

PG No. 19 C_{3v} $3m$ (3m1 setting) [trigonal]

Table 1 Harmonics for rank 0.

| No. | multipole | expression |
|-----|---------------------|------------|
| 1 | $\mathbb{G}_0(A_2)$ | 1 |

Table 2 Harmonics for rank 1.

| No. | multipole | expression |
|-----|-----------------------|------------|
| 2 | $\mathbb{G}_1(A_2)$ | z |
| 3 | $\mathbb{G}_{1,1}(E)$ | $-y$ |
| 4 | $\mathbb{G}_{1,2}(E)$ | x |

Table 3 Harmonics for rank 2.

| No. | multipole | expression |
|-----|--------------------------|--|
| 5 | $\mathbb{G}_2(A_2)$ | $-\frac{x^2}{2} - \frac{y^2}{2} + z^2$ |
| 6 | $\mathbb{G}_{2,1}(E, 1)$ | $\sqrt{3}yz$ |
| 7 | $\mathbb{G}_{2,2}(E, 1)$ | $-\sqrt{3}xz$ |
| 8 | $\mathbb{G}_{2,1}(E, 2)$ | $\frac{\sqrt{3}(x-y)(x+y)}{2}$ |
| 9 | $\mathbb{G}_{2,2}(E, 2)$ | $-\sqrt{3}xy$ |

Table 4 Harmonics for rank 3.

| No. | multipole | expression |
|-----|--------------------------|--------------------------------------|
| 10 | $\mathbb{G}_3(A_1)$ | $\frac{\sqrt{10}x(x^2-3y^2)}{4}$ |
| 11 | $\mathbb{G}_3(A_2, 1)$ | $-\frac{z(3x^2+3y^2-2z^2)}{2}$ |
| 12 | $\mathbb{G}_3(A_2, 2)$ | $\frac{\sqrt{10}y(3x^2-y^2)}{4}$ |
| 13 | $\mathbb{G}_{3,1}(E, 1)$ | $\frac{\sqrt{6}y(x^2+y^2-4z^2)}{4}$ |
| 14 | $\mathbb{G}_{3,2}(E, 1)$ | $-\frac{\sqrt{6}x(x^2+y^2-4z^2)}{4}$ |
| 15 | $\mathbb{G}_{3,1}(E, 2)$ | $-\frac{\sqrt{15}z(x-y)(x+y)}{2}$ |
| 16 | $\mathbb{G}_{3,2}(E, 2)$ | $\sqrt{15}xyz$ |

Table 5 Harmonics for rank 4.

| No. | multipole | expression |
|-----|--------------------------|---|
| 17 | $\mathbb{G}_4(A_1)$ | $\frac{\sqrt{70xz(x^2-3y^2)}}{4}$ |
| 18 | $\mathbb{G}_4(A_2, 1)$ | $\frac{3x^4}{8} + \frac{3x^2y^2}{4} - 3x^2z^2 + \frac{3y^4}{8} - 3y^2z^2 + z^4$ |
| 19 | $\mathbb{G}_4(A_2, 2)$ | $\frac{\sqrt{70yz(3x^2-y^2)}}{4}$ |
| 20 | $\mathbb{G}_{4,1}(E, 1)$ | $-\frac{\sqrt{10yz(3x^2+3y^2-4z^2)}}{4}$ |
| 21 | $\mathbb{G}_{4,2}(E, 1)$ | $\frac{\sqrt{10xz(3x^2+3y^2-4z^2)}}{4}$ |
| 22 | $\mathbb{G}_{4,1}(E, 2)$ | $\frac{\sqrt{35(x^2-2xy-y^2)(x^2+2xy-y^2)}}{8}$ |
| 23 | $\mathbb{G}_{4,2}(E, 2)$ | $\frac{\sqrt{35xy(x-y)(x+y)}}{2}$ |
| 24 | $\mathbb{G}_{4,1}(E, 3)$ | $-\frac{\sqrt{5}(x-y)(x+y)(x^2+y^2-6z^2)}{4}$ |
| 25 | $\mathbb{G}_{4,2}(E, 3)$ | $\frac{\sqrt{5xy(x^2+y^2-6z^2)}}{2}$ |

Table 6 Harmonics for rank 5.

