

PG No. 8  $D_{2h}$   $mmm$  [ orthorhombic ] (axial, internal polar quadrupole)

\* Harmonics for rank 0

\* Harmonics for rank 1

$$\vec{G}_1^{(2,1)}[q](B_{1g})$$

\*\* symmetry

$$z$$

\*\* expression

$$\frac{\sqrt{30}Q_vxy}{5} - \frac{\sqrt{30}Q_{xy}(x-y)(x+y)}{10} + \frac{\sqrt{30}Q_{xz}yz}{10} - \frac{\sqrt{30}Q_{yz}xz}{10}$$

$$\vec{G}_1^{(2,1)}[q](B_{2g})$$

\*\* symmetry

$$y$$

\*\* expression

$$\frac{3\sqrt{10}Q_uxz}{10} - \frac{\sqrt{30}Q_vxz}{10} - \frac{\sqrt{30}Q_{xy}yz}{10} + \frac{\sqrt{30}Q_{xz}(x-z)(x+z)}{10} + \frac{\sqrt{30}Q_{yz}xy}{10}$$

$$\vec{G}_1^{(2,1)}[q](B_{3g})$$

\*\* symmetry

$$x$$

\*\* expression

$$-\frac{3\sqrt{10}Q_uyz}{10} - \frac{\sqrt{30}Q_vyz}{10} + \frac{\sqrt{30}Q_{xy}xz}{10} - \frac{\sqrt{30}Q_{xz}xy}{10} - \frac{\sqrt{30}Q_{yz}(y-z)(y+z)}{10}$$

\* Harmonics for rank 2

$$\vec{G}_2^{(2,-1)}[q](A_u, 1)$$

\*\* symmetry

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

\*\* expression

$$\frac{\sqrt{2}Q_{xz}y}{2} - \frac{\sqrt{2}Q_{yz}x}{2}$$

$$\vec{G}_2^{(2,-1)}[q](A_u, 2)$$

\*\* symmetry

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

\*\* expression

$$\frac{\sqrt{6}Q_{xy}z}{3} - \frac{\sqrt{6}Q_{xz}y}{6} - \frac{\sqrt{6}Q_{yz}x}{6}$$

$$\vec{G}_2^{(2,1)}[q](A_u, 1)$$

\*\* symmetry

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

\*\* expression

$$\frac{5\sqrt{42}Q_vxyz}{14} - \frac{5\sqrt{42}Q_{xy}z(x-y)(x+y)}{28} - \frac{\sqrt{42}Q_{xz}y(x^2+y^2-4z^2)}{28} + \frac{\sqrt{42}Q_{yz}x(x^2+y^2-4z^2)}{28}$$

$$\vec{G}_2^{(2,1)}[q](A_u, 2)$$

\*\* symmetry

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

\*\* expression

$$-\frac{5\sqrt{42}Q_uxyz}{14} + \frac{\sqrt{14}Q_{xy}z(3x^2+3y^2-2z^2)}{28} - \frac{\sqrt{14}Q_{xz}y(9x^2-y^2-6z^2)}{28} + \frac{\sqrt{14}Q_{yz}x(x^2-9y^2+6z^2)}{28}$$

$$\vec{G}_2^{(2,-1)}[q](B_{1u})$$

\*\* symmetry

$$\sqrt{3}xy$$

\*\* expression

$$-\frac{\sqrt{6}Q_v z}{3} + \frac{\sqrt{6}Q_{xz}x}{6} - \frac{\sqrt{6}Q_{yz}y}{6}$$

$$\vec{\mathbb{G}}_2^{(2,1)}[q](B_{1u})$$

\*\* symmetry

$$\sqrt{3}xy$$

\*\* expression

$$\frac{5\sqrt{42}Q_{uz}(x-y)(x+y)}{28} - \frac{\sqrt{14}Q_v z(3x^2+3y^2-2z^2)}{28} + \frac{\sqrt{14}Q_{xx}x(2x^2-3y^2-3z^2)}{14} + \frac{\sqrt{14}Q_{yz}y(3x^2-2y^2+3z^2)}{14}$$

$$\vec{\mathbb{G}}_2^{(2,-1)}[q](B_{2u})$$

\*\* symmetry

$$\sqrt{3}xz$$

\*\* expression

$$-\frac{\sqrt{2}Q_{uy}}{2} + \frac{\sqrt{6}Q_v y}{6} - \frac{\sqrt{6}Q_{xy}x}{6} + \frac{\sqrt{6}Q_{yz}z}{6}$$

