PG No. 23 $C_{6\mathrm{h}}$ $6/m$ [hexagonal] (lg basis)

bra: $= \langle s |$
ket: $= | s \rangle$

Table 1: (s,s) block.

No.	multipole	matrix
1	symmetry	1
	$\mathbb{Q}_0^{(a)}(A_g)$	$\begin{bmatrix} 1 \end{bmatrix}$

bra: $= \langle s |$
ket: $= | p_x \rangle , | p_y \rangle , | p_z \rangle$

Table 2: (s,p) block.

No.	multipole	matrix
2	symmetry	z
	$\mathbb{Q}_1^{(a)}(A_u)$	$\begin{bmatrix} 0 & 0 & \frac{\sqrt{2}}{2} \end{bmatrix}$
3	symmetry	x
	$\mathbb{Q}_{1,0}^{(a)}(E_{1u})$	$\begin{bmatrix} \frac{\sqrt{2}}{2} & 0 & 0 \end{bmatrix}$
4	symmetry	y
	$\mathbb{Q}_{1,1}^{(a)}(E_{1u})$	$\begin{bmatrix} 0 & \frac{\sqrt{2}}{2} & 0 \end{bmatrix}$
5	symmetry	z
	$\mathbb{T}_1^{(a)}(A_u)$	$\begin{bmatrix} 0 & 0 & \frac{\sqrt{2}i}{2} \end{bmatrix}$
6	symmetry	x
	$\mathbb{T}_{1,0}^{(a)}(E_{1u})$	$\begin{bmatrix} \frac{\sqrt{2}i}{2} & 0 & 0 \end{bmatrix}$
7	symmetry	y
	$\mathbb{T}_{1,1}^{(a)}(E_{1u})$	$\begin{bmatrix} 0 & \frac{\sqrt{2}i}{2} & 0 \end{bmatrix}$

bra: $= \langle s |$
ket: $= | d_u \rangle , | d_{xz} \rangle , | d_{yz} \rangle , | d_{xy} \rangle , | d_v \rangle$

Table 3: (s,d) block.

No.	multipole	matrix
8	symmetry	$-\frac{x^2}{2} - \frac{y^2}{2} + z^2$
	$\mathbb{Q}_2^{(a)}(A_g)$	$\left[\begin{array}{ccccc} \frac{\sqrt{2}}{2} & 0 & 0 & 0 & 0 \end{array}\right]$
9	symmetry	$\sqrt{3}yz$
	$\mathbb{Q}_{2,0}^{(a)}(E_{1g})$	$\left[\begin{array}{ccccc} 0 & 0 & \frac{\sqrt{2}}{2} & 0 & 0 \end{array}\right]$
10	symmetry	$-\sqrt{3}xz$
	$\mathbb{Q}_{2,1}^{(a)}(E_{1g})$	$\left[\begin{array}{ccccc} 0 & 0 & 0 & -\frac{\sqrt{2}}{2} & 0 \end{array}\right]$
11	symmetry	$\frac{\sqrt{3}(x-y)(x+y)}{2}$
	$\mathbb{Q}_{2,0}^{(a)}(E_{2g})$	$\left[\begin{array}{ccccc} 0 & \frac{\sqrt{2}}{2} & 0 & 0 & 0 \end{array}\right]$
12	symmetry	$-\sqrt{3}xy$
	$\mathbb{Q}_{2,1}^{(a)}(E_{2g})$	$\left[\begin{array}{ccccc} 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{2} \end{array}\right]$
13	symmetry	$-\frac{x^2}{2} - \frac{y^2}{2} + z^2$
	$\mathbb{T}_2^{(a)}(A_g)$	$\left[\begin{array}{ccccc} \frac{\sqrt{2}i}{2} & 0 & 0 & 0 & 0 \end{array}\right]$
14	symmetry	$\sqrt{3}yz$
	$\mathbb{T}_{2,0}^{(a)}(E_{1g})$	$\left[\begin{array}{ccccc} 0 & 0 & \frac{\sqrt{2}i}{2} & 0 & 0 \end{array}\right]$
15	symmetry	$-\sqrt{3}xz$
	$\mathbb{T}_{2,1}^{(a)}(E_{1g})$	$\left[\begin{array}{ccccc} 0 & 0 & 0 & -\frac{\sqrt{2}i}{2} & 0 \end{array}\right]$
16	symmetry	$\frac{\sqrt{3}(x-y)(x+y)}{2}$
	$\mathbb{T}_{2,0}^{(a)}(E_{2g})$	$\left[\begin{array}{ccccc} 0 & \frac{\sqrt{2}i}{2} & 0 & 0 & 0 \end{array}\right]$
17	symmetry	$-\sqrt{3}xy$
	$\mathbb{T}_{2,1}^{(a)}(E_{2g})$	$\left[\begin{array}{ccccc} 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{2} \end{array}\right]$

