 0 & 0 & 0 & \frac{5\sqrt{7}i}{98} & 0 & -\frac{2\sqrt{105}i}{147} & 0 & 0 & 0 \\
0 & 0 & \frac{3\sqrt{35}i}{196} & 0 & \frac{3\sqrt{70}i}{392} & 0 & 0 & 0 & 0 & \frac{2\sqrt{105}i}{147} & 0 & -\frac{5\sqrt{7}i}{98} & 0 & 0 \\
0 & 0 & 0 & \frac{5\sqrt{21}i}{196} & 0 & \frac{\sqrt{210}i}{392} & 0 & 0 & 0 & 0 & \frac{5\sqrt{7}i}{98} & 0 & -\frac{\sqrt{35}i}{49} & 0 \\
0 & 0 & 0 & 0 & \frac{15\sqrt{14}i}{392} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{35}i}{49} & 0 & -\frac{\sqrt{15}i}{42} \\
0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{10}i}{56} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{42} & 0
\end{pmatrix}$$

| No. | | |
|---|---|---|
| 1007 | symmetry | $-\frac{z\left(3x^2+3y^2-2z^2\right)}{2}$ |

Table 10

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_3^{(1,1;a)}(A_{2g})$

$$\begin{pmatrix}
-\frac{5\sqrt{77}}{147} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{462}}{98} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{\sqrt{77}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{4\sqrt{77}}{147} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{231}}{98} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{4\sqrt{77}}{147} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{231}}{98} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{77}}{21} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{77}}{147} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{462}}{98} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{77}}{77} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{\sqrt{462}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{5\sqrt{77}}{539} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{77}}{77} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{231}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{77}}{539} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{231}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{77}}{539} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{77}}{77} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{462}}{98} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{5\sqrt{77}}{539} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{77}}{77}
\end{pmatrix}$$

| 1008 | symmetry | $\sqrt{15}xyz$ |
|---|---|---|

*continued …*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{M}_3^{(1,1;a)}(B_{1g})$ | $0$ | $0$ | $\frac{5\sqrt{462}i}{294}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{154}i}{98}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{2310}i}{294}$ | $0$ | $0$ | $-\frac{\sqrt{22}i}{28}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{770}i}{196}$ | $0$ | $0$ | $0$ |
| | | $-\frac{5\sqrt{462}i}{294}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2310}i}{294}$ | $0$ | $0$ | $-\frac{\sqrt{77}i}{196}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{231}i}{196}$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{2310}i}{294}$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{462}i}{294}$ | $0$ | $0$ | $\frac{\sqrt{231}i}{196}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{77}i}{196}$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{2310}i}{294}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{770}i}{196}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{22}i}{28}$ |
| | | $0$ | $0$ | $0$ | $\frac{5\sqrt{462}i}{294}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{154}i}{98}$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{22}i}{28}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{55}i}{77}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{77}i}{196}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{231}i}{539}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{\sqrt{231}i}{196}$ | $0$ | $0$ | $\frac{\sqrt{55}i}{77}$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{77}i}{539}$ | $0$ | $0$ | $0$ |
| | | $\frac{\sqrt{154}i}{98}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{770}i}{196}$ | $0$ | $0$ | $\frac{3\sqrt{231}i}{539}$ | $0$ | $0$ | $0$ | $\frac{2\sqrt{77}i}{539}$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{770}i}{196}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{154}i}{98}$ | $0$ | $0$ | $\frac{2\sqrt{77}i}{539}$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{231}i}{539}$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{231}i}{196}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{77}i}{539}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{55}i}{77}$ |
| | | $0$ | $0$ | $0$ | $-\frac{\sqrt{77}i}{196}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{231}i}{539}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{22}i}{28}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{55}i}{77}$ | $0$ | $0$ |
| 1009 | symmetry | $\frac{\sqrt{15}z(x-y)(x+y)}{2}$ | | | | | | | | | | | | | |

*continued ...*

Table 10

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{M}_3^{(1,1;a)}(B_{2g})$

$$
\begin{pmatrix}
0 & 0 & -\frac{5\sqrt{462}}{294} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{154}}{98} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{2310}}{294} & 0 & 0 & -\frac{\sqrt{22}}{28} & 0 & 0 & 0 & \frac{\sqrt{770}}{196} & 0 & 0 & 0 \\
-\frac{5\sqrt{462}}{294} & 0 & 0 & 0 & \frac{\sqrt{2310}}{294} & 0 & 0 & -\frac{\sqrt{77}}{196} & 0 & 0 & 0 & \frac{\sqrt{231}}{196} & 0 & 0 \\
0 & -\frac{\sqrt{2310}}{294} & 0 & 0 & 0 & \frac{5\sqrt{462}}{294} & 0 & 0 & \frac{\sqrt{231}}{196} & 0 & 0 & 0 & -\frac{\sqrt{77}}{196} & 0 \\
0 & 0 & \frac{\sqrt{2310}}{294} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{770}}{196} & 0 & 0 & 0 & -\frac{\sqrt{22}}{28} \\
0 & 0 & 0 & \frac{5\sqrt{462}}{294} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{154}}{98} & 0 & 0 & 0 \\
0 & -\frac{\sqrt{22}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{55}}{77} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\frac{\sqrt{77}}{196} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{231}}{539} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{\sqrt{231}}{196} & 0 & 0 & \frac{\sqrt{55}}{77} & 0 & 0 & 0 & \frac{2\sqrt{77}}{539} & 0 & 0 & 0 \\
\frac{\sqrt{154}}{98} & 0 & 0 & 0 & \frac{\sqrt{770}}{196} & 0 & 0 & \frac{3\sqrt{231}}{539} & 0 & 0 & 0 & -\frac{2\sqrt{77}}{539} & 0 & 0 \\
0 & \frac{\sqrt{770}}{196} & 0 & 0 & 0 & \frac{\sqrt{154}}{98} & 0 & 0 & \frac{2\sqrt{77}}{539} & 0 & 0 & 0 & -\frac{3\sqrt{231}}{539} & 0 \\
0 & 0 & \frac{\sqrt{231}}{196} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{77}}{539} & 0 & 0 & 0 & -\frac{\sqrt{55}}{77} \\
0 & 0 & 0 & -\frac{\sqrt{77}}{196} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{231}}{539} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -\frac{\sqrt{22}}{28} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{55}}{77} & 0 & 0
\end{pmatrix}
$$

| 1010 | symmetry | $\frac{x\left(2x^2-3y^2-3z^2\right)}{2}$ |
|------|----------|------|

*continued ...*

Table 10

| No. | multipole | matrix |

| $\mathbb{M}_{3,1}^{(1,1;a)}(E_g,1)$ |

| $0$ | $\frac{\sqrt{385}}{98}$ | $0$ | $-\frac{5\sqrt{770}}{588}$ | $0$ | $0$ | $\frac{\sqrt{66}}{112}$ | $0$ | $-\frac{3\sqrt{154}}{392}$ | $0$ | $\frac{\sqrt{2310}}{784}$ | $0$ | $0$ | $0$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\frac{\sqrt{385}}{98}$ | $0$ | $-\frac{\sqrt{154}}{196}$ | $0$ | $-\frac{5\sqrt{77}}{147}$ | $0$ | $0$ | $-\frac{\sqrt{2310}}{784}$ | $0$ | $-\frac{\sqrt{462}}{392}$ | $0$ | $\frac{3\sqrt{770}}{784}$ | $0$ | $0$ |
| $0$ | $-\frac{\sqrt{154}}{196}$ | $0$ | $-\frac{\sqrt{77}}{49}$ | $0$ | $-\frac{5\sqrt{770}}{588}$ | $-\frac{\sqrt{165}}{112}$ | $0$ | $-\frac{3\sqrt{385}}{784}$ | $0$ | $\frac{\sqrt{231}}{784}$ | $0$ | $\frac{3\sqrt{1155}}{784}$ | $0$ |
| $-\frac{5\sqrt{770}}{588}$ | $0$ | $-\frac{\sqrt{77}}{49}$ | $0$ | $-\frac{\sqrt{154}}{196}$ | $0$ | $0$ | $-\frac{3\sqrt{1155}}{784}$ | $0$ | $-\frac{\sqrt{231}}{784}$ | $0$ | $\frac{3\sqrt{385}}{784}$ | $0$ | $\frac{\sqrt{165}}{112}$ |
| $0$ | $-\frac{5\sqrt{77}}{147}$ | $0$ | $-\frac{\sqrt{154}}{196}$ | $0$ | $\frac{\sqrt{385}}{98}$ | $0$ | $0$ | $-\frac{3\sqrt{770}}{784}$ | $0$ | $\frac{\sqrt{462}}{392}$ | $0$ | $\frac{\sqrt{2310}}{784}$ | $0$ |
| $0$ | $0$ | $-\frac{5\sqrt{770}}{588}$ | $0$ | $\frac{\sqrt{385}}{98}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2310}}{784}$ | $0$ | $\frac{3\sqrt{154}}{392}$ | $0$ | $-\frac{\sqrt{66}}{112}$ |
| $\frac{\sqrt{66}}{112}$ | $0$ | $-\frac{\sqrt{165}}{112}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{11}}{154}$ | $0$ | $\frac{\sqrt{55}}{154}$ | $0$ | $0$ | $0$ | $0$ |
| $0$ | $-\frac{\sqrt{2310}}{784}$ | $0$ | $-\frac{3\sqrt{1155}}{784}$ | $0$ | $0$ | $-\frac{3\sqrt{11}}{154}$ | $0$ | $-\frac{\sqrt{231}}{1078}$ | $0$ | $\frac{2\sqrt{385}}{539}$ | $0$ | $0$ | $0$ |
| $-\frac{3\sqrt{154}}{392}$ | $0$ | $-\frac{3\sqrt{385}}{784}$ | $0$ | $-\frac{3\sqrt{770}}{784}$ | $0$ | $0$ | $-\frac{\sqrt{231}}{1078}$ | $0$ | $\frac{\sqrt{1155}}{1078}$ | $0$ | $\frac{5\sqrt{77}}{539}$ | $0$ | $0$ |
| $0$ | $-\frac{\sqrt{462}}{392}$ | $0$ | $-\frac{\sqrt{231}}{784}$ | $0$ | $-\frac{\sqrt{2310}}{784}$ | $\frac{\sqrt{55}}{154}$ | $0$ | $\frac{\sqrt{1155}}{1078}$ | $0$ | $\frac{3\sqrt{77}}{539}$ | $0$ | $\frac{2\sqrt{385}}{539}$ | $0$ |
| $\frac{\sqrt{2310}}{784}$ | $0$ | $\frac{\sqrt{231}}{784}$ | $0$ | $\frac{\sqrt{462}}{392}$ | $0$ | $0$ | $\frac{2\sqrt{385}}{539}$ | $0$ | $\frac{3\sqrt{77}}{539}$ | $0$ | $\frac{\sqrt{1155}}{1078}$ | $0$ | $\frac{\sqrt{55}}{154}$ |
| $0$ | $\frac{3\sqrt{770}}{784}$ | $0$ | $\frac{3\sqrt{385}}{784}$ | $0$ | $\frac{3\sqrt{154}}{392}$ | $0$ | $0$ | $\frac{5\sqrt{77}}{539}$ | $0$ | $\frac{\sqrt{1155}}{1078}$ | $0$ | $-\frac{\sqrt{231}}{1078}$ | $0$ |
| $0$ | $0$ | $\frac{3\sqrt{1155}}{784}$ | $0$ | $\frac{\sqrt{2310}}{784}$ | $0$ | $0$ | $0$ | $0$ | $\frac{2\sqrt{385}}{539}$ | $0$ | $-\frac{\sqrt{231}}{1078}$ | $0$ | $-\frac{3\sqrt{11}}{154}$ |
| $0$ | $0$ | $0$ | $\frac{\sqrt{165}}{112}$ | $0$ | $-\frac{\sqrt{66}}{112}$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{55}}{154}$ | $0$ | $-\frac{3\sqrt{11}}{154}$ | $0$ |