$$\vec{\mathbb{G}}_2^{(2,1)}[q](B_{2u})$$

\*\* symmetry

$$\sqrt{3}xz$$

\*\* expression

$$\frac{\sqrt{42}Q_{uy}(x^2+y^2-4z^2)}{28} + \frac{\sqrt{14}Q_v y(9x^2-y^2-6z^2)}{28} - \frac{\sqrt{14}Q_{xy}x(2x^2-3y^2-3z^2)}{14} - \frac{\sqrt{14}Q_{yz}z(3x^2+3y^2-2z^2)}{14}$$

$$\vec{\mathbb{G}}_2^{(2,-1)}[q](B_{3u})$$

\*\* symmetry

$$\sqrt{3}yz$$

\*\* expression

$$\frac{\sqrt{2}Q_{ux}}{2} + \frac{\sqrt{6}Q_v x}{6} + \frac{\sqrt{6}Q_{xy}y}{6} - \frac{\sqrt{6}Q_{xz}z}{6}$$

$$\vec{\mathbb{G}}_2^{(2,1)}[q](B_{3u})$$

\*\* symmetry

$$\sqrt{3}yz$$

\*\* expression

$$-\frac{\sqrt{42}Q_{ux}(x^2+y^2-4z^2)}{28} - \frac{\sqrt{14}Q_v x(x^2-9y^2+6z^2)}{28} - \frac{\sqrt{14}Q_{xy}y(3x^2-2y^2+3z^2)}{14} + \frac{\sqrt{14}Q_{xz}z(3x^2+3y^2-2z^2)}{14}$$

\* Harmonics for rank 3

$$\vec{\mathbb{G}}_3^{(2,-1)}[q](A_g)$$

\*\* symmetry

$$\sqrt{15}xyz$$

\*\* expression

$$\frac{\sqrt{6}Q_u(x-y)(x+y)}{4} + \frac{\sqrt{2}Q_v(x^2+y^2-2z^2)}{4}$$

$$\vec{\mathbb{G}}_3^{(2,1)}[q](A_g)$$

\*\* symmetry

$$\sqrt{15}xyz$$

\*\* expression

$$-\frac{\sqrt{3}Q_u(x-y)(x+y)(x^2+y^2-6z^2)}{6} - \frac{Q_v(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4)}{6} - \frac{7Q_{xy}xy(x-y)(x+y)}{6} + \frac{7Q_{xz}xz(x-z)(x+z)}{6} - \frac{7Q_{yz}yz(y-z)(y+z)}{6}$$

$$\bar{\mathbb{G}}_3^{(2,-1)}[q](B_{1g}, 1)$$

\*\* symmetry

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

\*\* expression

$$-\frac{\sqrt{30}Q_vxy}{10} + \frac{\sqrt{30}Q_{xy}(x-y)(x+y)}{20} + \frac{\sqrt{30}Q_{xz}yz}{5} - \frac{\sqrt{30}Q_{yz}xz}{5}$$

$$\bar{\mathbb{G}}_3^{(2,-1)}[q](B_{1g}, 2)$$

\*\* symmetry

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

\*\* expression

$$-\frac{\sqrt{6}Q_uxy}{2} - \frac{\sqrt{2}Q_{xy}(x^2 + y^2 - 2z^2)}{4}$$

$$\bar{\mathbb{G}}_3^{(2,1)}[q](B_{1g}, 1)$$

\*\* symmetry

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

\*\* expression

$$-\frac{\sqrt{15}Q_vxy(x^2 + y^2 - 6z^2)}{6} + \frac{\sqrt{15}Q_{xy}(x-y)(x+y)(x^2 + y^2 - 6z^2)}{12} - \frac{\sqrt{15}Q_{xz}yz(3x^2 + 3y^2 - 4z^2)}{12} + \frac{\sqrt{15}Q_{yz}xz(3x^2 + 3y^2 - 4z^2)}{12}$$

$$\bar{\mathbb{G}}_3^{(2,1)}[q](B_{1g}, 2)$$

\*\* symmetry

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

\*\* expression

$$\frac{\sqrt{3}Q_uxy(x^2 + y^2 - 6z^2)}{3} + \frac{7Q_vxy(x-y)(x+y)}{6} - \frac{Q_{xy}(5x^4 - 18x^2y^2 - 12x^2z^2 + 5y^4 - 12y^2z^2 + 4z^4)}{12} - \frac{7Q_{xz}yz(3x^2 + y^2 - 2z^2)}{12} - \frac{7Q_{yz}xz(x^2 + 3y^2 - 2z^2)}{12}$$