| No. | multipole | expression |
|-----|--------------------------|---|
| 26 | $\mathbb{G}_5(A_1)$ | $-\frac{\sqrt{70x(x^2-3y^2)(x^2+y^2-8z^2)}}{16}$ |
| 27 | $\mathbb{G}_5(A_2, 1)$ | $\frac{z(15x^4+30x^2y^2-40x^2z^2+15y^4-40y^2z^2+8z^4)}{8}$ |
| 28 | $\mathbb{G}_5(A_2, 2)$ | $-\frac{\sqrt{70y(3x^2-y^2)(x^2+y^2-8z^2)}}{16}$ |
| 29 | $\mathbb{G}_{5,1}(E, 1)$ | $\frac{3\sqrt{14y(5x^4-10x^2y^2+y^4)}}{16}$ |
| 30 | $\mathbb{G}_{5,2}(E, 1)$ | $\frac{3\sqrt{14x(x^4-10x^2y^2+5y^4)}}{16}$ |
| 31 | $\mathbb{G}_{5,1}(E, 2)$ | $-\frac{\sqrt{15y(x^4+2x^2y^2-12x^2z^2+y^4-12y^2z^2+8z^4)}}{8}$ |
| 32 | $\mathbb{G}_{5,2}(E, 2)$ | $\frac{\sqrt{15x(x^4+2x^2y^2-12x^2z^2+y^4-12y^2z^2+8z^4)}}{8}$ |
| 33 | $\mathbb{G}_{5,1}(E, 3)$ | $-\frac{3\sqrt{35z(x^2-2xy-y^2)(x^2+2xy-y^2)}}{8}$ |
| 34 | $\mathbb{G}_{5,2}(E, 3)$ | $-\frac{3\sqrt{35xyz(x-y)(x+y)}}{2}$ |
| 35 | $\mathbb{G}_{5,1}(E, 4)$ | $\frac{\sqrt{105z(x-y)(x+y)(x^2+y^2-2z^2)}}{4}$ |
| 36 | $\mathbb{G}_{5,2}(E, 4)$ | $-\frac{\sqrt{105xyz(x^2+y^2-2z^2)}}{2}$ |

Table 7 Harmonics for rank 6.

| No. | multipole | expression |
|-----|--------------------------|--|
| 37 | $\mathbb{G}_6(A_1, 1)$ | $\frac{\sqrt{462}xy(x^2-3y^2)(3x^2-y^2)}{16}$ |
| 38 | $\mathbb{G}_6(A_1, 2)$ | $-\frac{\sqrt{210}xz(x^2-3y^2)(3x^2+3y^2-8z^2)}{16}$ |
| 39 | $\mathbb{G}_6(A_2, 1)$ | $-\frac{5x^6}{16} - \frac{15x^4y^2}{16} + \frac{45x^4z^2}{8} - \frac{15x^2y^4}{16} + \frac{45x^2y^2z^2}{4} - \frac{15x^2z^4}{2} - \frac{5y^6}{16} + \frac{45y^4z^2}{8} - \frac{15y^2z^4}{2} + z^6$ |
| 40 | $\mathbb{G}_6(A_2, 2)$ | $\frac{\sqrt{462}(x-y)(x+y)(x^2-4xy+y^2)(x^2+4xy+y^2)}{32}$ |
| 41 | $\mathbb{G}_6(A_2, 3)$ | $-\frac{\sqrt{210}yz(3x^2-y^2)(3x^2+3y^2-8z^2)}{16}$ |
| 42 | $\mathbb{G}_{6,1}(E, 1)$ | $\frac{3\sqrt{154}yz(5x^4-10x^2y^2+y^4)}{16}$ |
| 43 | $\mathbb{G}_{6,2}(E, 1)$ | $\frac{3\sqrt{154}xz(x^4-10x^2y^2+5y^4)}{16}$ |
| 44 | $\mathbb{G}_{6,1}(E, 2)$ | $\frac{\sqrt{21}yz(5x^4+10x^2y^2-20x^2z^2+5y^4-20y^2z^2+8z^4)}{8}$ |
| 45 | $\mathbb{G}_{6,2}(E, 2)$ | $-\frac{\sqrt{21}xz(5x^4+10x^2y^2-20x^2z^2+5y^4-20y^2z^2+8z^4)}{8}$ |
| 46 | $\mathbb{G}_{6,1}(E, 3)$ | $-\frac{3\sqrt{7}(x^2+y^2-10z^2)(x^2-2xy-y^2)(x^2+2xy-y^2)}{16}$ |
| 47 | $\mathbb{G}_{6,2}(E, 3)$ | $-\frac{3\sqrt{7}xy(x-y)(x+y)(x^2+y^2-10z^2)}{4}$ |
| 48 | $\mathbb{G}_{6,1}(E, 4)$ | $\frac{\sqrt{210}(x-y)(x+y)(x^4+2x^2y^2-16x^2z^2+y^4-16y^2z^2+16z^4)}{32}$ |
| 49 | $\mathbb{G}_{6,2}(E, 4)$ | $-\frac{\sqrt{210}xy(x^4+2x^2y^2-16x^2z^2+y^4-16y^2z^2+16z^4)}{16}$ |

Table 8 Harmonics for rank 7.