| 1011 | symmetry | $\dfrac{y\left(3x^2-2y^2+3z^2\right)}{2}$ |

Table 10

| No. | multipole | matrix |
|-----|-----------|--------|

$\mathbb{M}_{3,2}^{(1,1;a)}(E_g,1)$

$$\begin{pmatrix}
0 & \frac{\sqrt{385}i}{98} & 0 & \frac{5\sqrt{770}i}{588} & 0 & 0 & -\frac{\sqrt{66}i}{112} & 0 & -\frac{3\sqrt{154}i}{392} & 0 & -\frac{\sqrt{2310}i}{784} & 0 & 0 & 0 \\
-\frac{\sqrt{385}i}{98} & 0 & -\frac{\sqrt{154}i}{196} & 0 & \frac{5\sqrt{77}i}{147} & 0 & 0 & \frac{\sqrt{2310}i}{784} & 0 & -\frac{\sqrt{462}i}{392} & 0 & -\frac{3\sqrt{770}i}{784} & 0 & 0 \\
0 & \frac{\sqrt{154}i}{196} & 0 & -\frac{\sqrt{77}i}{49} & 0 & \frac{5\sqrt{770}i}{588} & -\frac{\sqrt{165}i}{112} & 0 & \frac{3\sqrt{385}i}{784} & 0 & \frac{\sqrt{231}i}{784} & 0 & -\frac{3\sqrt{1155}i}{784} & 0 \\
-\frac{5\sqrt{770}i}{588} & 0 & \frac{\sqrt{77}i}{49} & 0 & -\frac{\sqrt{154}i}{196} & 0 & 0 & -\frac{3\sqrt{1155}i}{784} & 0 & \frac{\sqrt{231}i}{784} & 0 & \frac{3\sqrt{385}i}{784} & 0 & -\frac{\sqrt{165}i}{112} \\
0 & -\frac{5\sqrt{77}i}{147} & 0 & \frac{\sqrt{154}i}{196} & 0 & \frac{\sqrt{385}i}{98} & 0 & 0 & -\frac{3\sqrt{770}i}{784} & 0 & -\frac{\sqrt{462}i}{392} & 0 & \frac{\sqrt{2310}i}{784} & 0 \\
0 & 0 & -\frac{5\sqrt{770}i}{588} & 0 & -\frac{\sqrt{385}i}{98} & 0 & 0 & 0 & 0 & -\frac{\sqrt{2310}i}{784} & 0 & -\frac{3\sqrt{154}i}{392} & 0 & -\frac{\sqrt{66}i}{112} \\
\frac{\sqrt{66}i}{112} & 0 & \frac{\sqrt{165}i}{112} & 0 & 0 & 0 & 0 & -\frac{3\sqrt{11}i}{154} & 0 & -\frac{\sqrt{55}i}{154} & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{2310}i}{784} & 0 & \frac{3\sqrt{1155}i}{784} & 0 & 0 & \frac{3\sqrt{11}i}{154} & 0 & -\frac{\sqrt{231}i}{1078} & 0 & -\frac{2\sqrt{385}i}{539} & 0 & 0 & 0 \\
\frac{3\sqrt{154}i}{392} & 0 & -\frac{3\sqrt{385}i}{784} & 0 & \frac{3\sqrt{770}i}{784} & 0 & 0 & \frac{\sqrt{231}i}{1078} & 0 & \frac{\sqrt{1155}i}{1078} & 0 & -\frac{5\sqrt{77}i}{539} & 0 & 0 \\
0 & \frac{\sqrt{462}i}{392} & 0 & -\frac{\sqrt{231}i}{784} & 0 & \frac{\sqrt{2310}i}{784} & \frac{\sqrt{55}i}{154} & 0 & -\frac{\sqrt{1155}i}{1078} & 0 & \frac{3\sqrt{77}i}{539} & 0 & -\frac{2\sqrt{385}i}{539} & 0 \\
\frac{\sqrt{2310}i}{784} & 0 & -\frac{\sqrt{231}i}{784} & 0 & \frac{\sqrt{462}i}{392} & 0 & 0 & \frac{2\sqrt{385}i}{539} & 0 & -\frac{3\sqrt{77}i}{539} & 0 & \frac{\sqrt{1155}i}{1078} & 0 & -\frac{\sqrt{55}i}{154} \\
0 & \frac{3\sqrt{770}i}{784} & 0 & -\frac{3\sqrt{385}i}{784} & 0 & \frac{3\sqrt{154}i}{392} & 0 & 0 & \frac{5\sqrt{77}i}{539} & 0 & -\frac{\sqrt{1155}i}{1078} & 0 & -\frac{\sqrt{231}i}{1078} & 0 \\
0 & 0 & \frac{3\sqrt{1155}i}{784} & 0 & -\frac{\sqrt{2310}i}{784} & 0 & 0 & 0 & 0 & \frac{2\sqrt{385}i}{539} & 0 & \frac{\sqrt{231}i}{1078} & 0 & -\frac{3\sqrt{11}i}{154} \\
0 & 0 & 0 & \frac{\sqrt{165}i}{112} & 0 & \frac{\sqrt{66}i}{112} & 0 & 0 & 0 & 0 & \frac{\sqrt{55}i}{154} & 0 & \frac{3\sqrt{11}i}{154} & 0
\end{pmatrix}$$

| 1012 | symmetry | $\frac{\sqrt{15}x(y-z)(y+z)}{2}$ |
|------|----------|----------------------------------|