bra: $= \langle s|$

ket: $= |f_{az}\rangle, |f_1\rangle, |f_2\rangle, |f_{3x}\rangle, |f_{3y}\rangle, |f_3\rangle, |f_{bz}\rangle$

Table 4: (s,f) block.

No.	multipole	matrix
18	symmetry	$-\frac{z(3x^2+3y^2-2z^2)}{2}$
	$\mathbb{Q}_3^{(a)}(A_u)$	$\begin{bmatrix} 0 & 0 & 0 & \frac{\sqrt{2}}{2} & 0 & 0 & 0 \end{bmatrix}$
19	symmetry	$\frac{\sqrt{10}y(3x^2-y^2)}{4}$
	$\mathbb{Q}_3^{(a)}(B_u,1)$	$\begin{bmatrix} 0 & 0 & -\frac{\sqrt{5}}{4} & 0 & 0 & -\frac{\sqrt{3}}{4} & 0 \end{bmatrix}$
20	symmetry	$\frac{\sqrt{10}x(x^2-3y^2)}{4}$
	$\mathbb{Q}_3^{(a)}(B_u,2)$	$\begin{bmatrix} 0 & \frac{\sqrt{5}}{4} & 0 & 0 & -\frac{\sqrt{3}}{4} & 0 & 0 \end{bmatrix}$
21	symmetry	$-\frac{\sqrt{6}x(x^2+y^2-4z^2)}{4}$
	$\mathbb{Q}_{3,0}^{(a)}(E_{1u})$	$\begin{bmatrix} 0 & -\frac{\sqrt{3}}{4} & 0 & 0 & -\frac{\sqrt{5}}{4} & 0 & 0 \end{bmatrix}$
22	symmetry	$-\frac{\sqrt{6}y(x^2+y^2-4z^2)}{4}$
	$\mathbb{Q}_{3,1}^{(a)}(E_{1u})$	$\begin{bmatrix} 0 & 0 & -\frac{\sqrt{3}}{4} & 0 & 0 & \frac{\sqrt{5}}{4} & 0 \end{bmatrix}$
23	symmetry	$\sqrt{15}xyz$
	$\mathbb{Q}_{3,0}^{(a)}(E_{2u})$	$\begin{bmatrix} \frac{\sqrt{2}}{2} & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
24	symmetry	$\frac{\sqrt{15}z(x-y)(x+y)}{2}$
	$\mathbb{Q}_{3,1}^{(a)}(E_{2u})$	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{2} \end{bmatrix}$
25	symmetry	$-\frac{z(3x^2+3y^2-2z^2)}{2}$
	$\mathbb{T}_3^{(a)}(A_u)$	$\begin{bmatrix} 0 & 0 & 0 & \frac{\sqrt{2}i}{2} & 0 & 0 & 0 \end{bmatrix}$
26	symmetry	$\frac{\sqrt{10}y(3x^2-y^2)}{4}$
	$\mathbb{T}_3^{(a)}(B_u,1)$	$\begin{bmatrix} 0 & 0 & -\frac{\sqrt{5}i}{4} & 0 & 0 & -\frac{\sqrt{3}i}{4} & 0 \end{bmatrix}$
27	symmetry	$\frac{\sqrt{10}x(x^2-3y^2)}{4}$
	$\mathbb{T}_3^{(a)}(B_u,2)$	$\begin{bmatrix} 0 & \frac{\sqrt{5}i}{4} & 0 & 0 & -\frac{\sqrt{3}i}{4} & 0 & 0 \end{bmatrix}$
28	symmetry	$-\frac{\sqrt{6}x(x^2+y^2-4z^2)}{4}$
	$\mathbb{T}_{3,0}^{(a)}(E_{1u})$	$\begin{bmatrix} 0 & -\frac{\sqrt{3}i}{4} & 0 & 0 & -\frac{\sqrt{5}i}{4} & 0 & 0 \end{bmatrix}$
29	symmetry	$-\frac{\sqrt{6}y(x^2+y^2-4z^2)}{4}$
	$\mathbb{T}_{3,1}^{(a)}(E_{1u})$	$\begin{bmatrix} 0 & 0 & -\frac{\sqrt{3}i}{4} & 0 & 0 & \frac{\sqrt{5}i}{4} & 0 \end{bmatrix}$
30	symmetry	$\sqrt{15}xyz$
	$\mathbb{T}_{3,0}^{(a)}(E_{2u})$	$\begin{bmatrix} \frac{\sqrt{2}i}{2} & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
31	symmetry	$\frac{\sqrt{15}z(x-y)(x+y)}{2}$