$$\bar{\mathbb{G}}_3^{(2,-1)}[q](B_{2g}, 1)$$

\*\* symmetry

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

\*\* expression

$$-\frac{3\sqrt{10}Q_uxz}{20} + \frac{\sqrt{30}Q_vxz}{20} - \frac{\sqrt{30}Q_{xy}yz}{5} - \frac{\sqrt{30}Q_{xz}(x-z)(x+z)}{20} + \frac{\sqrt{30}Q_{yz}xy}{5}$$

$$\bar{\mathbb{G}}_3^{(2,-1)}[q](B_{2g}, 2)$$

\*\* symmetry

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

\*\* expression

$$\frac{\sqrt{6}Q_uxz}{4} + \frac{3\sqrt{2}Q_vxz}{4} - \frac{\sqrt{2}Q_{xz}(x^2 - 2y^2 + z^2)}{4}$$

$$\bar{\mathbb{G}}_3^{(2,1)}[q](B_{2g}, 1)$$

\*\* symmetry

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

\*\* expression

$$-\frac{\sqrt{5}Q_uxz(x^2 - 6y^2 + z^2)}{4} + \frac{\sqrt{15}Q_vxz(x^2 - 6y^2 + z^2)}{12} + \frac{\sqrt{15}Q_{xy}yz(3x^2 - 4y^2 + 3z^2)}{12} - \frac{\sqrt{15}Q_{xz}(x-z)(x+z)(x^2 - 6y^2 + z^2)}{12} - \frac{\sqrt{15}Q_{yz}xy(3x^2 - 4y^2 + 3z^2)}{12}$$

$$\bar{\mathbb{G}}_3^{(2,1)}[q](B_{2g}, 2)$$

\*\* symmetry

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

\*\* expression

$$-\frac{\sqrt{3}Q_u xz(9x^2-12y^2-5z^2)}{12} + \frac{Q_v xz(x^2+36y^2-13z^2)}{12} - \frac{7Q_{xy}yz(3x^2-2y^2+z^2)}{12} - \frac{Q_{xz}(5x^4-12x^2y^2-18x^2z^2+4y^4-12y^2z^2+5z^4)}{12} - \frac{7Q_{yz}xy(x^2-2y^2+3z^2)}{12}$$

$$\vec{\mathbb{G}}_3^{(2,-1)}[q](B_{3g}, 1)$$

\*\* symmetry

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

\*\* expression

$$\frac{3\sqrt{10}Q_u yz}{20} + \frac{\sqrt{30}Q_v yz}{20} + \frac{\sqrt{30}Q_{xy}xz}{5} - \frac{\sqrt{30}Q_{xz}xy}{5} + \frac{\sqrt{30}Q_{yz}(y-z)(y+z)}{20}$$

$$\vec{\mathbb{G}}_3^{(2,-1)}[q](B_{3g}, 2)$$

\*\* symmetry

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

\*\* expression

$$\frac{\sqrt{6}Q_u yz}{4} - \frac{3\sqrt{2}Q_v yz}{4} + \frac{\sqrt{2}Q_{yz}(2x^2-y^2-z^2)}{4}$$

$$\vec{\mathbb{G}}_3^{(2,1)}[q](B_{3g}, 1)$$

\*\* symmetry

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

\*\* expression

$$-\frac{\sqrt{5}Q_u yz(6x^2-y^2-z^2)}{4} - \frac{\sqrt{15}Q_v yz(6x^2-y^2-z^2)}{12} + \frac{\sqrt{15}Q_{xy}xz(4x^2-3y^2-3z^2)}{12} - \frac{\sqrt{15}Q_{xz}xy(4x^2-3y^2-3z^2)}{12} - \frac{\sqrt{15}Q_{yz}(y-z)(y+z)(6x^2-y^2-z^2)}{12}$$

$$\vec{\mathbb{G}}_3^{(2,1)}[q](B_{3g}, 2)$$

\*\* symmetry

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

\*\* expression

$$\frac{\sqrt{3}Q_u yz(12x^2-9y^2+5z^2)}{12} - \frac{Q_v yz(36x^2+y^2-13z^2)}{12} + \frac{7Q_{xy}xz(2x^2-3y^2-z^2)}{12} + \frac{7Q_{xz}xy(2x^2-y^2-3z^2)}{12} - \frac{Q_{yz}(4x^4-12x^2y^2-12x^2z^2+5y^4-18y^2z^2+5z^4)}{12}$$