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{M}_{3,1}^{(1,1;a)}(E_g,2)$ | $0$ | $\frac{5\sqrt{231}}{294}$ | $0$ | $\frac{5\sqrt{462}}{588}$ | $0$ | $0$ | $\frac{\sqrt{110}}{112}$ | $0$ | $-\frac{\sqrt{2310}}{392}$ | $0$ | $-\frac{3\sqrt{154}}{784}$ | $0$ | $0$ | $0$ |
| | | $\frac{5\sqrt{231}}{294}$ | $0$ | $-\frac{\sqrt{2310}}{588}$ | $0$ | $\frac{\sqrt{1155}}{147}$ | $0$ | $0$ | $-\frac{5\sqrt{154}}{784}$ | $0$ | $-\frac{\sqrt{770}}{392}$ | $0$ | $-\frac{3\sqrt{462}}{784}$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{2310}}{588}$ | $0$ | $-\frac{\sqrt{1155}}{147}$ | $0$ | $\frac{5\sqrt{462}}{588}$ | $\frac{3\sqrt{11}}{112}$ | $0$ | $-\frac{5\sqrt{231}}{784}$ | $0$ | $\frac{\sqrt{385}}{784}$ | $0$ | $-\frac{9\sqrt{77}}{784}$ | $0$ |
| | | $\frac{5\sqrt{462}}{588}$ | $0$ | $-\frac{\sqrt{1155}}{147}$ | $0$ | $-\frac{\sqrt{2310}}{588}$ | $0$ | $0$ | $\frac{9\sqrt{77}}{784}$ | $0$ | $-\frac{\sqrt{385}}{784}$ | $0$ | $\frac{5\sqrt{231}}{784}$ | $0$ | $-\frac{3\sqrt{11}}{112}$ |
| | | $0$ | $\frac{\sqrt{1155}}{147}$ | $0$ | $-\frac{\sqrt{2310}}{588}$ | $0$ | $\frac{5\sqrt{231}}{294}$ | $0$ | $0$ | $\frac{3\sqrt{462}}{784}$ | $0$ | $\frac{\sqrt{770}}{392}$ | $0$ | $\frac{5\sqrt{154}}{784}$ | $0$ |
| | | $0$ | $0$ | $\frac{5\sqrt{462}}{588}$ | $0$ | $\frac{5\sqrt{231}}{294}$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{154}}{784}$ | $0$ | $\frac{\sqrt{2310}}{392}$ | $0$ | $-\frac{\sqrt{110}}{112}$ |
| | | $\frac{\sqrt{110}}{112}$ | $0$ | $\frac{3\sqrt{11}}{112}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{165}}{154}$ | $0$ | $-\frac{\sqrt{33}}{154}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{5\sqrt{154}}{784}$ | $0$ | $\frac{9\sqrt{77}}{784}$ | $0$ | $0$ | $-\frac{\sqrt{165}}{154}$ | $0$ | $-\frac{\sqrt{385}}{1078}$ | $0$ | $-\frac{2\sqrt{231}}{539}$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{2310}}{392}$ | $0$ | $-\frac{5\sqrt{231}}{784}$ | $0$ | $\frac{3\sqrt{462}}{784}$ | $0$ | $0$ | $-\frac{\sqrt{385}}{1078}$ | $0$ | $\frac{5\sqrt{77}}{1078}$ | $0$ | $-\frac{\sqrt{1155}}{539}$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{770}}{392}$ | $0$ | $-\frac{\sqrt{385}}{784}$ | $0$ | $\frac{3\sqrt{154}}{784}$ | $-\frac{\sqrt{33}}{154}$ | $0$ | $\frac{5\sqrt{77}}{1078}$ | $0$ | $\frac{\sqrt{1155}}{539}$ | $0$ | $-\frac{2\sqrt{231}}{539}$ | $0$ |
| | | $-\frac{3\sqrt{154}}{784}$ | $0$ | $\frac{\sqrt{385}}{784}$ | $0$ | $\frac{\sqrt{770}}{392}$ | $0$ | $0$ | $-\frac{2\sqrt{231}}{539}$ | $0$ | $\frac{\sqrt{1155}}{539}$ | $0$ | $\frac{5\sqrt{77}}{1078}$ | $0$ | $-\frac{\sqrt{33}}{154}$ |
| | | $0$ | $-\frac{3\sqrt{462}}{784}$ | $0$ | $\frac{5\sqrt{231}}{784}$ | $0$ | $\frac{\sqrt{2310}}{392}$ | $0$ | $0$ | $-\frac{\sqrt{1155}}{539}$ | $0$ | $\frac{5\sqrt{77}}{1078}$ | $0$ | $-\frac{\sqrt{385}}{1078}$ | $0$ |
| | | $0$ | $0$ | $-\frac{9\sqrt{77}}{784}$ | $0$ | $\frac{5\sqrt{154}}{784}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{231}}{539}$ | $0$ | $-\frac{\sqrt{385}}{1078}$ | $0$ | $-\frac{\sqrt{165}}{154}$ |
| | | $0$ | $0$ | $0$ | $-\frac{3\sqrt{11}}{112}$ | $0$ | $-\frac{\sqrt{110}}{112}$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{33}}{154}$ | $0$ | $-\frac{\sqrt{165}}{154}$ | $0$ |
| 1013 | symmetry | $-\frac{\sqrt{15}y(x-z)(x+z)}{2}$ | | | | | | | | | | | | | |

*continued …*

Table 10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_{3,2}^{(1,1;a)}(E_g,2)$$

$$
\begin{pmatrix}
0 & \frac{5\sqrt{231}i}{294} & 0 & -\frac{5\sqrt{462}i}{588} & 0 & 0 & -\frac{\sqrt{110}i}{112} & 0 & -\frac{\sqrt{2310}i}{392} & 0 & \frac{3\sqrt{154}i}{784} & 0 & 0 & 0 \\
-\frac{5\sqrt{231}i}{294} & 0 & -\frac{\sqrt{2310}i}{588} & 0 & -\frac{\sqrt{1155}i}{147} & 0 & 0 & \frac{5\sqrt{154}i}{784} & 0 & -\frac{\sqrt{770}i}{392} & 0 & \frac{3\sqrt{462}i}{784} & 0 & 0 \\
0 & \frac{\sqrt{2310}i}{588} & 0 & -\frac{\sqrt{1155}i}{147} & 0 & -\frac{5\sqrt{462}i}{588} & \frac{3\sqrt{11}i}{112} & 0 & \frac{5\sqrt{231}i}{784} & 0 & \frac{\sqrt{385}i}{784} & 0 & \frac{9\sqrt{77}i}{784} & 0 \\
\frac{5\sqrt{462}i}{588} & 0 & \frac{\sqrt{1155}i}{147} & 0 & -\frac{\sqrt{2310}i}{588} & 0 & 0 & \frac{9\sqrt{77}i}{784} & 0 & \frac{\sqrt{385}i}{784} & 0 & \frac{5\sqrt{231}i}{784} & 0 & \frac{3\sqrt{11}i}{112} \\
0 & \frac{\sqrt{1155}i}{147} & 0 & \frac{\sqrt{2310}i}{588} & 0 & \frac{5\sqrt{231}i}{294} & 0 & 0 & \frac{3\sqrt{462}i}{784} & 0 & -\frac{\sqrt{770}i}{392} & 0 & \frac{5\sqrt{154}i}{784} & 0 \\
0 & 0 & \frac{5\sqrt{462}i}{588} & 0 & -\frac{5\sqrt{231}i}{294} & 0 & 0 & 0 & 0 & \frac{3\sqrt{154}i}{784} & 0 & -\frac{\sqrt{2310}i}{392} & 0 & -\frac{\sqrt{110}i}{112} \\
\frac{\sqrt{110}i}{112} & 0 & -\frac{3\sqrt{11}i}{112} & 0 & 0 & 0 & 0 & -\frac{\sqrt{165}i}{154} & 0 & \frac{\sqrt{33}i}{154} & 0 & 0 & 0 & 0 \\
0 & -\frac{5\sqrt{154}i}{784} & 0 & -\frac{9\sqrt{77}i}{784} & 0 & 0 & \frac{\sqrt{165}i}{154} & 0 & -\frac{\sqrt{385}i}{1078} & 0 & \frac{2\sqrt{231}i}{539} & 0 & 0 & 0 \\
\frac{\sqrt{2310}i}{392} & 0 & -\frac{5\sqrt{231}i}{784} & 0 & -\frac{3\sqrt{462}i}{784} & 0 & 0 & \frac{\sqrt{385}i}{1078} & 0 & \frac{5\sqrt{77}i}{1078} & 0 & \frac{\sqrt{1155}i}{539} & 0 & 0 \\
0 & \frac{\sqrt{770}i}{392} & 0 & -\frac{\sqrt{385}i}{784} & 0 & -\frac{3\sqrt{154}i}{784} & -\frac{\sqrt{33}i}{154} & 0 & -\frac{5\sqrt{77}i}{1078} & 0 & \frac{\sqrt{1155}i}{539} & 0 & \frac{2\sqrt{231}i}{539} & 0 \\
-\frac{3\sqrt{154}i}{784} & 0 & -\frac{\sqrt{385}i}{784} & 0 & \frac{\sqrt{770}i}{392} & 0 & 0 & -\frac{2\sqrt{231}i}{539} & 0 & -\frac{\sqrt{1155}i}{539} & 0 & \frac{5\sqrt{77}i}{1078} & 0 & \frac{\sqrt{33}i}{154} \\
0 & -\frac{3\sqrt{462}i}{784} & 0 & -\frac{5\sqrt{231}i}{784} & 0 & \frac{\sqrt{2310}i}{392} & 0 & 0 & -\frac{\sqrt{1155}i}{539} & 0 & -\frac{5\sqrt{77}i}{1078} & 0 & -\frac{\sqrt{385}i}{1078} & 0 \\
0 & 0 & -\frac{9\sqrt{77}i}{784} & 0 & -\frac{5\sqrt{154}i}{784} & 0 & 0 & 0 & 0 & -\frac{2\sqrt{231}i}{539} & 0 & \frac{\sqrt{385}i}{1078} & 0 & -\frac{\sqrt{165}i}{154} \\
0 & 0 & 0 & -\frac{3\sqrt{11}i}{112} & 0 & \frac{\sqrt{110}i}{112} & 0 & 0 & 0 & 0 & -\frac{\sqrt{33}i}{154} & 0 & \frac{\sqrt{165}i}{154} & 0
\end{pmatrix}
$$

| No. | | |
|---|---|---|
| 1014 | symmetry | $\frac{3\sqrt{35}xyz(x-y)(x+y)}{2}$ |

*continued ...*

Table 10

| No. | multipole | matrix |
|---|---|---|

$\mathbb{M}_5^{(1,1;a)}(A_{1g})$

$$\begin{pmatrix}
0 & 0 & 0 & 0 & -\frac{3\sqrt{143}i}{77} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{1430}i}{308} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{143}i}{77} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{858}i}{924} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{3003}i}{462} \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3003}i}{462} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\frac{3\sqrt{143}i}{77} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{858}i}{924} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{3\sqrt{143}i}{77} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{1430}i}{308} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{3003}i}{462} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{1001}i}{2002} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{\sqrt{858}i}{924} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2145}i}{2002} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{\sqrt{1430}i}{308} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2145}i}{2002} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{1001}i}{2002} \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{3\sqrt{1001}i}{2002} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{\sqrt{1430}i}{308} & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2145}i}{2002} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{858}i}{924} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2145}i}{2002} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \frac{\sqrt{3003}i}{462} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{3\sqrt{1001}i}{2002} & 0 & 0 & 0 & 0
\end{pmatrix}$$

| 1015 | symmetry | $\dfrac{z\left(15x^4+30x^2y^2-40x^2z^2+15y^4-40y^2z^2+8z^4\right)}{8}$ |
|---|---|---|