Table 4

No.	multipole	matrix						
	$\mathbb{T}_{3,1}^{(a)}(E_{2u})$	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{2} \end{bmatrix}$						

bra: $= \langle p_x |, \langle p_y |, \langle p_z |$

ket: $= |p_x\rangle, |p_y\rangle, |p_z\rangle$

Table 5: (p,p) block.

No.	multipole	matrix
32	symmetry	1
	$\mathbb{Q}_0^{(a)}(A_g)$	$\begin{bmatrix} \frac{\sqrt{3}}{3} & 0 & 0 \\ 0 & \frac{\sqrt{3}}{3} & 0 \\ 0 & 0 & \frac{\sqrt{3}}{3} \end{bmatrix}$
33	symmetry	$-\frac{x^2}{2} - \frac{y^2}{2} + z^2$
	$\mathbb{Q}_2^{(a)}(A_g)$	$\begin{bmatrix} -\frac{\sqrt{6}}{6} & 0 & 0 \\ 0 & -\frac{\sqrt{6}}{6} & 0 \\ 0 & 0 & \frac{\sqrt{6}}{3} \end{bmatrix}$
34	symmetry	$\sqrt{3}yz$
	$\mathbb{Q}_{2,0}^{(a)}(E_{1g})$	$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{2}}{2} \\ 0 & \frac{\sqrt{2}}{2} & 0 \end{bmatrix}$
35	symmetry	$-\sqrt{3}xz$
	$\mathbb{Q}_{2,1}^{(a)}(E_{1g})$	$\begin{bmatrix} 0 & 0 & -\frac{\sqrt{2}}{2} \\ 0 & 0 & 0 \\ -\frac{\sqrt{2}}{2} & 0 & 0 \end{bmatrix}$
36	symmetry	$\frac{\sqrt{3}(x-y)(x+y)}{2}$
	$\mathbb{Q}_{2,0}^{(a)}(E_{2g})$	$\begin{bmatrix} \frac{\sqrt{2}}{2} & 0 & 0 \\ 0 & -\frac{\sqrt{2}}{2} & 0 \\ 0 & 0 & 0 \end{bmatrix}$

continued ...

Table 5

No.	multipole	matrix
37	symmetry	$-\sqrt{3}xy$
	$\mathbb{Q}_{2,1}^{(a)}(E_{2g})$	$\begin{bmatrix} 0 & -\frac{\sqrt{2}}{2} & 0 \\ -\frac{\sqrt{2}}{2} & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$
38	symmetry	z
	$\mathbb{M}_{1}^{(a)}(A_{g})$	$\begin{bmatrix} 0 & -\frac{\sqrt{2}i}{2} & 0 \\ \frac{\sqrt{2}i}{2} & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$
39	symmetry	x
	$\mathbb{M}_{1,0}^{(a)}(E_{1g})$	$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{2}i}{2} \\ 0 & \frac{\sqrt{2}i}{2} & 0 \end{bmatrix}$
40	symmetry	y
	$\mathbb{M}_{1,1}^{(a)}(E_{1g})$	$\begin{bmatrix} 0 & 0 & \frac{\sqrt{2}i}{2} \\ 0 & 0 & 0 \\ -\frac{\sqrt{2}i}{2} & 0 & 0 \end{bmatrix}$

bra: $= \langle p_x|, \langle p_y|, \langle p_z|$
ket: $= |d_u\rangle, |d_{xz}\rangle, |d_{yz}\rangle, |d_{xy}\rangle, |d_v\rangle$

Table 6: (p,d) block.