| No. | multipole | expression |
|-----|--------------------------|---|
| 50 | $\mathbb{G}_7(A_1, 1)$ | $\frac{\sqrt{6006}xyz(x^2-3y^2)(3x^2-y^2)}{16}$ |
| 51 | $\mathbb{G}_7(A_1, 2)$ | $\frac{\sqrt{21}x(x^2-3y^2)(3x^4+6x^2y^2-60x^2z^2+3y^4-60y^2z^2+80z^4)}{32}$ |
| 52 | $\mathbb{G}_7(A_2, 1)$ | $-\frac{z(35x^6+105x^4y^2-210x^4z^2+105x^2y^4-420x^2y^2z^2+168x^2z^4+35y^6-210y^4z^2+168y^2z^4-16z^6)}{16}$ |
| 53 | $\mathbb{G}_7(A_2, 2)$ | $\frac{\sqrt{6006}z(x-y)(x+y)(x^2-4xy+y^2)(x^2+4xy+y^2)}{32}$ |
| 54 | $\mathbb{G}_7(A_2, 3)$ | $\frac{\sqrt{21}y(3x^2-y^2)(3x^4+6x^2y^2-60x^2z^2+3y^4-60y^2z^2+80z^4)}{32}$ |
| 55 | $\mathbb{G}_{7,1}(E, 1)$ | $-\frac{\sqrt{429}y(7x^6-35x^4y^2+21x^2y^4-y^6)}{32}$ |
| 56 | $\mathbb{G}_{7,2}(E, 1)$ | $\frac{\sqrt{429}x(x^6-21x^4y^2+35x^2y^4-7y^6)}{32}$ |
| 57 | $\mathbb{G}_{7,1}(E, 2)$ | $-\frac{\sqrt{231}y(x^2+y^2-12z^2)(5x^4-10x^2y^2+y^4)}{32}$ |
| 58 | $\mathbb{G}_{7,2}(E, 2)$ | $-\frac{\sqrt{231}x(x^2+y^2-12z^2)(x^4-10x^2y^2+5y^4)}{32}$ |
| 59 | $\mathbb{G}_{7,1}(E, 3)$ | $\frac{\sqrt{7}y(5x^6+15x^4y^2-120x^4z^2+15x^2y^4-240x^2y^2z^2+240x^2z^4+5y^6-120y^4z^2+240y^2z^4-64z^6)}{32}$ |
| 60 | $\mathbb{G}_{7,2}(E, 3)$ | $-\frac{\sqrt{7}x(5x^6+15x^4y^2-120x^4z^2+15x^2y^4-240x^2y^2z^2+240x^2z^4+5y^6-120y^4z^2+240y^2z^4-64z^6)}{32}$ |
| 61 | $\mathbb{G}_{7,1}(E, 4)$ | $\frac{\sqrt{231}z(x^2-2xy-y^2)(x^2+2xy-y^2)(3x^2+3y^2-10z^2)}{16}$ |
| 62 | $\mathbb{G}_{7,2}(E, 4)$ | $\frac{\sqrt{231}xyz(x-y)(x+y)(3x^2+3y^2-10z^2)}{4}$ |
| 63 | $\mathbb{G}_{7,1}(E, 5)$ | $-\frac{\sqrt{42}z(x-y)(x+y)(15x^4+30x^2y^2-80x^2z^2+15y^4-80y^2z^2+48z^4)}{32}$ |
| 64 | $\mathbb{G}_{7,2}(E, 5)$ | $\frac{\sqrt{42}xyz(15x^4+30x^2y^2-80x^2z^2+15y^4-80y^2z^2+48z^4)}{16}$ |

Table 9 Harmonics for rank 8.