*continued …*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $\frac{\sqrt{1001}}{539}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{6006}}{6468}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{5\sqrt{1001}}{539}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{10010}}{2156}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $\frac{10\sqrt{1001}}{539}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{3003}}{3234}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{10\sqrt{1001}}{539}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{3003}}{3234}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{1001}}{539}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{10010}}{2156}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{1001}}{539}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{6006}}{6468}$ | $0$ |
| | $\mathbb{M}_5^{(1,1;a)}(A_{2g},1)$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{1001}}{2002}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $-\frac{5\sqrt{6006}}{6468}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{23\sqrt{1001}}{14014}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $\frac{3\sqrt{10010}}{2156}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{17\sqrt{1001}}{14014}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $-\frac{5\sqrt{3003}}{3234}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{15\sqrt{1001}}{14014}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{5\sqrt{3003}}{3234}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{15\sqrt{1001}}{14014}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{10010}}{2156}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{17\sqrt{1001}}{14014}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{6006}}{6468}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{23\sqrt{1001}}{14014}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{1001}}{2002}$ |

| 1016 | symmetry | $\frac{3\sqrt{35}z\left(x^2-2xy-y^2\right)\left(x^2+2xy-y^2\right)}{8}$ |

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{M}_5^{(1,1;a)}(A_{2g},2)$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{143}}{77}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{1430}}{308}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{143}}{77}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{858}}{924}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{3003}}{462}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{3003}}{462}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $\frac{3\sqrt{143}}{77}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{858}}{924}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{3\sqrt{143}}{77}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{1430}}{308}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{3003}}{462}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{1001}}{2002}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{858}}{924}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2145}}{2002}$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{1430}}{308}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{2145}}{2002}$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{1001}}{2002}$ |
| | | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{1001}}{2002}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{1430}}{308}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2145}}{2002}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{858}}{924}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{2145}}{2002}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{3003}}{462}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{1001}}{2002}$ | $0$ | $0$ | $0$ | $0$ |

| 1017 | symmetry | $\frac{\sqrt{105}xyz\left(x^2+y^2-2z^2\right)}{2}$ |

*continued …*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $0$ | $0$ | $\frac{\sqrt{858}i}{154}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{286}i}{924}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $-\frac{\sqrt{4290}i}{154}$ | $0$ | $0$ | $-\frac{\sqrt{2002}i}{924}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{1430}i}{462}$ | $0$ | $0$ | $0$ |
| | | $-\frac{\sqrt{858}i}{154}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{4290}i}{154}$ | $0$ | $0$ | $\frac{2\sqrt{143}i}{231}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{429}i}{462}$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{4290}i}{154}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{858}i}{154}$ | $0$ | $0$ | $-\frac{\sqrt{429}i}{462}$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{143}i}{231}$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{4290}i}{154}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{1430}i}{462}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{2002}i}{924}$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{858}i}{154}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{5\sqrt{286}i}{924}$ | $0$ | $0$ | $0$ |
| | $\mathbb{M}_5^{(1,1;a)}(B_{1g})$ | $0$ | $\frac{\sqrt{2002}i}{924}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{5005}i}{2002}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $-\frac{2\sqrt{143}i}{231}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{429}i}{2002}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{429}i}{462}$ | $0$ | $0$ | $\frac{\sqrt{5005}i}{2002}$ | $0$ | $0$ | $0$ | $\frac{2\sqrt{143}i}{1001}$ | $0$ | $0$ | $0$ |
| | | $\frac{5\sqrt{286}i}{924}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{1430}i}{462}$ | $0$ | $0$ | $-\frac{3\sqrt{429}i}{2002}$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{143}i}{1001}$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{1430}i}{462}$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{286}i}{924}$ | $0$ | $0$ | $-\frac{2\sqrt{143}i}{1001}$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{429}i}{2002}$ | $0$ |
| | | $0$ | $0$ | $-\frac{\sqrt{429}i}{462}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{2\sqrt{143}i}{1001}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{5005}i}{2002}$ |
| | | $0$ | $0$ | $0$ | $\frac{2\sqrt{143}i}{231}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{429}i}{2002}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{2002}i}{924}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{5005}i}{2002}$ | $0$ | $0$ |

| 1018 | symmetry | $-\frac{\sqrt{105}z(x-y)(x+y)\left(x^2+y^2-2z^2\right)}{4}$ |

*continued ...*

Table 10

| No. | multipole | matrix | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | $0$ | $0$ | $\frac{\sqrt{858}}{154}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{286}}{924}$ | $0$ | $0$ | $0$ | $0$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $0$ | $0$ | $0$ | $-\frac{\sqrt{4290}}{154}$ | $0$ | $0$ | $\frac{\sqrt{2002}}{924}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{1430}}{462}$ | $0$ | $0$ | $0$ |
| | | $\frac{\sqrt{858}}{154}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{4290}}{154}$ | $0$ | $0$ | $-\frac{2\sqrt{143}}{231}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{429}}{462}$ | $0$ | $0$ |
| | | $0$ | $-\frac{\sqrt{4290}}{154}$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{858}}{154}$ | $0$ | $0$ | $\frac{\sqrt{429}}{462}$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{143}}{231}$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{4290}}{154}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{1430}}{462}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{2002}}{924}$ |
| | | $0$ | $0$ | $0$ | $-\frac{\sqrt{858}}{154}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{286}}{924}$ | $0$ | $0$ | $0$ |
| | $\mathbb{M}_5^{(1,1;a)}(B_{2g})$ | $0$ | $\frac{\sqrt{2002}}{924}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{\sqrt{5005}}{2002}$ | $0$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $-\frac{2\sqrt{143}}{231}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{3\sqrt{429}}{2002}$ | $0$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $\frac{\sqrt{429}}{462}$ | $0$ | $0$ | $-\frac{\sqrt{5005}}{2002}$ | $0$ | $0$ | $0$ | $\frac{2\sqrt{143}}{1001}$ | $0$ | $0$ | $0$ |
| | | $-\frac{5\sqrt{286}}{924}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{1430}}{462}$ | $0$ | $0$ | $\frac{3\sqrt{429}}{2002}$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{143}}{1001}$ | $0$ | $0$ |
| | | $0$ | $\frac{\sqrt{1430}}{462}$ | $0$ | $0$ | $0$ | $-\frac{5\sqrt{286}}{924}$ | $0$ | $0$ | $\frac{2\sqrt{143}}{1001}$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{429}}{2002}$ | $0$ |
| | | $0$ | $0$ | $\frac{\sqrt{429}}{462}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{2\sqrt{143}}{1001}$ | $0$ | $0$ | $0$ | $\frac{\sqrt{5005}}{2002}$ |
| | | $0$ | $0$ | $0$ | $-\frac{2\sqrt{143}}{231}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $-\frac{3\sqrt{429}}{2002}$ | $0$ | $0$ | $0$ |
| | | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{2002}}{924}$ | $0$ | $0$ | $0$ | $0$ | $0$ | $0$ | $\frac{\sqrt{5005}}{2002}$ | $0$ | $0$ |

| 1019 | symmetry | $\frac{x\left(8x^4-40x^2y^2-40x^2z^2+15y^4+30y^2z^2+15z^4\right)}{8}$ |
|---|---|---|