No.	multipole	matrix
41	symmetry	z
	$\mathbb{Q}_{1}^{(a)}(A_{u})$	$\begin{bmatrix} 0 & 0 & 0 & \frac{\sqrt{15}}{10} & 0 \\ 0 & 0 & \frac{\sqrt{15}}{10} & 0 & 0 \\ \frac{\sqrt{5}}{5} & 0 & 0 & 0 & 0 \end{bmatrix}$
42	symmetry	x

continued ...

Table 6

No.	multipole	matrix
	$\mathbb{Q}_{1,0}^{(a)}(E_{1u})$	$\begin{bmatrix} -\frac{\sqrt{5}}{10} & \frac{\sqrt{15}}{10} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{10} \\ 0 & 0 & 0 & \frac{\sqrt{15}}{10} & 0 \end{bmatrix}$
43	symmetry	y
	$\mathbb{Q}_{1,1}^{(a)}(E_{1u})$	$\begin{bmatrix} 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{10} \\ -\frac{\sqrt{5}}{10} & -\frac{\sqrt{15}}{10} & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{15}}{10} & 0 & 0 \end{bmatrix}$
44	symmetry	$-\frac{z\left(3x^2+3y^2-2z^2\right)}{2}$
	$\mathbb{Q}_{3}^{(a)}(A_u)$	$\begin{bmatrix} 0 & 0 & 0 & -\frac{\sqrt{10}}{10} & 0 \\ 0 & 0 & -\frac{\sqrt{10}}{10} & 0 & 0 \\ \frac{\sqrt{30}}{10} & 0 & 0 & 0 & 0 \end{bmatrix}$
45	symmetry	$\frac{\sqrt{10}y\left(3x^2-y^2\right)}{4}$
	$\mathbb{Q}_{3}^{(a)}(B_u,1)$	$\begin{bmatrix} 0 & 0 & 0 & 0 & \frac{1}{2} \\ 0 & \frac{1}{2} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
46	symmetry	$\frac{\sqrt{10}x\left(x^2-3y^2\right)}{4}$
	$\mathbb{Q}_{3}^{(a)}(B_u,2)$	$\begin{bmatrix} 0 & \frac{1}{2} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{1}{2} \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
47	symmetry	$-\frac{\sqrt{6}x\left(x^2+y^2-4z^2\right)}{4}$
	$\mathbb{Q}_{3,0}^{(a)}(E_{1u})$	$\begin{bmatrix} \frac{\sqrt{5}}{5} & -\frac{\sqrt{15}}{30} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{30} \\ 0 & 0 & 0 & \frac{2\sqrt{15}}{15} & 0 \end{bmatrix}$
48	symmetry	$-\frac{\sqrt{6}y\left(x^2+y^2-4z^2\right)}{4}$
	$\mathbb{Q}_{3,1}^{(a)}(E_{1u})$	$\begin{bmatrix} 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{30} \\ \frac{\sqrt{5}}{5} & \frac{\sqrt{15}}{30} & 0 & 0 & 0 \\ 0 & 0 & \frac{2\sqrt{15}}{15} & 0 & 0 \end{bmatrix}$
49	symmetry	$\sqrt{15}xyz$

continued ...