\* Harmonics for rank 4

$$\vec{\mathbb{G}}_4^{(2,-1)}[q](A_u, 1)$$

\*\* symmetry

$$\frac{\sqrt{21}(x^4-3x^2y^2-3x^2z^2+y^4-3y^2z^2+z^4)}{6}$$

\*\* expression

$$\frac{\sqrt{5}Q_{xy}z(x-y)(x+y)}{2} - \frac{\sqrt{5}Q_{xz}y(x-z)(x+z)}{2} + \frac{\sqrt{5}Q_{yz}x(y-z)(y+z)}{2}$$

$$\vec{\mathbb{G}}_4^{(2,-1)}[q](A_u, 2)$$

\*\* symmetry

$$-\frac{\sqrt{15}(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4)}{12}$$

\*\* expression

$$-\frac{6\sqrt{7}Q_v xyz}{7} - \frac{\sqrt{7}Q_{xyz}(x-y)(x+y)}{14} + \frac{\sqrt{7}Q_{xzy}(4x^2-3y^2+5z^2)}{14} + \frac{\sqrt{7}Q_{yzx}(3x^2-4y^2-5z^2)}{14}$$

$$\vec{\mathbb{G}}_4^{(2,-1)}[q](A_u, 3)$$

\*\* symmetry

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

\*\* expression

$$\frac{6\sqrt{7}Q_uxyz}{7} + \frac{\sqrt{21}Q_{xyz}(3x^2+3y^2-2z^2)}{14} - \frac{\sqrt{21}Q_{xzy}(2x^2-y^2+z^2)}{14} + \frac{\sqrt{21}Q_{yzx}(x^2-2y^2-z^2)}{14}$$

$$\vec{\mathbb{G}}_4^{(2,1)}[q](A_u, 1)$$

\*\* symmetry

$$\frac{\sqrt{21}(x^4-3x^2y^2-3x^2z^2+y^4-3y^2z^2+z^4)}{6}$$

\*\* expression

$$\begin{aligned} & -\frac{3\sqrt{2310}Q_uxyz(x-y)(x+y)}{44} - \frac{3\sqrt{770}Q_vxyz(x^2+y^2-2z^2)}{44} + \frac{\sqrt{770}Q_{xyz}(x-y)(x+y)(x^2+y^2-2z^2)}{22} \\ & - \frac{\sqrt{770}Q_{xzy}(x-z)(x+z)(x^2-2y^2+z^2)}{22} - \frac{\sqrt{770}Q_{yzx}(y-z)(y+z)(2x^2-y^2-z^2)}{22} \end{aligned}$$

$$\vec{\mathbb{G}}_4^{(2,1)}[q](A_u, 2)$$

\*\* symmetry

$$\frac{\sqrt{15}(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4)}{12}$$

\*\* expression

$$\begin{aligned} & \frac{21\sqrt{66}Q_uxyz(x-y)(x+y)}{44} - \frac{21\sqrt{22}Q_vxyz(x^2+y^2-2z^2)}{44} + \frac{7\sqrt{22}Q_{xyz}(x-y)(x+y)(x^2+y^2-2z^2)}{44} \\ & + \frac{\sqrt{22}Q_{xzy}(17x^4-22x^2y^2-36x^2z^2+3y^4-8y^2z^2+10z^4)}{44} - \frac{\sqrt{22}Q_{yzx}(3x^4-22x^2y^2-8x^2z^2+17y^4-36y^2z^2+10z^4)}{44} \end{aligned}$$

$$\vec{\mathbb{G}}_4^{(2,1)}[q](A_u, 3)$$

\*\* symmetry

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

\*\* expression

$$\begin{aligned} & -\frac{21\sqrt{22}Q_uxyz(x^2+y^2-2z^2)}{44} - \frac{21\sqrt{66}Q_vxyz(x-y)(x+y)}{44} + \frac{\sqrt{66}Q_{xyz}(9x^4-24x^2y^2-10x^2z^2+9y^4-10y^2z^2+2z^4)}{44} \\ & - \frac{\sqrt{66}Q_{xzy}(x^4+2x^2y^2-12x^2z^2+y^4-12y^2z^2+8z^4)}{44} - \frac{\sqrt{66}Q_{yzx}(x^4+2x^2y^2-12x^2z^2+y^4-12y^2z^2+8z^4)}{44} \end{aligned}$$