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Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{M}_{5,1}^{(1,1;a)}(E_g,1)$ | $0$ | $\frac{3\sqrt{5005}}{4312}$ | $0$ | $-\frac{\sqrt{10010}}{616}$ | $0$ | $\frac{9\sqrt{1001}}{616}$ | $\frac{5\sqrt{858}}{14784}$ | $0$ | $-\frac{25\sqrt{2002}}{34496}$ | $0$ | $\frac{5\sqrt{30030}}{14784}$ | $0$ | $-\frac{5\sqrt{6006}}{4928}$ | $0$ |
| | | $\frac{3\sqrt{5005}}{4312}$ | $0$ | $-\frac{15\sqrt{2002}}{4312}$ | $0$ | $\frac{5\sqrt{1001}}{616}$ | $0$ | $0$ | $-\frac{23\sqrt{30030}}{103488}$ | $0$ | $\frac{65\sqrt{6006}}{103488}$ | $0$ | $-\frac{\sqrt{10010}}{4928}$ | $0$ | $-\frac{\sqrt{4290}}{704}$ |
| | | $0$ | $-\frac{15\sqrt{2002}}{4312}$ | $0$ | $\frac{15\sqrt{1001}}{2156}$ | $0$ | $-\frac{\sqrt{10010}}{616}$ | $-\frac{\sqrt{2145}}{1056}$ | $0$ | $\frac{\sqrt{5005}}{1568}$ | $0$ | $-\frac{5\sqrt{3003}}{51744}$ | $0$ | $-\frac{\sqrt{15015}}{2464}$ | $0$ |
| | | $-\frac{\sqrt{10010}}{616}$ | $0$ | $\frac{15\sqrt{1001}}{2156}$ | $0$ | $-\frac{15\sqrt{2002}}{4312}$ | $0$ | $0$ | $\frac{\sqrt{15015}}{2464}$ | $0$ | $\frac{5\sqrt{3003}}{51744}$ | $0$ | $-\frac{\sqrt{5005}}{1568}$ | $0$ | $\frac{\sqrt{2145}}{1056}$ |
| | | $0$ | $\frac{5\sqrt{1001}}{616}$ | $0$ | $-\frac{15\sqrt{2002}}{4312}$ | $0$ | $\frac{3\sqrt{5005}}{4312}$ | $\frac{\sqrt{4290}}{704}$ | $0$ | $\frac{\sqrt{10010}}{4928}$ | $0$ | $-\frac{65\sqrt{6006}}{103488}$ | $0$ | $\frac{23\sqrt{30030}}{103488}$ | $0$ |
| | | $\frac{9\sqrt{1001}}{616}$ | $0$ | $-\frac{\sqrt{10010}}{616}$ | $0$ | $\frac{3\sqrt{5005}}{4312}$ | $0$ | $0$ | $\frac{5\sqrt{6006}}{4928}$ | $0$ | $-\frac{5\sqrt{30030}}{14784}$ | $0$ | $\frac{25\sqrt{2002}}{34496}$ | $0$ | $-\frac{5\sqrt{858}}{14784}$ |
| | | $\frac{5\sqrt{858}}{14784}$ | $0$ | $-\frac{\sqrt{2145}}{1056}$ | $0$ | $\frac{\sqrt{4290}}{704}$ | $0$ | $0$ | $-\frac{15\sqrt{143}}{16016}$ | $0$ | $\frac{\sqrt{715}}{1144}$ | $0$ | $-\frac{3\sqrt{429}}{2288}$ | $0$ | $0$ |
| | | $0$ | $-\frac{23\sqrt{30030}}{103488}$ | $0$ | $\frac{\sqrt{15015}}{2464}$ | $0$ | $\frac{5\sqrt{6006}}{4928}$ | $-\frac{15\sqrt{143}}{16016}$ | $0$ | $\frac{5\sqrt{3003}}{14014}$ | $0$ | $-\frac{\sqrt{5005}}{16016}$ | $0$ | $-\frac{9\sqrt{1001}}{8008}$ | $0$ |
| | | $-\frac{25\sqrt{2002}}{34496}$ | $0$ | $\frac{\sqrt{5005}}{1568}$ | $0$ | $\frac{\sqrt{10010}}{4928}$ | $0$ | $0$ | $\frac{5\sqrt{3003}}{14014}$ | $0$ | $-\frac{\sqrt{15015}}{112112}$ | $0$ | $-\frac{5\sqrt{1001}}{8008}$ | $0$ | $-\frac{3\sqrt{429}}{2288}$ |
| | | $0$ | $\frac{65\sqrt{6006}}{103488}$ | $0$ | $\frac{5\sqrt{3003}}{51744}$ | $0$ | $-\frac{5\sqrt{30030}}{14784}$ | $\frac{\sqrt{715}}{1144}$ | $0$ | $-\frac{\sqrt{15015}}{112112}$ | $0$ | $-\frac{15\sqrt{1001}}{28028}$ | $0$ | $-\frac{\sqrt{5005}}{16016}$ | $0$ |
| | | $\frac{5\sqrt{30030}}{14784}$ | $0$ | $-\frac{5\sqrt{3003}}{51744}$ | $0$ | $-\frac{65\sqrt{6006}}{103488}$ | $0$ | $0$ | $-\frac{\sqrt{5005}}{16016}$ | $0$ | $-\frac{15\sqrt{1001}}{28028}$ | $0$ | $-\frac{\sqrt{15015}}{112112}$ | $0$ | $\frac{\sqrt{715}}{1144}$ |
| | | $0$ | $-\frac{\sqrt{10010}}{4928}$ | $0$ | $-\frac{\sqrt{5005}}{1568}$ | $0$ | $\frac{25\sqrt{2002}}{34496}$ | $-\frac{3\sqrt{429}}{2288}$ | $0$ | $-\frac{5\sqrt{1001}}{8008}$ | $0$ | $-\frac{\sqrt{15015}}{112112}$ | $0$ | $\frac{5\sqrt{3003}}{14014}$ | $0$ |
| | | $-\frac{5\sqrt{6006}}{4928}$ | $0$ | $-\frac{\sqrt{15015}}{2464}$ | $0$ | $\frac{23\sqrt{30030}}{103488}$ | $0$ | $0$ | $-\frac{9\sqrt{1001}}{8008}$ | $0$ | $-\frac{\sqrt{5005}}{16016}$ | $0$ | $\frac{5\sqrt{3003}}{14014}$ | $0$ | $-\frac{15\sqrt{143}}{16016}$ |
| | | $0$ | $-\frac{\sqrt{4290}}{704}$ | $0$ | $\frac{\sqrt{2145}}{1056}$ | $0$ | $-\frac{5\sqrt{858}}{14784}$ | $0$ | $0$ | $-\frac{3\sqrt{429}}{2288}$ | $0$ | $\frac{\sqrt{715}}{1144}$ | $0$ | $-\frac{15\sqrt{143}}{16016}$ | $0$ |
| 1020 | symmetry | $-\frac{y\left(15x^4 - 40x^2y^2 + 30x^2z^2 + 8y^4 - 40y^2z^2 + 15z^4\right)}{8}$ | | | | | | | | | | | | | |

*continued ...*

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Table 10

| No. | multipole | matrix |
|---|---|---|

$$\mathbb{M}_{5,2}^{(1,1;a)}(E_g,1) =$$

$$\begin{pmatrix}
0 & \frac{3\sqrt{5005}i}{4312} & 0 & \frac{\sqrt{10010}i}{616} & 0 & \frac{9\sqrt{1001}i}{616} & -\frac{5\sqrt{858}i}{14784} & 0 & -\frac{25\sqrt{2002}i}{34496} & 0 & -\frac{5\sqrt{30030}i}{14784} & 0 & -\frac{5\sqrt{6006}i}{4928} & 0 \\[4pt]
-\frac{3\sqrt{5005}i}{4312} & 0 & -\frac{15\sqrt{2002}i}{4312} & 0 & -\frac{5\sqrt{1001}i}{616} & 0 & 0 & \frac{23\sqrt{30030}i}{103488} & 0 & \frac{65\sqrt{6006}i}{103488} & 0 & \frac{\sqrt{10010}i}{4928} & 0 & -\frac{\sqrt{4290}i}{704} \\[4pt]
0 & \frac{15\sqrt{2002}i}{4312} & 0 & \frac{15\sqrt{1001}i}{2156} & 0 & \frac{\sqrt{10010}i}{616} & -\frac{\sqrt{2145}i}{1056} & 0 & -\frac{\sqrt{5005}i}{1568} & 0 & -\frac{5\sqrt{3003}i}{51744} & 0 & \frac{\sqrt{15015}i}{2464} & 0 \\[4pt]
-\frac{\sqrt{10010}i}{616} & 0 & -\frac{15\sqrt{1001}i}{2156} & 0 & -\frac{15\sqrt{2002}i}{4312} & 0 & 0 & \frac{\sqrt{15015}i}{2464} & 0 & -\frac{5\sqrt{3003}i}{51744} & 0 & -\frac{\sqrt{5005}i}{1568} & 0 & -\frac{\sqrt{2145}i}{1056} \\[4pt]
0 & \frac{5\sqrt{1001}i}{616} & 0 & \frac{15\sqrt{2002}i}{4312} & 0 & \frac{3\sqrt{5005}i}{4312} & -\frac{\sqrt{4290}i}{704} & 0 & \frac{\sqrt{10010}i}{4928} & 0 & \frac{65\sqrt{6006}i}{103488} & 0 & \frac{23\sqrt{30030}i}{103488} & 0 \\[4pt]
-\frac{9\sqrt{1001}i}{616} & 0 & -\frac{\sqrt{10010}i}{616} & 0 & -\frac{3\sqrt{5005}i}{4312} & 0 & 0 & -\frac{5\sqrt{6006}i}{4928} & 0 & -\frac{5\sqrt{30030}i}{14784} & 0 & -\frac{25\sqrt{2002}i}{34496} & 0 & -\frac{5\sqrt{858}i}{14784} \\[4pt]
\frac{5\sqrt{858}i}{14784} & 0 & \frac{\sqrt{2145}i}{1056} & 0 & \frac{\sqrt{4290}i}{704} & 0 & 0 & -\frac{15\sqrt{143}i}{16016} & 0 & -\frac{\sqrt{715}i}{1144} & 0 & -\frac{3\sqrt{429}i}{2288} & 0 & 0 \\[4pt]
0 & -\frac{23\sqrt{30030}i}{103488} & 0 & -\frac{\sqrt{15015}i}{2464} & 0 & \frac{5\sqrt{6006}i}{4928} & \frac{15\sqrt{143}i}{16016} & 0 & \frac{5\sqrt{3003}i}{14014} & 0 & \frac{\sqrt{5005}i}{16016} & 0 & -\frac{9\sqrt{1001}i}{8008} & 0 \\[4pt]
\frac{25\sqrt{2002}i}{34496} & 0 & \frac{\sqrt{5005}i}{1568} & 0 & -\frac{\sqrt{10010}i}{4928} & 0 & 0 & -\frac{5\sqrt{3003}i}{14014} & 0 & -\frac{\sqrt{15015}i}{112112} & 0 & \frac{5\sqrt{1001}i}{8008} & 0 & -\frac{3\sqrt{429}i}{2288} \\[4pt]
0 & -\frac{65\sqrt{6006}i}{103488} & 0 & \frac{5\sqrt{3003}i}{51744} & 0 & \frac{5\sqrt{30030}i}{14784} & \frac{\sqrt{715}i}{1144} & 0 & \frac{\sqrt{15015}i}{112112} & 0 & -\frac{15\sqrt{1001}i}{28028} & 0 & \frac{\sqrt{5005}i}{16016} & 0 \\[4pt]
\frac{5\sqrt{30030}i}{14784} & 0 & \frac{5\sqrt{3003}i}{51744} & 0 & -\frac{65\sqrt{6006}i}{103488} & 0 & 0 & -\frac{\sqrt{5005}i}{16016} & 0 & \frac{15\sqrt{1001}i}{28028} & 0 & -\frac{\sqrt{15015}i}{112112} & 0 & -\frac{\sqrt{715}i}{1144} \\[4pt]
0 & -\frac{\sqrt{10010}i}{4928} & 0 & \frac{\sqrt{5005}i}{1568} & 0 & \frac{25\sqrt{2002}i}{34496} & \frac{3\sqrt{429}i}{2288} & 0 & -\frac{5\sqrt{1001}i}{8008} & 0 & \frac{\sqrt{15015}i}{112112} & 0 & \frac{5\sqrt{3003}i}{14014} & 0 \\[4pt]
\frac{5\sqrt{6006}i}{4928} & 0 & -\frac{\sqrt{15015}i}{2464} & 0 & -\frac{23\sqrt{30030}i}{103488} & 0 & 0 & \frac{9\sqrt{1001}i}{8008} & 0 & -\frac{\sqrt{5005}i}{16016} & 0 & -\frac{5\sqrt{3003}i}{14014} & 0 & -\frac{15\sqrt{143}i}{16016} \\[4pt]
0 & \frac{\sqrt{4290}i}{704} & 0 & \frac{\sqrt{2145}i}{1056} & 0 & \frac{5\sqrt{858}i}{14784} & 0 & 0 & \frac{3\sqrt{429}i}{2288} & 0 & \frac{\sqrt{715}i}{1144} & 0 & \frac{15\sqrt{143}i}{16016} & 0
\end{pmatrix}$$

