

PG No. 15  $D_{4h}$   $4/mmm$  [ tetragonal ]

Table 1 Harmonics for rank 0.

No.	multipole	expression
1	$\mathbb{G}_0(A_{1u})$	1

Table 2 Harmonics for rank 1.

No.	multipole	expression
2	$\mathbb{G}_1(A_{2g})$	$z$
3	$\mathbb{G}_{1,1}(E_g)$	$x$
4	$\mathbb{G}_{1,2}(E_g)$	$-y$

Table 3 Harmonics for rank 2.

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

Table 4 Harmonics for rank 3.

No.	multipole	expression
10	$\mathbb{G}_3(A_{2g})$	$-\frac{z(3x^2+3y^2-2z^2)}{2}$
11	$\mathbb{G}_3(B_{1g})$	$\sqrt{15}xyz$
12	$\mathbb{G}_3(B_{2g})$	$\frac{\sqrt{15}z(x-y)(x+y)}{2}$
13	$\mathbb{G}_{3,1}(E_g, 1)$	$\frac{x(2x^2-3y^2-3z^2)}{2}$
14	$\mathbb{G}_{3,2}(E_g, 1)$	$\frac{y(3x^2-2y^2+3z^2)}{2}$
15	$\mathbb{G}_{3,1}(E_g, 2)$	$\frac{\sqrt{15}x(y-z)(y+z)}{2}$
16	$\mathbb{G}_{3,2}(E_g, 2)$	$-\frac{\sqrt{15}y(x-z)(x+z)}{2}$

Table 5 Harmonics for rank 4.

No.	multipole	expression
17	$\mathbb{G}_4(A_{1u}, 1)$	$\frac{\sqrt{21}(x^4 - 3x^2y^2 - 3x^2z^2 + y^4 - 3y^2z^2 + z^4)}{6}$
18	$\mathbb{G}_4(A_{1u}, 2)$	$-\frac{\sqrt{15}(x^4 - 12x^2y^2 + 6x^2z^2 + y^4 + 6y^2z^2 - 2z^4)}{12}$
19	$\mathbb{G}_4(A_{2u})$	$\frac{\sqrt{35}xy(x-y)(x+y)}{2}$
20	$\mathbb{G}_4(B_{1u})$	$\frac{\sqrt{5}(x-y)(x+y)(x^2 + y^2 - 6z^2)}{4}$
21	$\mathbb{G}_4(B_{2u})$	$-\frac{\sqrt{5}xy(x^2 + y^2 - 6z^2)}{2}$
22	$\mathbb{G}_{4,1}(E_u, 1)$	$\frac{\sqrt{35}yz(y-z)(y+z)}{2}$
23	$\mathbb{G}_{4,2}(E_u, 1)$	$-\frac{\sqrt{35}xz(x-z)(x+z)}{2}$
24	$\mathbb{G}_{4,1}(E_u, 2)$	$\frac{\sqrt{5}yz(6x^2 - y^2 - z^2)}{2}$
25	$\mathbb{G}_{4,2}(E_u, 2)$	$\frac{\sqrt{5}xz(x^2 - 6y^2 + z^2)}{2}$

Table 6 Harmonics for rank 5.

No.	multipole	expression
26	$\mathbb{G}_5(A_{1g})$	$\frac{3\sqrt{35}xyz(x-y)(x+y)}{2}$
27	$\mathbb{G}_5(A_{2g}, 1)$	$\frac{z(15x^4 + 30x^2y^2 - 40x^2z^2 + 15y^4 - 40y^2z^2 + 8z^4)}{8}$
28	$\mathbb{G}_5(A_{2g}, 2)$	$\frac{3\sqrt{35}z(x^2 - 2xy - y^2)(x^2 + 2xy - y^2)}{8}$
29	$\mathbb{G}_5(B_{1g})$	$\frac{\sqrt{105}xyz(x^2 + y^2 - 2z^2)}{2}$
30	$\mathbb{G}_5(B_{2g})$	$-\frac{\sqrt{105}z(x-y)(x+y)(x^2 + y^2 - 2z^2)}{4}$
31	$\mathbb{G}_{5,1}(E_g, 1)$	$\frac{x(8x^4 - 40x^2y^2 - 40x^2z^2 + 15y^4 + 30y^2z^2 + 15z^4)}{8}$
32	$\mathbb{G}_{5,2}(E_g, 1)$	$-\frac{y(15x^4 - 40x^2y^2 + 30x^2z^2 + 8y^4 - 40y^2z^2 + 15z^4)}{8}$
33	$\mathbb{G}_{5,1}(E_g, 2)$	$\frac{3\sqrt{35}x(y^2 - 2yz - z^2)(y^2 + 2yz - z^2)}{8}$
34	$\mathbb{G}_{5,2}(E_g, 2)$	$-\frac{3\sqrt{35}y(x^2 - 2xz - z^2)(x^2 + 2xz - z^2)}{8}$
35	$\mathbb{G}_{5,1}(E_g, 3)$	$\frac{\sqrt{105}x(y-z)(y+z)(2x^2 - y^2 - z^2)}{4}$
36	$\mathbb{G}_{5,2}(E_g, 3)$	$\frac{\sqrt{105}y(x-z)(x+z)(x^2 - 2y^2 + z^2)}{4}$

Table 7 Harmonics for rank 6.