Table 6

No.	multipole	matrix
	$\mathbb{Q}_{3,0}^{(a)}(E_{2u})$	$\begin{bmatrix} 0 & 0 & \frac{\sqrt{6}}{6} & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{6}}{6} & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{6} \end{bmatrix}$
50	symmetry	$\frac{\sqrt{15}z(x-y)(x+y)}{2}$
	$\mathbb{Q}_{3,1}^{(a)}(E_{2u})$	$\begin{bmatrix} 0 & 0 & 0 & \frac{\sqrt{6}}{6} & 0 \\ 0 & 0 & -\frac{\sqrt{6}}{6} & 0 & 0 \\ 0 & \frac{\sqrt{6}}{6} & 0 & 0 & 0 \end{bmatrix}$
51	symmetry	$-\frac{x^2}{2} - \frac{y^2}{2} + z^2$
	$\mathbb{G}_{2}^{(a)}(A_u)$	$\begin{bmatrix} 0 & 0 & \frac{1}{2} & 0 & 0 \\ 0 & 0 & 0 & -\frac{1}{2} & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
52	symmetry	$\sqrt{3}yz$
	$\mathbb{G}_{2,0}^{(a)}(E_{1u})$	$\begin{bmatrix} -\frac{1}{2} & -\frac{\sqrt{3}}{6} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{6} \\ 0 & 0 & 0 & \frac{\sqrt{3}}{6} & 0 \end{bmatrix}$
53	symmetry	$-\sqrt{3}xz$
	$\mathbb{G}_{2,1}^{(a)}(E_{1u})$	$\begin{bmatrix} 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{6} \\ -\frac{1}{2} & \frac{\sqrt{3}}{6} & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{3}}{6} & 0 & 0 \end{bmatrix}$
54	symmetry	$\frac{\sqrt{3}(x-y)(x+y)}{2}$
	$\mathbb{G}_{2,0}^{(a)}(E_{2u})$	$\begin{bmatrix} 0 & 0 & \frac{\sqrt{3}}{6} & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{3}}{6} & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{3} \end{bmatrix}$
55	symmetry	$-\sqrt{3}xy$
	$\mathbb{G}_{2,1}^{(a)}(E_{2u})$	$\begin{bmatrix} 0 & 0 & 0 & \frac{\sqrt{3}}{6} & 0 \\ 0 & 0 & -\frac{\sqrt{3}}{6} & 0 & 0 \\ 0 & -\frac{\sqrt{3}}{3} & 0 & 0 & 0 \end{bmatrix}$
56	symmetry	z

continued …

Table 6

No.	multipole	matrix
	$\mathbb{T}_1^{(a)}(A_u)$	$\begin{bmatrix} 0 & 0 & 0 & \frac{\sqrt{15}i}{10} & 0 \\ 0 & 0 & \frac{\sqrt{15}i}{10} & 0 & 0 \\ \frac{\sqrt{5}i}{5} & 0 & 0 & 0 & 0 \end{bmatrix}$
57	symmetry	x
	$\mathbb{T}_{1,0}^{(a)}(E_{1u})$	$\begin{bmatrix} -\frac{\sqrt{5}i}{10} & \frac{\sqrt{15}i}{10} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{10} \\ 0 & 0 & 0 & \frac{\sqrt{15}i}{10} & 0 \end{bmatrix}$
58	symmetry	y
	$\mathbb{T}_{1,1}^{(a)}(E_{1u})$	$\begin{bmatrix} 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{10} \\ -\frac{\sqrt{5}i}{10} & -\frac{\sqrt{15}i}{10} & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{15}i}{10} & 0 & 0 \end{bmatrix}$
59	symmetry	$-\frac{z\left(3x^2+3y^2-2z^2\right)}{2}$
	$\mathbb{T}_3^{(a)}(A_u)$	$\begin{bmatrix} 0 & 0 & 0 & -\frac{\sqrt{10}i}{10} & 0 \\ 0 & 0 & -\frac{\sqrt{10}i}{10} & 0 & 0 \\ \frac{\sqrt{30}i}{10} & 0 & 0 & 0 & 0 \end{bmatrix}$
60	symmetry	$\frac{\sqrt{10}y\left(3x^2-y^2\right)}{4}$
	$\mathbb{T}_3^{(a)}(B_u,1)$	$\begin{bmatrix} 0 & 0 & 0 & 0 & \frac{i}{2} \\ 0 & \frac{i}{2} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
61	symmetry	$\frac{\sqrt{10}x\left(x^2-3y^2\right)}{4}$
	$\mathbb{T}_3^{(a)}(B_u,2)$	$\begin{bmatrix} 0 & \frac{i}{2} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{i}{2} \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
62	symmetry	$-\frac{\sqrt{6}x\left(x^2+y^2-4z^2\right)}{4}$
	$\mathbb{T}_{3,0}^{(a)}(E_{1u})$	$\begin{bmatrix} \frac{\sqrt{5}i}{5} & -\frac{\sqrt{15}i}{30} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{30} \\ 0 & 0 & 0 & \frac{2\sqrt{15}i}{15} & 0 \end{bmatrix}$
63	symmetry	$-\frac{\sqrt{6}y\left(x^2+y^2-4z^2\right)}{4}$