| No. | multipole | expression |
|-----|--------------------------|---|
| 65 | $\mathbb{G}_8(A_1, 1)$ | $-\frac{\sqrt{858}xy(x^2-3y^2)(3x^2-y^2)(x^2+y^2-14z^2)}{32}$ |
| 66 | $\mathbb{G}_8(A_1, 2)$ | $\frac{\sqrt{1155}xz(x^2-3y^2)(3x^4+6x^2y^2-20x^2z^2+3y^4-20y^2z^2+16z^4)}{32}$ |
| 67 | $\mathbb{G}_8(A_2, 1)$ | $\frac{35x^8}{128} + \frac{35x^6y^2}{32} - \frac{35x^6z^2}{4} + \frac{105x^4y^4}{64} - \frac{105x^4y^2z^2}{4} + \frac{105x^4z^4}{4} + \frac{35x^2y^6}{32} - \frac{105x^2y^4z^2}{4} + \frac{105x^2y^2z^4}{2} - 14x^2z^6 + \frac{35y^8}{128} - \frac{35y^6z^2}{4} + \frac{105y^4z^4}{4} - 14y^2z^6 + z^8$ |
| 68 | $\mathbb{G}_8(A_2, 2)$ | $-\frac{\sqrt{858}(x-y)(x+y)(x^2+y^2-14z^2)(x^2-4xy+y^2)(x^2+4xy+y^2)}{64}$ |
| 69 | $\mathbb{G}_8(A_2, 3)$ | $\frac{\sqrt{1155}yz(3x^2-y^2)(3x^4+6x^2y^2-20x^2z^2+3y^4-20y^2z^2+16z^4)}{32}$ |
| 70 | $\mathbb{G}_{8,1}(E, 1)$ | $\frac{3\sqrt{715}yz(7x^6-35x^4y^2+21x^2y^4-y^6)}{32}$ |
| 71 | $\mathbb{G}_{8,2}(E, 1)$ | $-\frac{3\sqrt{715}xz(x^6-21x^4y^2+35x^2y^4-7y^6)}{32}$ |
| 72 | $\mathbb{G}_{8,1}(E, 2)$ | $-\frac{3\sqrt{1001}yz(x^2+y^2-4z^2)(5x^4-10x^2y^2+y^4)}{32}$ |
| 73 | $\mathbb{G}_{8,2}(E, 2)$ | $-\frac{3\sqrt{1001}xz(x^2+y^2-4z^2)(x^4-10x^2y^2+5y^4)}{32}$ |
| 74 | $\mathbb{G}_{8,1}(E, 3)$ | $-\frac{3yz(35x^6+105x^4y^2-280x^4z^2+105x^2y^4-560x^2y^2z^2+336x^2z^4+35y^6-280y^4z^2+336y^2z^4-64z^6)}{32}$ |
| 75 | $\mathbb{G}_{8,2}(E, 3)$ | $-\frac{3xz(35x^6+105x^4y^2-280x^4z^2+105x^2y^4-560x^2y^2z^2+336x^2z^4+35y^6-280y^4z^2+336y^2z^4-64z^6)}{32}$ |
| 76 | $\mathbb{G}_{8,1}(E, 4)$ | $\frac{3\sqrt{715}(x^4-4x^3y-6x^2y^2+4xy^3+y^4)(x^4+4x^3y-6x^2y^2-4xy^3+y^4)}{128}$ |
| 77 | $\mathbb{G}_{8,2}(E, 4)$ | $-\frac{3\sqrt{715}xy(x-y)(x+y)(x^2-2xy-y^2)(x^2+2xy-y^2)}{16}$ |
| 78 | $\mathbb{G}_{8,1}(E, 5)$ | $\frac{3\sqrt{77}(x^2-2xy-y^2)(x^2+2xy-y^2)(x^4+2x^2y^2-24x^2z^2+y^4-24y^2z^2+40z^4)}{64}$ |
| 79 | $\mathbb{G}_{8,2}(E, 5)$ | $\frac{3\sqrt{77}xy(x-y)(x+y)(x^4+2x^2y^2-24x^2z^2+y^4-24y^2z^2+40z^4)}{16}$ |
| 80 | $\mathbb{G}_{8,1}(E, 6)$ | $-\frac{3\sqrt{70}(x-y)(x+y)(x^6+3x^4y^2-30x^4z^2+3x^2y^4-60x^2y^2z^2+80x^2z^4+y^6-30y^4z^2+80y^2z^4-32z^6)}{64}$ |
| 81 | $\mathbb{G}_{8,2}(E, 6)$ | $\frac{3\sqrt{70}xy(x^6+3x^4y^2-30x^4z^2+3x^2y^4-60x^2y^2z^2+80x^2z^4+y^6-30y^4z^2+80y^2z^4-32z^6)}{32}$ |

Table 10 Harmonics for rank 9.