| No. | symmetry |
|---|---|
| 1021 | $\dfrac{3\sqrt{35}x\left(y^2-2yz-z^2\right)\left(y^2+2yz-z^2\right)}{8}$ |

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Table 10

| No. | multipole | matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{M}_{5,1}^{(1,1;a)}(E_g,2)$ | $0$ | $\frac{3\sqrt{143}}{616}$ | $0$ | $\frac{9\sqrt{286}}{616}$ | $0$ | $\frac{3\sqrt{715}}{616}$ | $\frac{\sqrt{30030}}{14784}$ | $0$ | $-\frac{5\sqrt{1430}}{4928}$ | $0$ | $-\frac{15\sqrt{858}}{4928}$ | $0$ | $-\frac{5\sqrt{4290}}{14784}$ | $0$ |
| | | $\frac{3\sqrt{143}}{616}$ | $0$ | $-\frac{3\sqrt{1430}}{616}$ | $0$ | $-\frac{9\sqrt{715}}{616}$ | $0$ | $0$ | $-\frac{23\sqrt{858}}{14784}$ | $0$ | $\frac{13\sqrt{4290}}{14784}$ | $0$ | $\frac{9\sqrt{286}}{4928}$ | $0$ | $-\frac{5\sqrt{6006}}{14784}$ |
| | | $0$ | $-\frac{3\sqrt{1430}}{616}$ | $0$ | $\frac{3\sqrt{715}}{308}$ | $0$ | $\frac{9\sqrt{286}}{616}$ | $\frac{3\sqrt{3003}}{2464}$ | $0$ | $\frac{\sqrt{143}}{224}$ | $0$ | $-\frac{\sqrt{2145}}{7392}$ | $0$ | $\frac{9\sqrt{429}}{2464}$ | $0$ |
| | | $\frac{9\sqrt{286}}{616}$ | $0$ | $\frac{3\sqrt{715}}{308}$ | $0$ | $-\frac{3\sqrt{1430}}{616}$ | $0$ | $0$ | $-\frac{9\sqrt{429}}{2464}$ | $0$ | $\frac{\sqrt{2145}}{7392}$ | $0$ | $-\frac{\sqrt{143}}{224}$ | $0$ | $-\frac{3\sqrt{3003}}{2464}$ |
| | | $0$ | $-\frac{9\sqrt{715}}{616}$ | $0$ | $-\frac{3\sqrt{1430}}{616}$ | $0$ | $\frac{3\sqrt{143}}{616}$ | $\frac{5\sqrt{6006}}{14784}$ | $0$ | $-\frac{9\sqrt{286}}{4928}$ | $0$ | $-\frac{13\sqrt{4290}}{14784}$ | $0$ | $\frac{23\sqrt{858}}{14784}$ | $0$ |
| | | $\frac{3\sqrt{715}}{616}$ | $0$ | $\frac{9\sqrt{286}}{616}$ | $0$ | $\frac{3\sqrt{143}}{616}$ | $0$ | $0$ | $\frac{5\sqrt{4290}}{14784}$ | $0$ | $\frac{15\sqrt{858}}{4928}$ | $0$ | $\frac{5\sqrt{1430}}{4928}$ | $0$ | $-\frac{\sqrt{30030}}{14784}$ |
| | | $\frac{\sqrt{30030}}{14784}$ | $0$ | $\frac{3\sqrt{3003}}{2464}$ | $0$ | $\frac{5\sqrt{6006}}{14784}$ | $0$ | $0$ | $-\frac{3\sqrt{5005}}{16016}$ | $0$ | $-\frac{9\sqrt{1001}}{8008}$ | $0$ | $-\frac{\sqrt{15015}}{16016}$ | $0$ | $0$ |
| | | $0$ | $-\frac{23\sqrt{858}}{14784}$ | $0$ | $-\frac{9\sqrt{429}}{2464}$ | $0$ | $\frac{5\sqrt{4290}}{14784}$ | $-\frac{3\sqrt{5005}}{16016}$ | $0$ | $\frac{\sqrt{2145}}{2002}$ | $0$ | $\frac{9\sqrt{143}}{16016}$ | $0$ | $-\frac{3\sqrt{715}}{8008}$ | $0$ |
| | | $-\frac{5\sqrt{1430}}{4928}$ | $0$ | $\frac{\sqrt{143}}{224}$ | $0$ | $-\frac{9\sqrt{286}}{4928}$ | $0$ | $0$ | $\frac{\sqrt{2145}}{2002}$ | $0$ | $-\frac{\sqrt{429}}{16016}$ | $0$ | $\frac{9\sqrt{715}}{8008}$ | $0$ | $-\frac{\sqrt{15015}}{16016}$ |
| | | $0$ | $\frac{13\sqrt{4290}}{14784}$ | $0$ | $\frac{\sqrt{2145}}{7392}$ | $0$ | $\frac{15\sqrt{858}}{4928}$ | $-\frac{9\sqrt{1001}}{8008}$ | $0$ | $-\frac{\sqrt{429}}{16016}$ | $0$ | $-\frac{3\sqrt{715}}{4004}$ | $0$ | $\frac{9\sqrt{143}}{16016}$ | $0$ |
| | | $-\frac{15\sqrt{858}}{4928}$ | $0$ | $-\frac{\sqrt{2145}}{7392}$ | $0$ | $-\frac{13\sqrt{4290}}{14784}$ | $0$ | $0$ | $\frac{9\sqrt{143}}{16016}$ | $0$ | $-\frac{3\sqrt{715}}{4004}$ | $0$ | $-\frac{\sqrt{429}}{16016}$ | $0$ | $-\frac{9\sqrt{1001}}{8008}$ |
| | | $0$ | $\frac{9\sqrt{286}}{4928}$ | $0$ | $-\frac{\sqrt{143}}{224}$ | $0$ | $\frac{5\sqrt{1430}}{4928}$ | $-\frac{\sqrt{15015}}{16016}$ | $0$ | $\frac{9\sqrt{715}}{8008}$ | $0$ | $-\frac{\sqrt{429}}{16016}$ | $0$ | $\frac{\sqrt{2145}}{2002}$ | $0$ |
| | | $-\frac{5\sqrt{4290}}{14784}$ | $0$ | $\frac{9\sqrt{429}}{2464}$ | $0$ | $\frac{23\sqrt{858}}{14784}$ | $0$ | $0$ | $-\frac{3\sqrt{715}}{8008}$ | $0$ | $\frac{9\sqrt{143}}{16016}$ | $0$ | $\frac{\sqrt{2145}}{2002}$ | $0$ | $-\frac{3\sqrt{5005}}{16016}$ |
| | | $0$ | $-\frac{5\sqrt{6006}}{14784}$ | $0$ | $-\frac{3\sqrt{3003}}{2464}$ | $0$ | $-\frac{\sqrt{30030}}{14784}$ | $0$ | $0$ | $-\frac{\sqrt{15015}}{16016}$ | $0$ | $-\frac{9\sqrt{1001}}{8008}$ | $0$ | $-\frac{3\sqrt{5005}}{16016}$ | $0$ |

| 1022 | symmetry | $-\frac{3\sqrt{35}\,y\left(x^2-2xz-z^2\right)\left(x^2+2xz-z^2\right)}{8}$ |