No.	multipole	expression
37	$\mathbb{G}_6(A_{1u}, 1)$	$\frac{\sqrt{2}(2x^6 - 15x^4y^2 - 15x^4z^2 - 15x^2y^4 + 180x^2y^2z^2 - 15x^2z^4 + 2y^6 - 15y^4z^2 - 15y^2z^4 + 2z^6)}{8}$
38	$\mathbb{G}_6(A_{1u}, 2)$	$-\frac{\sqrt{14}(x^6 - 15x^4z^2 + 15x^2z^4 + y^6 - 15y^4z^2 + 15y^2z^4 - 2z^6)}{8}$
39	$\mathbb{G}_6(A_{2u})$	$-\frac{3\sqrt{7}xy(x-y)(x+y)(x^2+y^2-10z^2)}{4}$
40	$\mathbb{G}_6(B_{1u}, 1)$	$-\frac{\sqrt{2310}(x-y)(x+y)(x-z)(x+z)(y-z)(y+z)}{8}$
41	$\mathbb{G}_6(B_{1u}, 2)$	$\frac{\sqrt{42}(x-y)(x+y)(x^4-9x^2y^2-5x^2z^2+y^4-5y^2z^2+5z^4)}{8}$
42	$\mathbb{G}_6(B_{2u}, 1)$	$\frac{\sqrt{462}xy(x^2-3y^2)(3x^2-y^2)}{16}$
43	$\mathbb{G}_6(B_{2u}, 2)$	$\frac{\sqrt{210}xy(x^4+2x^2y^2-16x^2z^2+y^4-16y^2z^2+16z^4)}{16}$
44	$\mathbb{G}_{6,1}(E_u, 1)$	$3\sqrt{7}yz(y-z)(y+z)(10x^2-y^2-z^2)$
45	$\mathbb{G}_{6,2}(E_u, 1)$	$3\sqrt{7}xz(x-z)(x+z)(x^2-10y^2+z^2)$
46	$\mathbb{G}_{6,1}(E_u, 2)$	$\frac{\sqrt{462}yz(y^2-3z^2)(3y^2-z^2)}{16}$
47	$\mathbb{G}_{6,2}(E_u, 2)$	$-\frac{\sqrt{462}xz(x^2-3z^2)(3x^2-z^2)}{16}$
48	$\mathbb{G}_{6,1}(E_u, 3)$	$\frac{\sqrt{210}yz(16x^4-16x^2y^2-16x^2z^2+y^4+2y^2z^2+z^4)}{16}$
49	$\mathbb{G}_{6,2}(E_u, 3)$	$-\frac{\sqrt{210}xz(x^4-16x^2y^2+2x^2z^2+16y^4-16y^2z^2+z^4)}{16}$

Table 8 Harmonics for rank 7.

No.	multipole	expression
50	$\mathbb{G}_7(A_{1g})$	$-\frac{\sqrt{231}xyz(x-y)(x+y)(3x^2+3y^2-10z^2)}{4}$
51	$\mathbb{G}_7(A_{2g}, 1)$	$-\frac{z(35x^6+105x^4y^2-210x^4z^2+105x^2y^4-420x^2y^2z^2+168x^2z^4+35y^6-210y^4z^2+168y^2z^4-16z^6)}{16}$
52	$\mathbb{G}_7(A_{2g}, 2)$	$-\frac{\sqrt{231}z(x^2-2xy-y^2)(x^2+2xy-y^2)(3x^2+3y^2-10z^2)}{16}$
53	$\mathbb{G}_7(B_{1g}, 1)$	$\frac{\sqrt{91}xyz(3x^4-5x^2y^2-5x^2z^2+3y^4-5y^2z^2+3z^4)}{2}$
54	$\mathbb{G}_7(B_{1g}, 2)$	$-\frac{\sqrt{77}xyz(3x^4-20x^2y^2+10x^2z^2+3y^4+10y^2z^2-6z^4)}{4}$
55	$\mathbb{G}_7(B_{2g}, 1)$	$\frac{\sqrt{6006}z(x-y)(x+y)(x^2-4xy+y^2)(x^2+4xy+y^2)}{32}$
56	$\mathbb{G}_7(B_{2g}, 2)$	$\frac{\sqrt{42}z(x-y)(x+y)(15x^4+30x^2y^2-80x^2z^2+15y^4-80y^2z^2+48z^4)}{32}$
57	$\mathbb{G}_{7,1}(E_g, 1)$	$\frac{x(16x^6-168x^4y^2-168x^4z^2+210x^2y^4+420x^2y^2z^2+210x^2z^4-35y^6-105y^4z^2-105y^2z^4-35z^6)}{16}$
58	$\mathbb{G}_{7,2}(E_g, 1)$	$\frac{y(35x^6-210x^4y^2+105x^4z^2+168x^2y^4-420x^2y^2z^2+105x^2z^4-16y^6+168y^4z^2-210y^2z^4+35z^6)}{16}$
59	$\mathbb{G}_{7,1}(E_g, 2)$	$\frac{\sqrt{231}x(10x^2-3y^2-3z^2)(y^2-2yz-z^2)(y^2+2yz-z^2)}{16}$
60	$\mathbb{G}_{7,2}(E_g, 2)$	$\frac{\sqrt{231}y(x^2-2xz-z^2)(x^2+2xz-z^2)(3x^2-10y^2+3z^2)}{16}$
61	$\mathbb{G}_{7,1}(E_g, 3)$	$\frac{\sqrt{6006}x(y-z)(y+z)(y^2-4yz+z^2)(y^2+4yz+z^2)}{32}$
62	$\mathbb{G}_{7,2}(E_g, 3)$	$-\frac{\sqrt{6006}y(x-z)(x+z)(x^2-4xz+z^2)(x^2+4xz+z^2)}{32}$
63	$\mathbb{G}_{7,1}(E_g, 4)$	$\frac{\sqrt{42}x(y-z)(y+z)(48x^4-80x^2y^2-80x^2z^2+15y^4+30y^2z^2+15z^4)}{32}$
64	$\mathbb{G}_{7,2}(E_g, 4)$	$-\frac{\sqrt{42}y(x-z)(x+z)(15x^4-80x^2y^2+30x^2z^2+48y^4-80y^2z^2+15z^4)}{32}$