| No. | multipole | expression |
|-----|--------------------------|---|
| 82 | $\mathbb{G}_9(A_1, 1)$ | $-\frac{\sqrt{4290}xyz(x^2-3y^2)(3x^2-y^2)(3x^2+3y^2-14z^2)}{32}$ |
| 83 | $\mathbb{G}_9(A_1, 2)$ | $\frac{\sqrt{24310}x(x^2-3y^2)(x^6-33x^4y^2+27x^2y^4-3y^6)}{256}$ |
| 84 | $\mathbb{G}_9(A_1, 3)$ | $-\frac{\sqrt{2310}x(x^2-3y^2)(x^6+3x^4y^2-36x^4z^2+3x^2y^4-72x^2y^2z^2+120x^2z^4+y^6-36y^4z^2+120y^2z^4-64z^6)}{128}$ |
| 85 | $\mathbb{G}_9(A_2, 1)$ | $\frac{z(315x^8+1260x^6y^2-3360x^6z^2+1890x^4y^4-10080x^4y^2z^2+6048x^4z^4+1260x^2y^6-10080x^2y^4z^2+12096x^2y^2z^4-2304x^2z^6+315y^8-3360y^6z^2+6048y^4z^4-2304y^2z^6+128z^8)}{128}$ |
| 86 | $\mathbb{G}_9(A_2, 2)$ | $-\frac{\sqrt{4290}z(x-y)(x+y)(x^2-4xy+y^2)(x^2+4xy+y^2)(3x^2+3y^2-14z^2)}{64}$ |
| 87 | $\mathbb{G}_9(A_2, 3)$ | $\frac{\sqrt{24310}y(3x^2-y^2)(3x^6-27x^4y^2+33x^2y^4-y^6)}{256}$ |
| 88 | $\mathbb{G}_9(A_2, 4)$ | $-\frac{\sqrt{2310}y(3x^2-y^2)(x^6+3x^4y^2-36x^4z^2+3x^2y^4-72x^2y^2z^2+120x^2z^4+y^6-36y^4z^2+120y^2z^4-64z^6)}{128}$ |
| 89 | $\mathbb{G}_{9,1}(E, 1)$ | $\frac{3\sqrt{1430}y(x^2+y^2-16z^2)(7x^6-35x^4y^2+21x^2y^4-y^6)}{256}$ |
| 90 | $\mathbb{G}_{9,2}(E, 1)$ | $-\frac{3\sqrt{1430}x(x^2+y^2-16z^2)(x^6-21x^4y^2+35x^2y^4-7y^6)}{256}$ |
| 91 | $\mathbb{G}_{9,1}(E, 2)$ | $\frac{3\sqrt{286}y(5x^4-10x^2y^2+y^4)(x^4+2x^2y^2-28x^2z^2+y^4-28y^2z^2+56z^4)}{128}$ |
| 92 | $\mathbb{G}_{9,2}(E, 2)$ | $\frac{3\sqrt{286}x(x^4-10x^2y^2+5y^4)(x^4+2x^2y^2-28x^2z^2+y^4-28y^2z^2+56z^4)}{128}$ |
| 93 | $\mathbb{G}_{9,1}(E, 3)$ | $-\frac{3\sqrt{5}y(7x^8+28x^6y^2-280x^6z^2+42x^4y^4-840x^4y^2z^2+1120x^4z^4+28x^2y^6-840x^2y^4z^2+2240x^2y^2z^4-896x^2z^6+7y^8-280y^6z^2+1120y^4z^4-896y^2z^6+128z^8)}{128}$ |
| 94 | $\mathbb{G}_{9,2}(E, 3)$ | $\frac{3\sqrt{5}x(7x^8+28x^6y^2-280x^6z^2+42x^4y^4-840x^4y^2z^2+1120x^4z^4+28x^2y^6-840x^2y^4z^2+2240x^2y^2z^4-896x^2z^6+7y^8-280y^6z^2+1120y^4z^4-896y^2z^6+128z^8)}{128}$ |
| 95 | $\mathbb{G}_{9,1}(E, 4)$ | $-\frac{3\sqrt{12155}z(x^4-4x^3y-6x^2y^2+4xy^3+y^4)(x^4+4x^3y-6x^2y^2-4xy^3+y^4)}{128}$ |
| 96 | $\mathbb{G}_{9,2}(E, 4)$ | $\frac{3\sqrt{12155}xyz(x-y)(x+y)(x^2-2xy-y^2)(x^2+2xy-y^2)}{16}$ |
| 97 | $\mathbb{G}_{9,1}(E, 5)$ | $-\frac{3\sqrt{5005}z(x^2-2xy-y^2)(x^2+2xy-y^2)(x^4+2x^2y^2-8x^2z^2+y^4-8y^2z^2+8z^4)}{64}$ |
| 98 | $\mathbb{G}_{9,2}(E, 5)$ | $-\frac{3\sqrt{5005}xyz(x-y)(x+y)(x^4+2x^2y^2-8x^2z^2+y^4-8y^2z^2+8z^4)}{16}$ |
| 99 | $\mathbb{G}_{9,1}(E, 6)$ | $\frac{3\sqrt{110}z(x-y)(x+y)(7x^6+21x^4y^2-70x^4z^2+21x^2y^4-140x^2y^2z^2+112x^2z^4+7y^6-70y^4z^2+112y^2z^4-32z^6)}{64}$ |
| 100 | $\mathbb{G}_{9,2}(E, 6)$ | $-\frac{3\sqrt{110}xyz(7x^6+21x^4y^2-70x^4z^2+21x^2y^4-140x^2y^2z^2+112x^2z^4+7y^6-70y^4z^2+112y^2z^4-32z^6)}{32}$ |

Table 11 Harmonics for rank 10.