Table  10

| No. | multipole | matrix | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\mathbb{M}_{5,2}^{(1,1;a)}(E_g,2)$ | $0$ | $\frac{3\sqrt{143}i}{616}$ | $0$ | $-\frac{9\sqrt{286}i}{616}$ | $0$ | $\frac{3\sqrt{715}i}{616}$ | $-\frac{\sqrt{30030}i}{14784}$ | $0$ | $-\frac{5\sqrt{1430}i}{4928}$ | $0$ | $\frac{15\sqrt{858}i}{4928}$ | $0$ | $-\frac{5\sqrt{4290}i}{14784}$ | $0$ |
| | | $-\frac{3\sqrt{143}i}{616}$ | $0$ | $-\frac{3\sqrt{1430}i}{616}$ | $0$ | $\frac{9\sqrt{715}i}{616}$ | $0$ | $0$ | $\frac{23\sqrt{858}i}{14784}$ | $0$ | $\frac{13\sqrt{4290}i}{14784}$ | $0$ | $-\frac{9\sqrt{286}i}{4928}$ | $0$ | $-\frac{5\sqrt{6006}i}{14784}$ |
| | | $0$ | $\frac{3\sqrt{1430}i}{616}$ | $0$ | $\frac{3\sqrt{715}i}{308}$ | $0$ | $-\frac{9\sqrt{286}i}{616}$ | $\frac{3\sqrt{3003}i}{2464}$ | $0$ | $-\frac{\sqrt{143}i}{224}$ | $0$ | $-\frac{\sqrt{2145}i}{7392}$ | $0$ | $-\frac{9\sqrt{429}i}{2464}$ | $0$ |
| | | $\frac{9\sqrt{286}i}{616}$ | $0$ | $-\frac{3\sqrt{715}i}{308}$ | $0$ | $-\frac{3\sqrt{1430}i}{616}$ | $0$ | $0$ | $-\frac{9\sqrt{429}i}{2464}$ | $0$ | $-\frac{\sqrt{2145}i}{7392}$ | $0$ | $-\frac{\sqrt{143}i}{224}$ | $0$ | $\frac{3\sqrt{3003}i}{2464}$ |
| | | $0$ | $-\frac{9\sqrt{715}i}{616}$ | $0$ | $\frac{3\sqrt{1430}i}{616}$ | $0$ | $\frac{3\sqrt{143}i}{616}$ | $-\frac{5\sqrt{6006}i}{14784}$ | $0$ | $-\frac{9\sqrt{286}i}{4928}$ | $0$ | $\frac{13\sqrt{4290}i}{14784}$ | $0$ | $\frac{23\sqrt{858}i}{14784}$ | $0$ |
| | | $-\frac{3\sqrt{715}i}{616}$ | $0$ | $\frac{9\sqrt{286}i}{616}$ | $0$ | $-\frac{3\sqrt{143}i}{616}$ | $0$ | $0$ | $-\frac{5\sqrt{4290}i}{14784}$ | $0$ | $\frac{15\sqrt{858}i}{4928}$ | $0$ | $-\frac{5\sqrt{1430}i}{4928}$ | $0$ | $-\frac{\sqrt{30030}i}{14784}$ |
| | | $\frac{\sqrt{30030}i}{14784}$ | $0$ | $-\frac{3\sqrt{3003}i}{2464}$ | $0$ | $\frac{5\sqrt{6006}i}{14784}$ | $0$ | $0$ | $-\frac{3\sqrt{5005}i}{16016}$ | $0$ | $\frac{9\sqrt{1001}i}{8008}$ | $0$ | $-\frac{\sqrt{15015}i}{16016}$ | $0$ | $0$ |
| | | $0$ | $-\frac{23\sqrt{858}i}{14784}$ | $0$ | $\frac{9\sqrt{429}i}{2464}$ | $0$ | $\frac{5\sqrt{4290}i}{14784}$ | $\frac{3\sqrt{5005}i}{16016}$ | $0$ | $\frac{\sqrt{2145}i}{2002}$ | $0$ | $-\frac{9\sqrt{143}i}{16016}$ | $0$ | $-\frac{3\sqrt{715}i}{8008}$ | $0$ |
| | | $\frac{5\sqrt{1430}i}{4928}$ | $0$ | $\frac{\sqrt{143}i}{224}$ | $0$ | $\frac{9\sqrt{286}i}{4928}$ | $0$ | $0$ | $-\frac{\sqrt{2145}i}{2002}$ | $0$ | $-\frac{\sqrt{429}i}{16016}$ | $0$ | $-\frac{9\sqrt{715}i}{8008}$ | $0$ | $-\frac{\sqrt{15015}i}{16016}$ |
| | | $0$ | $-\frac{13\sqrt{4290}i}{14784}$ | $0$ | $\frac{\sqrt{2145}i}{7392}$ | $0$ | $-\frac{15\sqrt{858}i}{4928}$ | $-\frac{9\sqrt{1001}i}{8008}$ | $0$ | $\frac{\sqrt{429}i}{16016}$ | $0$ | $-\frac{3\sqrt{715}i}{4004}$ | $0$ | $-\frac{9\sqrt{143}i}{16016}$ | $0$ |
| | | $-\frac{15\sqrt{858}i}{4928}$ | $0$ | $\frac{\sqrt{2145}i}{7392}$ | $0$ | $-\frac{13\sqrt{4290}i}{14784}$ | $0$ | $0$ | $\frac{9\sqrt{143}i}{16016}$ | $0$ | $\frac{3\sqrt{715}i}{4004}$ | $0$ | $-\frac{\sqrt{429}i}{16016}$ | $0$ | $\frac{9\sqrt{1001}i}{8008}$ |
| | | $0$ | $\frac{9\sqrt{286}i}{4928}$ | $0$ | $\frac{\sqrt{143}i}{224}$ | $0$ | $\frac{5\sqrt{1430}i}{4928}$ | $\frac{\sqrt{15015}i}{16016}$ | $0$ | $\frac{9\sqrt{715}i}{8008}$ | $0$ | $\frac{\sqrt{429}i}{16016}$ | $0$ | $\frac{\sqrt{2145}i}{2002}$ | $0$ |
| | | $\frac{5\sqrt{4290}i}{14784}$ | $0$ | $\frac{9\sqrt{429}i}{2464}$ | $0$ | $-\frac{23\sqrt{858}i}{14784}$ | $0$ | $0$ | $\frac{3\sqrt{715}i}{8008}$ | $0$ | $\frac{9\sqrt{143}i}{16016}$ | $0$ | $-\frac{\sqrt{2145}i}{2002}$ | $0$ | $-\frac{3\sqrt{5005}i}{16016}$ |
| | | $0$ | $\frac{5\sqrt{6006}i}{14784}$ | $0$ | $-\frac{3\sqrt{3003}i}{2464}$ | $0$ | $\frac{\sqrt{30030}i}{14784}$ | $0$ | $0$ | $\frac{\sqrt{15015}i}{16016}$ | $0$ | $-\frac{9\sqrt{1001}i}{8008}$ | $0$ | $\frac{3\sqrt{5005}i}{16016}$ | $0$ |

| 1023 | symmetry | $\dfrac{\sqrt{105}x(y-z)(y+z)\left(2x^2-y^2-z^2\right)}{4}$ |

Table 10

| No. | multipole | matrix |

$\mathbb{M}_{5,1}^{(1,1;a)}(E_g,3)$

$$
\begin{pmatrix}
0 & \frac{\sqrt{429}}{308} & 0 & -\frac{\sqrt{858}}{308} & 0 & -\frac{3\sqrt{2145}}{308} & \frac{\sqrt{10010}}{7392} & 0 & -\frac{5\sqrt{4290}}{7392} & 0 & \frac{5\sqrt{286}}{2464} & 0 & \frac{5\sqrt{1430}}{2464} & 0 \\[4pt]
\frac{\sqrt{429}}{308} & 0 & -\frac{\sqrt{4290}}{308} & 0 & \frac{\sqrt{2145}}{308} & 0 & 0 & -\frac{23\sqrt{286}}{7392} & 0 & \frac{13\sqrt{1430}}{7392} & 0 & -\frac{\sqrt{858}}{2464} & 0 & \frac{5\sqrt{2002}}{2464} \\[4pt]
0 & -\frac{\sqrt{4290}}{308} & 0 & \frac{\sqrt{2145}}{154} & 0 & -\frac{\sqrt{858}}{308} & -\frac{\sqrt{1001}}{1232} & 0 & \frac{\sqrt{429}}{336} & 0 & -\frac{\sqrt{715}}{3696} & 0 & -\frac{3\sqrt{143}}{1232} & 0 \\[4pt]
-\frac{\sqrt{858}}{308} & 0 & \frac{\sqrt{2145}}{154} & 0 & -\frac{\sqrt{4290}}{308} & 0 & 0 & \frac{3\sqrt{143}}{1232} & 0 & \frac{\sqrt{715}}{3696} & 0 & -\frac{\sqrt{429}}{336} & 0 & \frac{\sqrt{1001}}{1232} \\[4pt]
0 & \frac{\sqrt{2145}}{308} & 0 & -\frac{\sqrt{4290}}{308} & 0 & \frac{\sqrt{429}}{308} & -\frac{5\sqrt{2002}}{2464} & 0 & \frac{\sqrt{858}}{2464} & 0 & -\frac{13\sqrt{1430}}{7392} & 0 & \frac{23\sqrt{286}}{7392} & 0 \\[4pt]
-\frac{3\sqrt{2145}}{308} & 0 & -\frac{\sqrt{858}}{308} & 0 & \frac{\sqrt{429}}{308} & 0 & 0 & -\frac{5\sqrt{1430}}{2464} & 0 & -\frac{5\sqrt{286}}{2464} & 0 & \frac{5\sqrt{4290}}{7392} & 0 & -\frac{\sqrt{10010}}{7392} \\[4pt]
\frac{\sqrt{10010}}{7392} & 0 & -\frac{\sqrt{1001}}{1232} & 0 & -\frac{5\sqrt{2002}}{2464} & 0 & 0 & -\frac{\sqrt{15015}}{8008} & 0 & \frac{\sqrt{3003}}{4004} & 0 & \frac{3\sqrt{5005}}{8008} & 0 & 0 \\[4pt]
0 & -\frac{23\sqrt{286}}{7392} & 0 & \frac{3\sqrt{143}}{1232} & 0 & -\frac{5\sqrt{1430}}{2464} & -\frac{\sqrt{15015}}{8008} & 0 & \frac{\sqrt{715}}{1001} & 0 & -\frac{\sqrt{429}}{8008} & 0 & \frac{3\sqrt{2145}}{4004} & 0 \\[4pt]
-\frac{5\sqrt{4290}}{7392} & 0 & \frac{\sqrt{429}}{336} & 0 & \frac{\sqrt{858}}{2464} & 0 & 0 & \frac{\sqrt{715}}{1001} & 0 & -\frac{\sqrt{143}}{8008} & 0 & -\frac{\sqrt{2145}}{4004} & 0 & \frac{3\sqrt{5005}}{8008} \\[4pt]
0 & \frac{13\sqrt{1430}}{7392} & 0 & \frac{\sqrt{715}}{3696} & 0 & -\frac{5\sqrt{286}}{2464} & \frac{\sqrt{3003}}{4004} & 0 & -\frac{\sqrt{143}}{8008} & 0 & -\frac{\sqrt{2145}}{2002} & 0 & -\frac{\sqrt{429}}{8008} & 0 \\[4pt]
\frac{5\sqrt{286}}{2464} & 0 & -\frac{\sqrt{715}}{3696} & 0 & -\frac{13\sqrt{1430}}{7392} & 0 & 0 & -\frac{\sqrt{429}}{8008} & 0 & -\frac{\sqrt{2145}}{2002} & 0 & -\frac{\sqrt{143}}{8008} & 0 & \frac{\sqrt{3003}}{4004} \\[4pt]
0 & -\frac{\sqrt{858}}{2464} & 0 & -\frac{\sqrt{429}}{336} & 0 & \frac{5\sqrt{4290}}{7392} & \frac{3\sqrt{5005}}{8008} & 0 & -\frac{\sqrt{2145}}{4004} & 0 & -\frac{\sqrt{143}}{8008} & 0 & \frac{\sqrt{715}}{1001} & 0 \\[4pt]
\frac{5\sqrt{1430}}{2464} & 0 & -\frac{3\sqrt{143}}{1232} & 0 & \frac{23\sqrt{286}}{7392} & 0 & 0 & \frac{3\sqrt{2145}}{4004} & 0 & -\frac{\sqrt{429}}{8008} & 0 & \frac{\sqrt{715}}{1001} & 0 & -\frac{\sqrt{15015}}{8008} \\[4pt]
0 & \frac{5\sqrt{2002}}{2464} & 0 & \frac{\sqrt{1001}}{1232} & 0 & -\frac{\sqrt{10010}}{7392} & 0 & 0 & \frac{3\sqrt{5005}}{8008} & 0 & \frac{\sqrt{3003}}{4004} & 0 & -\frac{\sqrt{15015}}{8008} & 0
\end{pmatrix}
$$