Table 9 Harmonics for rank 8.

No.	multipole	expression
65	$\mathbb{G}_8(A_{1u}, 1)$	$\frac{\sqrt{33}(x^8 - 14x^6y^2 - 14x^6z^2 + 35x^4y^4 + 35x^4z^4 - 14x^2y^6 - 14x^2z^6 + y^8 - 14y^6z^2 + 35y^4z^4 - 14y^2z^6 + z^8)}{8}$
66	$\mathbb{G}_8(A_{1u}, 2)$	$\frac{\sqrt{286}(x^8 - 14x^6y^2 - 14x^6z^2 + 210x^4y^2z^2 - 14x^2y^6 + 210x^2y^4z^2 - 420x^2y^2z^4 + 28x^2z^6 + y^8 - 14y^6z^2 + 28y^2z^6 - 2z^8)}{64}$
67	$\mathbb{G}_8(A_{1u}, 3)$	$\frac{\sqrt{210}(x^8 - 62x^6y^2 + 34x^6z^2 + 160x^4y^4 - 30x^4y^2z^2 - 80x^4z^4 - 62x^2y^6 - 30x^2y^4z^2 + 60x^2y^2z^4 + 28x^2z^6 + y^8 + 34y^6z^2 - 80y^4z^4 + 28y^2z^6 - 2z^8)}{64}$
68	$\mathbb{G}_8(A_{2u}, 1)$	$\frac{3\sqrt{715}xy(x-y)(x+y)(x^2 - 2xy - y^2)(x^2 + 2xy - y^2)}{16}$
69	$\mathbb{G}_8(A_{2u}, 2)$	$\frac{3\sqrt{77}xy(x-y)(x+y)(x^4 + 2x^2y^2 - 24x^2z^2 + y^4 - 24y^2z^2 + 40z^4)}{16}$
70	$\mathbb{G}_8(B_{1u}, 1)$	$-\frac{\sqrt{858}(x-y)(x+y)(x^2 + y^2 - 14z^2)(x^2 - 4xy + y^2)(x^2 + 4xy + y^2)}{64}$
71	$\mathbb{G}_8(B_{1u}, 2)$	$-\frac{3\sqrt{70}(x-y)(x+y)(x^6 + 3x^4y^2 - 30x^4z^2 + 3x^2y^4 - 60x^2y^2z^2 + 80x^2z^4 + y^6 - 30y^4z^2 + 80y^2z^4 - 32z^6)}{64}$
72	$\mathbb{G}_8(B_{2u}, 1)$	$-\frac{\sqrt{858}xy(x^2 - 3y^2)(3x^2 - y^2)(x^2 + y^2 - 14z^2)}{32}$
73	$\mathbb{G}_8(B_{2u}, 2)$	$-\frac{3\sqrt{70}xy(x^6 + 3x^4y^2 - 30x^4z^2 + 3x^2y^4 - 60x^2y^2z^2 + 80x^2z^4 + y^6 - 30y^4z^2 + 80y^2z^4 - 32z^6)}{32}$
74	$\mathbb{G}_{8,1}(E_u, 1)$	$\frac{3\sqrt{715}yz(y-z)(y+z)(y^2 - 2yz - z^2)(y^2 + 2yz - z^2)}{16}$
75	$\mathbb{G}_{8,2}(E_u, 1)$	$-\frac{3\sqrt{715}xz(x-z)(x+z)(x^2 - 2xz - z^2)(x^2 + 2xz - z^2)}{16}$
76	$\mathbb{G}_{8,1}(E_u, 2)$	$\frac{3\sqrt{77}yz(y-z)(y+z)(40x^4 - 24x^2y^2 - 24x^2z^2 + y^4 + 2y^2z^2 + z^4)}{16}$
77	$\mathbb{G}_{8,2}(E_u, 2)$	$-\frac{3\sqrt{77}xz(x-z)(x+z)(x^4 - 24x^2y^2 + 2x^2z^2 + 40y^4 - 24y^2z^2 + z^4)}{16}$
78	$\mathbb{G}_{8,1}(E_u, 3)$	$\frac{\sqrt{858}yz(y^2 - 3z^2)(3y^2 - z^2)(14x^2 - y^2 - z^2)}{32}$
79	$\mathbb{G}_{8,2}(E_u, 3)$	$\frac{\sqrt{858}xz(x^2 - 3z^2)(3x^2 - z^2)(x^2 - 14y^2 + z^2)}{32}$
80	$\mathbb{G}_{8,1}(E_u, 4)$	$\frac{3\sqrt{70}yz(32x^6 - 80x^4y^2 - 80x^4z^2 + 30x^2y^4 + 60x^2y^2z^2 + 30x^2z^4 - y^6 - 3y^4z^2 - 3y^2z^4 - z^6)}{32}$
81	$\mathbb{G}_{8,2}(E_u, 4)$	$\frac{3\sqrt{70}xz(x^6 - 30x^4y^2 + 3x^4z^2 + 80x^2y^4 - 60x^2y^2z^2 + 3x^2z^4 - 32y^6 + 80y^4z^2 - 30y^2z^4 + z^6)}{32}$