| No. | multipole | expression |
|-----|---------------------------|---|
| 101 | $\mathbb{G}_{10}(A_1, 1)$ | $\frac{\sqrt{4290}xy(x^2-3y^2)(3x^2-y^2)(3x^4+6x^2y^2-96x^2z^2+3y^4-96y^2z^2+224z^4)}{256}$ |
| 102 | $\mathbb{G}_{10}(A_1, 2)$ | $\frac{\sqrt{461890}xz(x^2-3y^2)(x^6-33x^4y^2+27x^2y^4-3y^6)}{256}$ |
| 103 | $\mathbb{G}_{10}(A_1, 3)$ | $-\frac{\sqrt{4290}xz(x^2-3y^2)(7x^6+21x^4y^2-84x^4z^2+21x^2y^4-168x^2y^2z^2+168x^2z^4+7y^6-84y^4z^2+168y^2z^4-64z^6)}{128}$ |
| 104 | $\mathbb{G}_{10}(A_2, 1)$ | $-\frac{63x^{10}}{256} - \frac{315x^8y^2}{256} + \frac{1575x^8z^2}{128} - \frac{315x^6y^4}{128} + \frac{1575x^6y^2z^2}{32} - \frac{525x^6z^4}{8} - \frac{315x^4y^6}{128} + \frac{4725x^4y^4z^2}{64} - \frac{1575x^4y^2z^4}{8} + \frac{315x^4z^6}{4} - \frac{315x^2y^8}{256} + \frac{1575x^2y^6z^2}{32} - \frac{1575x^2y^4z^4}{8} + \frac{315x^2y^2z^6}{2} - \frac{45x^2z^8}{2} - \frac{63y^{10}}{256} + \frac{1575y^8z^2}{128} - \frac{525y^6z^4}{8} + \frac{315y^4z^6}{4} - \frac{45y^2z^8}{2} + z^{10}$ |
| 105 | $\mathbb{G}_{10}(A_2, 2)$ | $\frac{\sqrt{4290}(x-y)(x+y)(x^2-4xy+y^2)(x^2+4xy+y^2)(3x^4+6x^2y^2-96x^2z^2+3y^4-96y^2z^2+224z^4)}{512}$ |
| 106 | $\mathbb{G}_{10}(A_2, 3)$ | $\frac{\sqrt{461890}yz(3x^2-y^2)(3x^6-27x^4y^2+33x^2y^4-y^6)}{256}$ |
| 107 | $\mathbb{G}_{10}(A_2, 4)$ | $-\frac{\sqrt{4290}yz(3x^2-y^2)(7x^6+21x^4y^2-84x^4z^2+21x^2y^4-168x^2y^2z^2+168x^2z^4+7y^6-84y^4z^2+168y^2z^4-64z^6)}{128}$ |
| 108 | $\mathbb{G}_{10,1}(E, 1)$ | $-\frac{\sqrt{72930}yz(3x^2+3y^2-16z^2)(7x^6-35x^4y^2+21x^2y^4-y^6)}{256}$ |
| 109 | $\mathbb{G}_{10,2}(E, 1)$ | $\frac{\sqrt{72930}xz(3x^2+3y^2-16z^2)(x^6-21x^4y^2+35x^2y^4-7y^6)}{256}$ |
| 110 | $\mathbb{G}_{10,1}(E, 2)$ | $\frac{\sqrt{858}yz(5x^4-10x^2y^2+y^4)(15x^4+30x^2y^2-140x^2z^2+15y^4-140y^2z^2+168z^4)}{128}$ |
| 111 | $\mathbb{G}_{10,2}(E, 2)$ | $\frac{\sqrt{858}xz(x^4-10x^2y^2+5y^4)(15x^4+30x^2y^2-140x^2z^2+15y^4-140y^2z^2+168z^4)}{128}$ |
| 112 | $\mathbb{G}_{10,1}(E, 3)$ | $\frac{\sqrt{55}yz(63x^8+252x^6y^2-840x^6z^2+378x^4y^4-2520x^4y^2z^2+2016x^4z^4+252x^2y^6-2520x^2y^4z^2+4032x^2y^2z^4-1152x^2z^6+63y^8-840y^6z^2+2016y^4z^4-1152y^2z^6+128z^8)}{128}$ |
| 113 | $\mathbb{G}_{10,2}(E, 3)$ | $-\frac{\sqrt{55}xz(63x^8+252x^6y^2-840x^6z^2+378x^4y^4-2520x^4y^2z^2+2016x^4z^4+252x^2y^6-2520x^2y^4z^2+4032x^2y^2z^4-1152x^2z^6+63y^8-840y^6z^2+2016y^4z^4-1152y^2z^6+128z^8)}{128}$ |
| 114 | $\mathbb{G}_{10,1}(E, 4)$ | $\frac{\sqrt{92378}(x-y)(x+y)(x^4-4x^3y-14x^2y^2-4xy^3+y^4)(x^4+4x^3y-14x^2y^2+4xy^3+y^4)}{512}$ |
| 115 | $\mathbb{G}_{10,2}(E, 4)$ | $\frac{\sqrt{92378}xy(x^4-10x^2y^2+5y^4)(5x^4-10x^2y^2+y^4)}{256}$ |
| 116 | $\mathbb{G}_{10,1}(E, 5)$ | $-\frac{\sqrt{12155}(x^2+y^2-18z^2)(x^4-4x^3y-6x^2y^2+4xy^3+y^4)(x^4+4x^3y-6x^2y^2-4xy^3+y^4)}{256}$ |
| 117 | $\mathbb{G}_{10,2}(E, 5)$ | $\frac{\sqrt{12155}xy(x-y)(x+y)(x^2+y^2-18z^2)(x^2-2xy-y^2)(x^2+2xy-y^2)}{32}$ |
| 118 | $\mathbb{G}_{10,1}(E, 6)$ | $-\frac{\sqrt{2145}(x^2-2xy-y^2)(x^2+2xy-y^2)(x^6+3x^4y^2-42x^4z^2+3x^2y^4-84x^2y^2z^2+168x^2z^4+y^6-42y^4z^2+168y^2z^4-112z^6)}{128}$ |
| 119 | $\mathbb{G}_{10,2}(E, 6)$ | $-\frac{\sqrt{2145}xy(x-y)(x+y)(x^6+3x^4y^2-42x^4z^2+3x^2y^4-84x^2y^2z^2+168x^2z^4+y^6-42y^4z^2+168y^2z^4-112z^6)}{128}$ |
| 120 | $\mathbb{G}_{10,1}(E, 7)$ | $\frac{\sqrt{165}(x-y)(x+y)(7x^8+28x^6y^2-336x^6z^2+42x^4y^4-1008x^4y^2z^2+1680x^4z^4+28x^2y^6-1008x^2y^4z^2+3360x^2y^2z^4-1792x^2z^6+7y^8-336y^6z^2+1680y^4z^4-1792y^2z^6+384z^8)}{256}$ |
| 121 | $\mathbb{G}_{10,2}(E, 7)$ | $-\frac{\sqrt{165}xy(7x^8+28x^6y^2-336x^6z^2+42x^4y^4-1008x^4y^2z^2+1680x^4z^4+28x^2y^6-1008x^2y^4z^2+3360x^2y^2z^4-1792x^2z^6+7y^8-336y^6z^2+1680y^4z^4-1792y^2z^6+384z^8)}{128}$ |