| 1024 | symmetry | $\dfrac{\sqrt{105}\,y(x-z)(x+z)\left(x^2-2y^2+z^2\right)}{4}$ |

*continued …*

Table 10

| No. | multipole | | | | | | | matrix | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

$\mathbb{M}_{5,2}^{(1,1;a)}(E_g,3)$

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $0$ | $\frac{\sqrt{429}i}{308}$ | $0$ | $\frac{\sqrt{858}i}{308}$ | $0$ | $-\frac{3\sqrt{2145}i}{308}$ | $-\frac{\sqrt{10010}i}{7392}$ | $0$ | $-\frac{5\sqrt{4290}i}{7392}$ | $0$ | $-\frac{5\sqrt{286}i}{2464}$ | $0$ | $\frac{5\sqrt{1430}i}{2464}$ | $0$ |
| $-\frac{\sqrt{429}i}{308}$ | $0$ | $-\frac{\sqrt{4290}i}{308}$ | $0$ | $-\frac{\sqrt{2145}i}{308}$ | $0$ | $0$ | $\frac{23\sqrt{286}i}{7392}$ | $0$ | $\frac{13\sqrt{1430}i}{7392}$ | $0$ | $\frac{\sqrt{858}i}{2464}$ | $0$ | $\frac{5\sqrt{2002}i}{2464}$ |
| $0$ | $\frac{\sqrt{4290}i}{308}$ | $0$ | $\frac{\sqrt{2145}i}{154}$ | $0$ | $\frac{\sqrt{858}i}{308}$ | $-\frac{\sqrt{1001}i}{1232}$ | $0$ | $-\frac{\sqrt{429}i}{336}$ | $0$ | $-\frac{\sqrt{715}i}{3696}$ | $0$ | $\frac{3\sqrt{143}i}{1232}$ | $0$ |
| $-\frac{\sqrt{858}i}{308}$ | $0$ | $-\frac{\sqrt{2145}i}{154}$ | $0$ | $-\frac{\sqrt{4290}i}{308}$ | $0$ | $0$ | $\frac{3\sqrt{143}i}{1232}$ | $0$ | $-\frac{\sqrt{715}i}{3696}$ | $0$ | $-\frac{\sqrt{429}i}{336}$ | $0$ | $-\frac{\sqrt{1001}i}{1232}$ |
| $0$ | $\frac{\sqrt{2145}i}{308}$ | $0$ | $\frac{\sqrt{4290}i}{308}$ | $0$ | $\frac{\sqrt{429}i}{308}$ | $\frac{5\sqrt{2002}i}{2464}$ | $0$ | $\frac{\sqrt{858}i}{2464}$ | $0$ | $\frac{13\sqrt{1430}i}{7392}$ | $0$ | $\frac{23\sqrt{286}i}{7392}$ | $0$ |
| $\frac{3\sqrt{2145}i}{308}$ | $0$ | $-\frac{\sqrt{858}i}{308}$ | $0$ | $-\frac{\sqrt{429}i}{308}$ | $0$ | $0$ | $\frac{5\sqrt{1430}i}{2464}$ | $0$ | $-\frac{5\sqrt{286}i}{2464}$ | $0$ | $-\frac{5\sqrt{4290}i}{7392}$ | $0$ | $-\frac{\sqrt{10010}i}{7392}$ |
| $\frac{\sqrt{10010}i}{7392}$ | $0$ | $\frac{\sqrt{1001}i}{1232}$ | $0$ | $-\frac{5\sqrt{2002}i}{2464}$ | $0$ | $0$ | $-\frac{\sqrt{15015}i}{8008}$ | $0$ | $-\frac{\sqrt{3003}i}{4004}$ | $0$ | $\frac{3\sqrt{5005}i}{8008}$ | $0$ | $0$ |
| $0$ | $-\frac{23\sqrt{286}i}{7392}$ | $0$ | $-\frac{3\sqrt{143}i}{1232}$ | $0$ | $-\frac{5\sqrt{1430}i}{2464}$ | $\frac{\sqrt{15015}i}{8008}$ | $0$ | $\frac{\sqrt{715}i}{1001}$ | $0$ | $\frac{\sqrt{429}i}{8008}$ | $0$ | $\frac{3\sqrt{2145}i}{4004}$ | $0$ |
| $\frac{5\sqrt{4290}i}{7392}$ | $0$ | $\frac{\sqrt{429}i}{336}$ | $0$ | $-\frac{\sqrt{858}i}{2464}$ | $0$ | $0$ | $-\frac{\sqrt{715}i}{1001}$ | $0$ | $-\frac{\sqrt{143}i}{8008}$ | $0$ | $\frac{\sqrt{2145}i}{4004}$ | $0$ | $\frac{3\sqrt{5005}i}{8008}$ |
| $0$ | $-\frac{13\sqrt{1430}i}{7392}$ | $0$ | $\frac{\sqrt{715}i}{3696}$ | $0$ | $\frac{5\sqrt{286}i}{2464}$ | $\frac{\sqrt{3003}i}{4004}$ | $0$ | $\frac{\sqrt{143}i}{8008}$ | $0$ | $-\frac{\sqrt{2145}i}{2002}$ | $0$ | $\frac{\sqrt{429}i}{8008}$ | $0$ |
| $\frac{5\sqrt{286}i}{2464}$ | $0$ | $\frac{\sqrt{715}i}{3696}$ | $0$ | $-\frac{13\sqrt{1430}i}{7392}$ | $0$ | $0$ | $-\frac{\sqrt{429}i}{8008}$ | $0$ | $\frac{\sqrt{2145}i}{2002}$ | $0$ | $-\frac{\sqrt{143}i}{8008}$ | $0$ | $-\frac{\sqrt{3003}i}{4004}$ |
| $0$ | $-\frac{\sqrt{858}i}{2464}$ | $0$ | $\frac{\sqrt{429}i}{336}$ | $0$ | $\frac{5\sqrt{4290}i}{7392}$ | $-\frac{3\sqrt{5005}i}{8008}$ | $0$ | $-\frac{\sqrt{2145}i}{4004}$ | $0$ | $\frac{\sqrt{143}i}{8008}$ | $0$ | $\frac{\sqrt{715}i}{1001}$ | $0$ |
| $-\frac{5\sqrt{1430}i}{2464}$ | $0$ | $-\frac{3\sqrt{143}i}{1232}$ | $0$ | $-\frac{23\sqrt{286}i}{7392}$ | $0$ | $0$ | $-\frac{3\sqrt{2145}i}{4004}$ | $0$ | $-\frac{\sqrt{429}i}{8008}$ | $0$ | $-\frac{\sqrt{715}i}{1001}$ | $0$ | $-\frac{\sqrt{15015}i}{8008}$ |
| $0$ | $-\frac{5\sqrt{2002}i}{2464}$ | $0$ | $\frac{\sqrt{1001}i}{1232}$ | $0$ | $\frac{\sqrt{10010}i}{7392}$ | $0$ | $0$ | $-\frac{3\sqrt{5005}i}{8008}$ | $0$ | $\frac{\sqrt{3003}i}{4004}$ | $0$ | $\frac{\sqrt{15015}i}{8008}$ | $0$ |