Table 10 Harmonics for rank 9.

No.	multipole	expression
82	$\mathbb{G}_9(A_{1g}, 1)$	$-\frac{\sqrt{510510}xyz(x-y)(x+y)(x-z)(x+z)(y-z)(y+z)}{8}$
83	$\mathbb{G}_9(A_{1g}, 2)$	$\frac{\sqrt{4290}xyz(x-y)(x+y)(3x^4 - 11x^2y^2 - 7x^2z^2 + 3y^4 - 7y^2z^2 + 7z^4)}{8}$
84	$\mathbb{G}_9(A_{2g}, 1)$	$\frac{z(315x^8 + 1260x^6y^2 - 3360x^6z^2 + 1890x^4y^4 - 10080x^4y^2z^2 + 6048x^4z^4 + 1260x^2y^6 - 10080x^2y^4z^2 + 12096x^2y^2z^4 - 2304x^2z^6 + 315y^8 - 3360y^6z^2 + 6048y^4z^4 - 2304y^2z^6 + 128z^8)}{128}$
85	$\mathbb{G}_9(A_{2g}, 2)$	$\frac{3\sqrt{12155}z(x^4 - 4x^3y - 6x^2y^2 + 4xy^3 + y^4)(x^4 + 4x^3y - 6x^2y^2 - 4xy^3 + y^4)}{128}$
86	$\mathbb{G}_9(A_{2g}, 3)$	$\frac{3\sqrt{5005}z(x^2 - 2xy - y^2)(x^2 + 2xy - y^2)(x^4 + 2x^2y^2 - 8x^2z^2 + y^4 - 8y^2z^2 + 8z^4)}{64}$
87	$\mathbb{G}_9(B_{1g}, 1)$	$\frac{\sqrt{330}xyz(6x^6 - 21x^4y^2 - 21x^4z^2 - 21x^2y^4 + 140x^2y^2z^2 - 21x^2z^4 + 6y^6 - 21y^4z^2 - 21y^2z^4 + 6z^6)}{8}$
88	$\mathbb{G}_9(B_{1g}, 2)$	$\frac{3\sqrt{1430}xyz(x^6 - 7x^4z^2 + 7x^2z^4 + y^6 - 7y^4z^2 + 7y^2z^4 - 2z^6)}{8}$
89	$\mathbb{G}_9(B_{2g}, 1)$	$-\frac{\sqrt{4290}z(x-y)(x+y)(x^2 - 4xy + y^2)(x^2 + 4xy + y^2)(3x^2 + 3y^2 - 14z^2)}{64}$
90	$\mathbb{G}_9(B_{2g}, 2)$	$-\frac{3\sqrt{110}z(x-y)(x+y)(7x^6 + 21x^4y^2 - 70x^4z^2 + 21x^2y^4 - 140x^2y^2z^2 + 112x^2z^4 + 7y^6 - 70y^4z^2 + 112y^2z^4 - 32z^6)}{64}$
91	$\mathbb{G}_{9,1}(E_g, 1)$	$\frac{x(128x^8 - 2304x^6y^2 - 2304x^6z^2 + 6048x^4y^4 + 12096x^4y^2z^2 + 6048x^4z^4 - 3360x^2y^6 - 10080x^2y^4z^2 - 10080x^2y^2z^4 - 3360x^2z^6 + 315y^8 + 1260y^6z^2 + 1890y^4z^4 + 1260y^2z^6 + 315z^8)}{128}$
92	$\mathbb{G}_{9,2}(E_g, 1)$	$-\frac{y(315x^8 - 3360x^6y^2 + 1260x^6z^2 + 6048x^4y^4 - 10080x^4y^2z^2 + 1890x^4z^4 - 2304x^2y^6 + 12096x^2y^4z^2 - 10080x^2y^2z^4 + 1260x^2z^6 + 128y^8 - 2304y^6z^2 + 6048y^4z^4 - 3360y^2z^6 + 315z^8)}{128}$
93	$\mathbb{G}_{9,1}(E_g, 2)$	$\frac{3\sqrt{12155}x(y^4 - 4y^3z - 6y^2z^2 + 4yz^3 + z^4)(y^4 + 4y^3z - 6y^2z^2 - 4yz^3 + z^4)}{128}$
94	$\mathbb{G}_{9,2}(E_g, 2)$	$-\frac{3\sqrt{12155}y(x^4 - 4x^3z - 6x^2z^2 + 4xz^3 + z^4)(x^4 + 4x^3z - 6x^2z^2 - 4xz^3 + z^4)}{128}$
95	$\mathbb{G}_{9,1}(E_g, 3)$	$\frac{3\sqrt{5005}x(y^2 - 2yz - z^2)(y^2 + 2yz - z^2)(8x^4 - 8x^2y^2 - 8x^2z^2 + y^4 + 2y^2z^2 + z^4)}{64}$
96	$\mathbb{G}_{9,2}(E_g, 3)$	$-\frac{3\sqrt{5005}y(x^2 - 2xz - z^2)(x^2 + 2xz - z^2)(x^4 - 8x^2y^2 + 2x^2z^2 + 8y^4 - 8y^2z^2 + z^4)}{64}$
97	$\mathbb{G}_{9,1}(E_g, 4)$	$\frac{\sqrt{4290}x(y-z)(y+z)(14x^2 - 3y^2 - 3z^2)(y^2 - 4yz + z^2)(y^2 + 4yz + z^2)}{64}$
98	$\mathbb{G}_{9,2}(E_g, 4)$	$\frac{\sqrt{4290}y(x-z)(x+z)(x^2 - 4xz + z^2)(x^2 + 4xz + z^2)(3x^2 - 14y^2 + 3z^2)}{64}$
99	$\mathbb{G}_{9,1}(E_g, 5)$	$\frac{3\sqrt{110}x(y-z)(y+z)(32x^6 - 112x^4y^2 - 112x^4z^2 + 70x^2y^4 + 140x^2y^2z^2 + 70x^2z^4 - 7y^6 - 21y^4z^2 - 21y^2z^4 - 7z^6)}{64}$
100	$\mathbb{G}_{9,2}(E_g, 5)$	$\frac{3\sqrt{110}y(x-z)(x+z)(7x^6 - 70x^4y^2 + 21x^4z^2 + 112x^2y^4 - 140x^2y^2z^2 + 21x^2z^4 - 32y^6 + 112y^4z^2 - 70y^2z^4 + 7z^6)}{64}$

Table 11 Harmonics for rank 10.