Table 6

No.	multipole	matrix
	$\mathbb{T}^{(a)}_{3,1}(E_{1u})$	$\begin{bmatrix} 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{30} \\ \frac{\sqrt{5}i}{5} & \frac{\sqrt{15}i}{30} & 0 & 0 & 0 \\ 0 & 0 & \frac{2\sqrt{15}i}{15} & 0 & 0 \end{bmatrix}$
64	symmetry	$\sqrt{15}xyz$
	$\mathbb{T}^{(a)}_{3,0}(E_{2u})$	$\begin{bmatrix} 0 & 0 & \frac{\sqrt{6}i}{6} & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{6}i}{6} & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{6} \end{bmatrix}$
65	symmetry	$\frac{\sqrt{15}z(x-y)(x+y)}{2}$
	$\mathbb{T}^{(a)}_{3,1}(E_{2u})$	$\begin{bmatrix} 0 & 0 & 0 & \frac{\sqrt{6}i}{6} & 0 \\ 0 & 0 & -\frac{\sqrt{6}i}{6} & 0 & 0 \\ 0 & \frac{\sqrt{6}i}{6} & 0 & 0 & 0 \end{bmatrix}$
66	symmetry	$-\frac{x^2}{2} - \frac{y^2}{2} + z^2$
	$\mathbb{M}^{(a)}_2(A_u)$	$\begin{bmatrix} 0 & 0 & -\frac{i}{2} & 0 & 0 \\ 0 & 0 & 0 & \frac{i}{2} & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
67	symmetry	$\sqrt{3}yz$
	$\mathbb{M}^{(a)}_{2,0}(E_{1u})$	$\begin{bmatrix} \frac{i}{2} & \frac{\sqrt{3}i}{6} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{6} \\ 0 & 0 & 0 & -\frac{\sqrt{3}i}{6} & 0 \end{bmatrix}$
68	symmetry	$-\sqrt{3}xz$
	$\mathbb{M}^{(a)}_{2,1}(E_{1u})$	$\begin{bmatrix} 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{6} \\ \frac{i}{2} & -\frac{\sqrt{3}i}{6} & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{3}i}{6} & 0 & 0 \end{bmatrix}$
69	symmetry	$\frac{\sqrt{3}(x-y)(x+y)}{2}$
	$\mathbb{M}^{(a)}_{2,0}(E_{2u})$	$\begin{bmatrix} 0 & 0 & -\frac{\sqrt{3}i}{6} & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{3}i}{6} & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{3} \end{bmatrix}$
70	symmetry	$-\sqrt{3}xy$

Table 6

No.	multipole	matrix				
	$\mathbb{M}_{2,1}^{(a)}(E_{2u})$	$\begin{matrix} 0 & 0 & 0 & -\frac{\sqrt{3}i}{6} & 0 \\ 0 & 0 & \frac{\sqrt{3}i}{6} & 0 & 0 \\ 0 & \frac{\sqrt{3}i}{3} & 0 & 0 & 0 \end{matrix}$				

bra: $= \langle p_x|,\langle p_y|,\langle p_z|$
ket: $= |f_{az}\rangle,|f_1\rangle,|f_2\rangle,|f_{3x}\rangle,|f_{3y}\rangle,|f_3\rangle,|f_{bz}\rangle$

Table 7: (p,f) block.