Table 12 Harmonics for rank 11.

| No. | multipole | expression |
|-----|---------------------------|---|
| 122 | $\mathbb{G}_{11}(A_1, 1)$ | $\frac{\sqrt{14586}xyz(x^2-3y^2)(3x^2-y^2)(15x^4+30x^2y^2-160x^2z^2+15y^4-160y^2z^2+224z^4)}{256}$ |
| 123 | $\mathbb{G}_{11}(A_1, 2)$ | $-\frac{\sqrt{46189}x(x^2-3y^2)(x^2+y^2-20z^2)(x^6-33x^4y^2+27x^2y^4-3y^6)}{512}$ |
| 124 | $\mathbb{G}_{11}(A_1, 3)$ | $\frac{\sqrt{30030}x(x^2-3y^2)(x^8+4x^6y^2-56x^6z^2+6x^4y^4-168x^4y^2z^2+336x^4z^4+4x^2y^6-168x^2y^4z^2+672x^2y^2z^4-448x^2z^6+y^8-56y^6z^2+336y^4z^4-448y^2z^6+128z^8)}{512}$ |
| 125 | $\mathbb{G}_{11}(A_2, 1)$ | $-\frac{z(693x^{10}+3465x^8y^2-11550x^8z^2+6930x^6y^4-46200x^6y^2z^2+36960x^6z^4+6930x^4y^6-69300x^4y^4z^2+110880x^4y^2z^4-31680x^4z^6+3465x^2y^8-46200x^2y^6z^2+110880x^2y^4z^4-63360x^2y^2z^6+7040x^2z^8+693y^{10}-11550y^8z^2+36960y^6z^4-31680y^4z^6+7040y^2z^8-256z^{10})}{256}$ |
| 126 | $\mathbb{G}_{11}(A_2, 2)$ | $\frac{\sqrt{14586}z(x-y)(x+y)(x^2-4xy+y^2)(x^2+4xy+y^2)(15x^4+30x^2y^2-160x^2z^2+15y^4-160y^2z^2+224z^4)}{512}$ |
| 127 | $\mathbb{G}_{11}(A_2, 3)$ | $-\frac{\sqrt{46189}y(3x^2-y^2)(x^2+y^2-20z^2)(3x^6-27x^4y^2+33x^2y^4-y^6)}{512}$ |
| 128 | $\mathbb{G}_{11}(A_2, 4)$ | $\frac{\sqrt{30030}y(3x^2-y^2)(x^8+4x^6y^2-56x^6z^2+6x^4y^4-168x^4y^2z^2+336x^4z^4+4x^2y^6-168x^2y^4z^2+672x^2y^2z^4-448x^2z^6+y^8-56y^6z^2+336y^4z^4-448y^2z^6+128z^8)}{512}$ |
| 129 | $\mathbb{G}_{11,1}(E, 1)$ | $\frac{\sqrt{88179}y(11x^{10}-165x^8y^2+462x^6y^4-330x^4y^6+55x^2y^8-y^{10})}{512}$ |
| 130 | $\mathbb{G}_{11,2}(E, 1)$ | $\frac{\sqrt{88179}x(x^{10}-55x^8y^2+330x^6y^4-462x^4y^6+165x^2y^8-11y^{10})}{512}$ |
| 131 | $\mathbb{G}_{11,1}(E, 2)$ | $-\frac{\sqrt{36465}y(7x^6-35x^4y^2+21x^2y^4-y^6)(x^4+2x^2y^2-36x^2z^2+y^4-36y^2z^2+96z^4)}{512}$ |
| 132 | $\mathbb{G}_{11,2}(E, 2)$ | $\frac{\sqrt{36465}x(x^6-21x^4y^2+35x^2y^4-7y^6)(x^4+2x^2y^2-36x^2z^2+y^4-36y^2z^2+96z^4)}{512}$ |
| 133 | $\mathbb{G}_{11,1}(E, 3)$ | $-\frac{3\sqrt{143}y(5x^4-10x^2y^2+y^4)(5x^6+15x^4y^2-240x^4z^2+15x^2y^4-480x^2y^2z^2+1120x^2z^4+5y^6-240y^4z^2+1120y^2z^4-896z^6)}{512}$ |