No.	multipole	expression
101	$\mathbb{G}_{10}(A_{1u}, 1)$	$\frac{\sqrt{390}(2x^{10}-45x^8y^2-45x^8z^2+42x^6y^4+1008x^6y^2z^2+42x^6z^4+42x^4y^6-1260x^4y^4z^2-1260x^4y^2z^4+42x^4z^6-45x^2y^8+1008x^2y^6z^2-1260x^2y^4z^4+1008x^2y^2z^6-45x^2z^8+2y^{10}-45y^8z^2+42y^6z^4+42y^4z^6-45y^2z^8+2z^{10})}{96}$
102	$\mathbb{G}_{10}(A_{1u}, 2)$	$-\frac{\sqrt{420189}(22x^{10}+45x^8y^2-1035x^8z^2-105x^6y^4-630x^6y^2z^2+4935x^6z^4-105x^4y^6+3150x^4y^4z^2-1575x^4y^2z^4-4830x^4z^6+45x^2y^8-630x^2y^6z^2-1575x^2y^4z^4+1260x^2y^2z^6+990x^2z^8+22y^{10}-1035y^8z^2+4935y^6z^4-4830y^4z^6+990y^2z^8-44z^{10})}{35952}$
103	$\mathbb{G}_{10}(A_{1u}, 3)$	$-\frac{\sqrt{3213210}(3x^{10}-96x^8y^2-39x^8z^2+224x^6y^4+1344x^6y^2z^2-42x^6z^4+224x^4y^6-6720x^4y^4z^2+3360x^4y^2z^4-182x^4z^6-96x^2y^8+1344x^2y^6z^2+3360x^2y^4z^4-2688x^2y^2z^6+135x^2z^8+3y^{10}-39y^8z^2-42y^6z^4-182y^4z^6+135y^2z^8-6z^{10})}{23968}$
104	$\mathbb{G}_{10}(A_{2u}, 1)$	$-\frac{\sqrt{12155}xy(x-y)(x+y)(x^2+y^2-18z^2)(x^2-2xy-y^2)(x^2+2xy-y^2)}{32}$
105	$\mathbb{G}_{10}(A_{2u}, 2)$	$-\frac{\sqrt{2145}xy(x-y)(x+y)(x^6+3x^4y^2-42x^4z^2+3x^2y^4-84x^2y^2z^2+168x^2z^4+y^6-42y^4z^2+168y^2z^4-112z^6)}{32}$
106	$\mathbb{G}_{10}(B_{1u}, 1)$	$-\frac{\sqrt{27170}(x-y)(x+y)(x+z)(y-z)(y+z)(3x^4-11x^2y^2-11x^2z^2+3y^4-11y^2z^2+3z^4)}{32}$
107	$\mathbb{G}_{10}(B_{1u}, 2)$	$\frac{\sqrt{140063}(x-y)(x+y)(22x^8-653x^6y^2-315x^6z^2+2602x^4y^4-945x^4y^2z^2+1575x^4z^4-653x^2y^6-945x^2y^4z^2+3150x^2y^2z^4-1680x^2z^6+22y^8-315y^6z^2+1575y^4z^4-1680y^2z^6+360z^8)}{11984}$
108	$\mathbb{G}_{10}(B_{1u}, 3)$	$-\frac{\sqrt{1071070}(x-y)(x+y)(9x^8-165x^6y^2-231x^6z^2-25x^4y^4+3801x^4y^2z^2+406x^4z^4-165x^2y^6+3801x^2y^4z^2-9674x^2y^2z^4+266x^2z^6+9y^8-231y^6z^2+406y^4z^4+266y^2z^6-57z^8)}{23968}$