$$\vec{\mathbb{G}}_4^{(2,-1)}[q](B_{1u}, 1)$$

\*\* symmetry

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

\*\* expression

$$-\frac{\sqrt{3}Q_vz(x-y)(x+y)}{2} + \sqrt{3}Q_{xy}xyz + \frac{\sqrt{3}Q_{xzx}(x^2-3y^2)}{4} - \frac{\sqrt{3}Q_{yzy}(3x^2-y^2)}{4}$$

$$\vec{\mathbb{G}}_4^{(2,-1)}[q](B_{1u}, 2)$$

\*\* symmetry

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

\*\* expression

$$\frac{3\sqrt{7}Q_uz(x-y)(x+y)}{7} + \frac{\sqrt{21}Q_vz(3x^2+3y^2-2z^2)}{14} - \frac{\sqrt{21}Q_{xzx}(x^2-5y^2+2z^2)}{28} - \frac{\sqrt{21}Q_{yzy}(5x^2-y^2-2z^2)}{28}$$

$$\vec{\mathbb{G}}_4^{(2,1)}[q](B_{1u}, 1)$$

\*\* symmetry

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

\*\* expression

$$\frac{9\sqrt{154}Q_u z (x^2 - 2xy - y^2) (x^2 + 2xy - y^2)}{88} - \frac{\sqrt{462}Q_v z (x - y) (x + y) (x^2 + y^2 - 2z^2)}{88} + \frac{\sqrt{462}Q_{xy}xyz (x^2 + y^2 - 2z^2)}{44}$$

$$+ \frac{\sqrt{462}Q_{xz}x (x^4 - 8x^2y^2 - 2x^2z^2 + 3y^4 + 6y^2z^2)}{44} + \frac{\sqrt{462}Q_{yz}y (3x^4 - 8x^2y^2 + 6x^2z^2 + y^4 - 2y^2z^2)}{44}$$

$$\vec{\mathbb{G}}_4^{(2,1)}[q](B_{1u}, 2)$$

\*\* symmetry

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

\*\* expression

$$- \frac{21\sqrt{22}Q_u z (x - y) (x + y) (x^2 + y^2 - 2z^2)}{88} - \frac{\sqrt{66}Q_v z (3x^4 - 78x^2y^2 + 20x^2z^2 + 3y^4 + 20y^2z^2 - 4z^4)}{88} - \frac{21\sqrt{66}Q_{xy}xyz (x - y) (x + y)}{44}$$

$$- \frac{\sqrt{66}Q_{xz}x (x^4 + 2x^2y^2 - 12x^2z^2 + y^4 - 12y^2z^2 + 8z^4)}{44} + \frac{\sqrt{66}Q_{yz}y (x^4 + 2x^2y^2 - 12x^2z^2 + y^4 - 12y^2z^2 + 8z^4)}{44}$$

$$\vec{\mathbb{G}}_4^{(2,-1)}[q](B_{2u}, 1)$$

\*\* symmetry

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

\*\* expression

$$\frac{3Q_u y (x - z) (x + z)}{4} - \frac{\sqrt{3}Q_v y (x - z) (x + z)}{4} + \frac{\sqrt{3}Q_{xy}x (x^2 - 3z^2)}{4} + \sqrt{3}Q_{xz}xyz - \frac{\sqrt{3}Q_{yz}z (3x^2 - z^2)}{4}$$

$$\vec{\mathbb{G}}_4^{(2,-1)}[q](B_{2u}, 2)$$

\*\* symmetry

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

\*\* expression

$$\frac{3\sqrt{7}Q_u y (5x^2 - 2y^2 + z^2)}{28} + \frac{\sqrt{21}Q_v y (3x^2 + 2y^2 - 9z^2)}{28} + \frac{\sqrt{21}Q_{xy}x (x^2 + 2y^2 - 5z^2)}{28} + \frac{\sqrt{21}Q_{yz}z (5x^2 - 2y^2 - z^2)}{28}$$

$$\vec{\mathbb{G}}_4^{(2,1)}[q](B_{2u}, 1)$$

\*\* symmetry

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

\*\* expression

$$- \frac{3\sqrt{154}Q_u y (x^4 + x^2y^2 - 9x^2z^2 - y^2z^2 + 2z^4)}{88} - \frac{\sqrt{462}Q_v y (5x^4 - x^2y^2 - 27x^2z^2 + y^2z^2 + 4z^4)}{88}$$