| 134 | $\mathbb{G}_{11,2}(E, 3)$ | $-\frac{3\sqrt{143}x(x^4-10x^2y^2+5y^4)(5x^6+15x^4y^2-240x^4z^2+15x^2y^4-480x^2y^2z^2+1120x^2z^4+5y^6-240y^4z^2+1120y^2z^4-896z^6)}{512}$ |
| 135 | $\mathbb{G}_{11,1}(E, 4)$ | $\frac{\sqrt{66}y(21x^{10}+105x^8y^2-1260x^8z^2+210x^6y^4-5040x^6y^2z^2+8400x^6z^4+210x^4y^6-7560x^4y^4z^2+25200x^4y^2z^4-13440x^4z^6+105x^2y^8-5040x^2y^6z^2+25200x^2y^4z^4-26880x^2y^2z^6+5760x^2z^8+21y^{10}-1260y^8z^2+8400y^6z^4-13440y^4z^6+5760y^2z^8-512z^{10})}{512}$ |
| 136 | $\mathbb{G}_{11,2}(E, 4)$ | $-\frac{\sqrt{66}x(21x^{10}+105x^8y^2-1260x^8z^2+210x^6y^4-5040x^6y^2z^2+8400x^6z^4+210x^4y^6-7560x^4y^4z^2+25200x^4y^2z^4-13440x^4z^6+105x^2y^8-5040x^2y^6z^2+25200x^2y^4z^4-26880x^2y^2z^6+5760x^2z^8+21y^{10}-1260y^8z^2+8400y^6z^4-13440y^4z^6+5760y^2z^8-512z^{10})}{512}$ |
| 137 | $\mathbb{G}_{11,1}(E, 5)$ | $-\frac{\sqrt{1939938}z(x-y)(x+y)(x^4-4x^3y-14x^2y^2-4xy^3+y^4)(x^4+4x^3y-14x^2y^2+4xy^3+y^4)}{512}$ |
| 138 | $\mathbb{G}_{11,2}(E, 5)$ | $-\frac{\sqrt{1939938}xyz(x^4-10x^2y^2+5y^4)(5x^4-10x^2y^2+y^4)}{256}$ |
| 139 | $\mathbb{G}_{11,1}(E, 6)$ | $\frac{\sqrt{692835}z(x^2+y^2-6z^2)(x^4-4x^3y-6x^2y^2+4xy^3+y^4)(x^4+4x^3y-6x^2y^2-4xy^3+y^4)}{256}$ |
| 140 | $\mathbb{G}_{11,2}(E, 6)$ | $-\frac{\sqrt{692835}xyz(x-y)(x+y)(x^2+y^2-6z^2)(x^2-2xy-y^2)(x^2+2xy-y^2)}{32}$ |
| 141 | $\mathbb{G}_{11,1}(E, 7)$ | $\frac{3\sqrt{1001}z(x^2-2xy-y^2)(x^2+2xy-y^2)(5x^6+15x^4y^2-70x^4z^2+15x^2y^4-140x^2y^2z^2+168x^2z^4+5y^6-70y^4z^2+168y^2z^4-80z^6)}{128}$ |
| 142 | $\mathbb{G}_{11,2}(E, 7)$ | $\frac{3\sqrt{1001}xyz(x-y)(x+y)(5x^6+15x^4y^2-70x^4z^2+15x^2y^4-140x^2y^2z^2+168x^2z^4+5y^6-70y^4z^2+168y^2z^4-80z^6)}{32}$ |
| 143 | $\mathbb{G}_{11,1}(E, 8)$ | $-\frac{\sqrt{2145}z(x-y)(x+y)(21x^8+84x^6y^2-336x^6z^2+126x^4y^4-1008x^4y^2z^2+1008x^4z^4+84x^2y^6-1008x^2y^4z^2+2016x^2y^2z^4-768x^2z^6+21y^8-336y^6z^2+1008y^4z^4-768y^2z^6+128z^8)}{256}$ |
| 144 | $\mathbb{G}_{11,2}(E, 8)$ | $\frac{\sqrt{2145}xyz(21x^8+84x^6y^2-336x^6z^2+126x^4y^4-1008x^4y^2z^2+1008x^4z^4+84x^2y^6-1008x^2y^4z^2+2016x^2y^2z^4-768x^2z^6+21y^8-336y^6z^2+1008y^4z^4-768y^2z^6+128z^8)}{128}$ |