109	$\mathbb{G}_{10}(B_{2u}, 1)$	$-\frac{\sqrt{92378}xy(x^4-10x^2y^2+5y^4)(5x^4-10x^2y^2+y^4)}{256}$
110	$\mathbb{G}_{10}(B_{2u}, 2)$	$-\frac{\sqrt{4290}xy(x^2-3y^2)(3x^2+6x^2y^2-96x^2z^2+3y^4-96y^2z^2+224z^4)}{256}$
111	$\mathbb{G}_{10}(B_{2u}, 3)$	$-\frac{\sqrt{165}xy(7x^8+28x^6y^2-336x^6z^2+42x^4y^4-1008x^4y^2z^2+1680x^4z^4+28x^2y^6-1008x^2y^4z^2+3360x^2y^2z^4-1792x^2z^6+7y^8-336y^6z^2+1680y^4z^4-1792y^2z^6+384z^8)}{128}$
112	$\mathbb{G}_{10,1}(E_u, 1)$	$-\frac{\sqrt{12155}yz(y-z)(y+z)(18x^2-y^2-z^2)(y^2-2yz-z^2)(y^2+2yz-z^2)}{32}$
113	$\mathbb{G}_{10,2}(E_u, 1)$	$-\frac{\sqrt{12155}xz(x-z)(x+z)(x^2-18y^2+z^2)(x^2-2xz-z^2)(x^2+2xz-z^2)}{32}$
114	$\mathbb{G}_{10,1}(E_u, 2)$	$-\frac{\sqrt{2145}yz(y-z)(y+z)(112x^6-168x^4y^2-168x^4z^2+42x^2y^4+84x^2y^2z^2+42x^2z^4-y^6-3y^4z^2-3y^2z^4-z^6)}{32}$
115	$\mathbb{G}_{10,2}(E_u, 2)$	$-\frac{\sqrt{2145}xz(x-z)(x+z)(x^6-42x^4y^2+3x^4z^2+168x^2y^4-84x^2y^2z^2+3x^2z^4-112y^6+168y^4z^2-42y^2z^4+z^6)}{32}$
116	$\mathbb{G}_{10,1}(E_u, 3)$	$-\frac{\sqrt{92378}yz(y^4-10y^2z^2+5z^4)(5y^4-10y^2z^2+z^4)}{256}$
117	$\mathbb{G}_{10,2}(E_u, 3)$	$-\frac{\sqrt{92378}xz(x^4-10x^2z^2+5z^4)(5x^4-10x^2z^2+z^4)}{256}$
118	$\mathbb{G}_{10,1}(E_u, 4)$	$-\frac{\sqrt{4290}yz(y^2-3z^2)(3y^2-z^2)(224x^4-96x^2y^2-96x^2z^2+3y^4+6y^2z^2+3z^4)}{256}$
119	$\mathbb{G}_{10,2}(E_u, 4)$	$-\frac{\sqrt{4290}xz(x^2-3z^2)(3x^2-z^2)(3x^4-96x^2y^2+6x^2z^2+224y^4-96y^2z^2+3z^4)}{256}$
120	$\mathbb{G}_{10,1}(E_u, 5)$	$-\frac{\sqrt{165}yz(384x^8-1792x^6y^2-1792x^6z^2+1680x^4y^4+3360x^4y^2z^2+1680x^4z^4-336x^2y^6-1008x^2y^4z^2-1008x^2z^6+7y^8+28y^6z^2+42y^4z^4+28y^2z^6+7z^8)}{128}$
121	$\mathbb{G}_{10,2}(E_u, 5)$	$-\frac{\sqrt{165}xz(7x^8-336x^6y^2+28x^6z^2+1680x^4y^4-1008x^4y^2z^2+42x^4z^4-1792x^2y^6+3360x^2y^4z^2-1008x^2y^2z^4+28x^2z^6+384y^8-1792y^6z^2+1680y^4z^4-336y^2z^6+7z^8)}{128}$