$$+ \frac{\sqrt{462}Q_{xy}x (x^4 - 2x^2y^2 - 8x^2z^2 + 6y^2z^2 + 3z^4)}{44} + \frac{\sqrt{462}Q_{xz}xyz (x^2 - 2y^2 + z^2)}{44} + \frac{\sqrt{462}Q_{yz}z (3x^4 + 6x^2y^2 - 8x^2z^2 - 2y^2z^2 + z^4)}{44}$$

$$\vec{\mathbb{G}}_4^{(2,1)}[q](B_{2u}, 2)$$

\*\* symmetry

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

\*\* expression

$$- \frac{3\sqrt{22}Q_u y (5x^4 + 3x^2y^2 - 39x^2z^2 - 2y^4 + 17y^2z^2 - 2z^4)}{88} - \frac{\sqrt{66}Q_v y (9x^4 - 31x^2y^2 + 39x^2z^2 + 2y^4 + 11y^2z^2 - 12z^4)}{88}$$

$$+ \frac{\sqrt{66}Q_{xy}x (x^4 - 12x^2y^2 + 2x^2z^2 + 8y^4 - 12y^2z^2 + z^4)}{44} + \frac{21\sqrt{66}Q_{xz}xyz (x - z) (x + z)}{44} - \frac{\sqrt{66}Q_{yz}z (x^4 - 12x^2y^2 + 2x^2z^2 + 8y^4 - 12y^2z^2 + z^4)}{44}$$

$$\vec{\mathbb{G}}_4^{(2,-1)}[q](B_{3u}, 1)$$

\*\* symmetry

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

\*\* expression

$$\frac{3Q_u x (y - z) (y + z)}{4} + \frac{\sqrt{3}Q_v x (y - z) (y + z)}{4} + \frac{\sqrt{3}Q_{xy}y (y^2 - 3z^2)}{4} - \frac{\sqrt{3}Q_{xz}z (3y^2 - z^2)}{4} + \sqrt{3}Q_{yz}xyz$$

$$\vec{\mathbb{G}}_4^{(2,-1)}[q](B_{3u}, 2)$$

\*\* symmetry

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

\*\* expression

$$\frac{3\sqrt{7}Q_u x(2x^2 - 5y^2 - z^2)}{28} + \frac{\sqrt{21}Q_v x(2x^2 + 3y^2 - 9z^2)}{28} - \frac{\sqrt{21}Q_{xy} y(2x^2 + y^2 - 5z^2)}{28} + \frac{\sqrt{21}Q_{xz} z(2x^2 - 5y^2 + z^2)}{28}$$

$$\vec{\mathbb{G}}_4^{(2,1)}[q](B_{3u}, 1)$$

\*\* symmetry

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

\*\* expression

$$\begin{aligned} & - \frac{3\sqrt{154}Q_u x(x^2 y^2 - x^2 z^2 + y^4 - 9y^2 z^2 + 2z^4)}{88} - \frac{\sqrt{462}Q_v x(x^2 y^2 - x^2 z^2 - 5y^4 + 27y^2 z^2 - 4z^4)}{88} \\ & - \frac{\sqrt{462}Q_{xy} y(2x^2 y^2 - 6x^2 z^2 - y^4 + 8y^2 z^2 - 3z^4)}{44} + \frac{\sqrt{462}Q_{xz} z(6x^2 y^2 - 2x^2 z^2 + 3y^4 - 8y^2 z^2 + z^4)}{44} - \frac{\sqrt{462}Q_{yz} x y z(2x^2 - y^2 - z^2)}{44} \end{aligned}$$

$$\vec{\mathbb{G}}_4^{(2,1)}[q](B_{3u}, 2)$$

\*\* symmetry

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

\*\* expression

$$\begin{aligned} & - \frac{3\sqrt{22}Q_u x(2x^4 - 3x^2 y^2 - 17x^2 z^2 - 5y^4 + 39y^2 z^2 + 2z^4)}{88} - \frac{\sqrt{66}Q_v x(2x^4 - 31x^2 y^2 + 11x^2 z^2 + 9y^4 + 39y^2 z^2 - 12z^4)}{88} \\ & - \frac{\sqrt{66}Q_{xy} y(8x^4 - 12x^2 y^2 - 12x^2 z^2 + y^4 + 2y^2 z^2 + z^4)}{44} + \frac{\sqrt{66}Q_{xz} z(8x^4 - 12x^2 y^2 - 12x^2 z^2 + y^4 + 2y^2 z^2 + z^4)}{44} - \frac{21\sqrt{66}Q_{yz} x y z(y-z)(y+z)}{44} \end{aligned}$$