Table 12 Harmonics for rank 11.

No.	multipole	expression
122	$\mathbb{G}_{11}(A_{1g}, 1)$	$-\frac{\sqrt{692835xyz(x-y)(x+y)(x^2+y^2-6z^2)(x^2-2xy-y^2)(x^2+2xy-y^2)}}{32}$
123	$\mathbb{G}_{11}(A_{1g}, 2)$	$-\frac{3\sqrt{1001xyz(x-y)(x+y)(5x^6+15x^4y^2-70x^4z^2+15x^2y^4-140x^2y^2z^2+168x^2z^4+5y^6-70y^4z^2+168y^2z^4-80z^6)}}{32}$
124	$\mathbb{G}_{11}(A_{2g}, 1)$	$-\frac{z(693x^{10}+3465x^8y^2-11550x^8z^2+6930x^6y^4-46200x^6y^2z^2+36960x^6z^4+6930x^4y^6-69300x^4y^4z^2+110880x^4y^2z^4-31680x^4z^6+3465x^2y^8-46200x^2y^6z^2+110880x^2y^4z^4-63360x^2y^2z^6+7040x^2z^8+693y^{10}-11550y^8z^2+36960y^6z^4-31680y^4z^6+7040y^2z^8-256z^{10})}{256}$
125	$\mathbb{G}_{11}(A_{2g}, 2)$	$-\frac{\sqrt{692835z(x^2+y^2-6z^2)(x^4-4x^3y-6x^2y^2+4xy^3+y^4)(x^4+4x^3y-6x^2y^2-4xy^3+y^4)}}{256}$
126	$\mathbb{G}_{11}(A_{2g}, 3)$	$-\frac{3\sqrt{1001z(x^2-2xy-y^2)(x^2+2xy-y^2)(5x^6+15x^4y^2-70x^4z^2+15x^2y^4-140x^2y^2z^2+168x^2z^4+5y^6-70y^4z^2+168y^2z^4-80z^6)}}{128}$
127	$\mathbb{G}_{11}(B_{1g}, 1)$	$\frac{\sqrt{2431xyz(5x^8-30x^6y^2-30x^6z^2+63x^4y^4+63x^4z^4-30x^2y^6-30x^2z^6+5y^8-30y^6z^2+63y^4z^4-30y^2z^6+5z^8)}}{8}$
128	$\mathbb{G}_{11}(B_{1g}, 2)$	$-\frac{\sqrt{230945xyz(x^8-6x^6y^2-6x^6z^2+42x^4y^2z^2-6x^2y^6+42x^2y^4z^2-84x^2y^2z^4+12x^2z^6+y^8-6y^6z^2+12y^2z^6-2z^8)}}{32}$
129	$\mathbb{G}_{11}(B_{1g}, 3)$	$-\frac{\sqrt{3003xyz(5x^8-150x^6y^2+90x^6z^2+336x^4y^4-70x^4y^2z^2-168x^4z^4-150x^2y^6-70x^2y^4z^2+140x^2y^2z^4+60x^2z^6+5y^8+90y^6z^2-168y^4z^4+60y^2z^6-10z^8)}}{32}$
130	$\mathbb{G}_{11}(B_{2g}, 1)$	$\frac{\sqrt{1939938z(x-y)(x^4-4x^3y-14x^2y^2-4xy^3+y^4)(x^4+4x^3y-14x^2y^2+4xy^3+y^4)}}{512}$
131	$\mathbb{G}_{11}(B_{2g}, 2)$	$-\frac{\sqrt{14586z(x-y)(x^2-4xy+y^2)(x^2+4xy+y^2)(15x^4+30x^2y^2-160x^2z^2+15y^4-160y^2z^2+224z^4)}}{512}$
132	$\mathbb{G}_{11}(B_{2g}, 3)$	$-\frac{\sqrt{2145z(x-y)(21x^8+84x^6y^2-336x^6z^2+126x^4y^4-1008x^4y^2z^2+1008x^4y^6+84x^2y^6-1008x^2y^4z^2+2016x^2y^2z^4-768x^2z^6+21y^8-336y^6z^2+1008y^4z^4-768y^2z^6+128z^8)}}{256}$
133	$\mathbb{G}_{11,1}(E_g, 1)$	$x(256x^{10}-7040x^8y^2-7040x^8z^2+31680x^6y^4+63360x^6y^2z^2+31680x^6z^4-36960x^4y^6-110880x^4y^4z^2-110880x^4y^2z^4-36960x^4z^6+11550x^2y^8+46200x^2y^6z^2+69300x^2y^4z^4+46200x^2y^2z^6+11550x^2z^8-693y^{10}-3465y^8z^2-6930y^6z^4-6930y^4z^6-3465y^2z^8-693z^{10})$
134	$\mathbb{G}_{11,2}(E_g, 1)$	$y(693x^{10}-11550x^8y^2+3465x^8z^2+36960x^6y^4-46200x^6y^2z^2+6930x^6z^4-31680x^4y^6+110880x^4y^4z^2-69300x^4y^2z^4+6930x^4z^6+7040x^2y^8-63360x^2y^6z^2+110880x^2y^4z^4-46200x^2y^2z^6+3465x^2z^8-256y^{10}+7040y^8z^2-31680y^6z^4+36960y^4z^6-11550y^2z^8+693z^{10})$
135	$\mathbb{G}_{11,1}(E_g, 2)$	$\frac{\sqrt{692835x(6x^2-y^2-z^2)(y^4-4y^3z-6y^2z^2+4yz^3+z^4)(y^4+4y^3z-6y^2z^2-4yz^3+z^4)}}{256}$
136	$\mathbb{G}_{11,2}(E_g, 2)$	$-\frac{\sqrt{692835y(x^2-6y^2+z^2)(x^4-4x^3z-6x^2z^2+4xz^3+z^4)(x^4+4x^3z-6x^2z^2-4xz^3+z^4)}}{256}$
137	$\mathbb{G}_{11,1}(E_g, 3)$	$3\sqrt{1001x(y^2-2yz-z^2)(y^2+2yz-z^2)(80x^6-168x^4y^2-168x^4z^2+70x^2y^4+140x^2y^2z^2+70x^2z^4-5y^6-15y^4z^2-15y^2z^4-5z^6)}$
138	$\mathbb{G}_{11,2}(E_g, 3)$	$3\sqrt{1001y(x^2-2xz-z^2)(x^2+2xz-z^2)(5x^6-70x^4y^2+15x^4z^2+168x^2y^4-140x^2y^2z^2+15x^2z^4-80y^6+168y^4z^2-70y^2z^4+5z^6)}$
139	$\mathbb{G}_{11,1}(E_g, 4)$	$-\frac{\sqrt{1939938x(y-z)(y+z)(y^4-4y^3z-14y^2z^2-4yz^3+z^4)(y^4+4y^3z-14y^2z^2+4yz^3+z^4)}}{512}$
140	$\mathbb{G}_{11,2}(E_g, 4)$	$-\frac{\sqrt{1939938y(x-z)(x+z)(x^4-4x^3z-14x^2z^2-4xz^3+z^4)(x^4+4x^3z-14x^2z^2+4xz^3+z^4)}}{512}$
141	$\mathbb{G}_{11,1}(E_g, 5)$	$\frac{\sqrt{14586x(y-z)(y+z)(y^2-4yz+z^2)(y^2+4yz+z^2)(224x^4-160x^2y^2-160x^2z^2+15y^4+30y^2z^2+15z^4)}}{512}$
142	$\mathbb{G}_{11,2}(E_g, 5)$	$-\frac{\sqrt{14586y(x-z)(x+z)(x^2-4xz+z^2)(x^2+4xz+z^2)(15x^4-160x^2y^2+30x^2z^2+224y^4-160y^2z^2+15z^4)}}{512}$
143	$\mathbb{G}_{11,1}(E_g, 6)$	$-\frac{\sqrt{2145x(y-z)(y+z)(128x^8-768x^6y^2-768x^6z^2+1008x^4y^4+2016x^4y^2z^2+1008x^4z^4-336x^2y^6-1008x^2y^4z^2-1008x^2y^2z^4-336x^2z^6+21y^8+84y^6z^2+126y^4z^4+84y^2z^6+21z^8)}}{256}$
144	$\mathbb{G}_{11,2}(E_g, 6)$	$-\frac{\sqrt{2145y(x-z)(x+z)(21x^8-336x^6y^2+84x^6z^2+1008x^4y^4-1008x^4y^2z^2+126x^4z^4-768x^2y^6+2016x^2y^4z^2-1008x^2y^2z^4+84x^2z^6+128y^8-768y^6z^2+1008y^4z^4-336y^2z^6+21z^8)}}{256}$