No.	multipole	matrix
71	symmetry	$-\frac{x^2}{2}-\frac{y^2}{2}+z^2$
	$\mathbb{Q}_2^{(a)}(A_g)$	$\begin{bmatrix} 0 & -\frac{\sqrt{42}}{28} & 0 & 0 & -\frac{\sqrt{70}}{28} & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{42}}{28} & 0 & 0 & \frac{\sqrt{70}}{28} & 0 \\ 0 & 0 & 0 & \frac{\sqrt{42}}{14} & 0 & 0 & 0 \end{bmatrix}$
72	symmetry	$\sqrt{3}yz$
	$\mathbb{Q}_{2,0}^{(a)}(E_{1g})$	$\begin{bmatrix} \frac{\sqrt{210}}{42} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{14}}{14} & 0 & 0 & -\frac{\sqrt{210}}{42} \\ 0 & 0 & -\frac{\sqrt{14}}{14} & 0 & 0 & \frac{\sqrt{210}}{42} & 0 \end{bmatrix}$
73	symmetry	$-\sqrt{3}xz$
	$\mathbb{Q}_{2,1}^{(a)}(E_{1g})$	$\begin{bmatrix} 0 & 0 & 0 & \frac{\sqrt{14}}{14} & 0 & 0 & -\frac{\sqrt{210}}{42} \\ -\frac{\sqrt{210}}{42} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{14}}{14} & 0 & 0 & \frac{\sqrt{210}}{42} & 0 & 0 \end{bmatrix}$
74	symmetry	$\frac{\sqrt{3}(x-y)(x+y)}{2}$
	$\mathbb{Q}_{2,0}^{(a)}(E_{2g})$	$\begin{bmatrix} 0 & \frac{3\sqrt{14}}{28} & 0 & 0 & -\frac{\sqrt{210}}{84} & 0 & 0 \\ 0 & 0 & -\frac{3\sqrt{14}}{28} & 0 & 0 & -\frac{\sqrt{210}}{84} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}}{42} \end{bmatrix}$
75	symmetry	$-\sqrt{3}xy$

continued …

Table 7

No.	multipole	matrix

	$\mathbb{Q}_{2,1}^{(a)}(E_{2g})$	$\begin{pmatrix} 0 & 0 & \frac{\sqrt{14}}{14} & 0 & 0 & \frac{\sqrt{210}}{42} & 0 \\ 0 & \frac{\sqrt{14}}{14} & 0 & 0 & -\frac{\sqrt{210}}{42} & 0 & 0 \\ -\frac{\sqrt{210}}{42} & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$
76	symmetry	$\frac{3x^4}{8} + \frac{3x^2y^2}{4} - 3x^2z^2 + \frac{3y^4}{8} - 3y^2z^2 + z^4$
	$\mathbb{Q}_{4}^{(a)}(A_g)$	$\begin{bmatrix} 0 & \frac{3\sqrt{14}}{56} & 0 & 0 & \frac{\sqrt{210}}{56} & 0 & 0 \\ 0 & 0 & \frac{3\sqrt{14}}{56} & 0 & 0 & -\frac{\sqrt{210}}{56} & 0 \\ 0 & 0 & 0 & \frac{\sqrt{14}}{7} & 0 & 0 & 0 \end{bmatrix}$
77	symmetry	$\frac{\sqrt{70}xz(x^2-3y^2)}{4}$
	$\mathbb{Q}_{4}^{(a)}(B_g,1)$	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{4} \\ -\frac{\sqrt{3}}{4} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{5}}{8} & 0 & 0 & -\frac{\sqrt{3}}{8} & 0 & 0 \end{bmatrix}$
78	symmetry	$\frac{\sqrt{70}yz(3x^2-y^2)}{4}$
	$\mathbb{Q}_{4}^{(a)}(B_g,2)$	$\begin{bmatrix} \frac{\sqrt{3}}{4} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{4} \\ 0 & 0 & -\frac{\sqrt{5}}{8} & 0 & 0 & -\frac{\sqrt{3}}{8} & 0 \end{bmatrix}$
79	symmetry	$-\frac{\sqrt{10}yz(3x^2+3y^2-4z^2)}{4}$
	$\mathbb{Q}_{4,0}^{(a)}(E_{1g})$	$\begin{bmatrix} -\frac{\sqrt{21}}{28} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{35}}{14} & 0 & 0 & \frac{\sqrt{21}}{28} \\ 0 & 0 & -\frac{3\sqrt{35}}{56} & 0 & 0 & \frac{5\sqrt{21}}{56} & 0 \end{bmatrix}$
80	symmetry	$\frac{\sqrt{10}xz(3x^2+3y^2-4z^2)}{4}$
	$\mathbb{Q}_{4,1}^{(a)}(E_{1g})$	$\begin{bmatrix} 0 & 0 & 0 & -\frac{\sqrt{35}}{14} & 0 & 0 & \frac{\sqrt{21}}{28} \\ \frac{\sqrt{21}}{28} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{3\sqrt{35}}{56} & 0 & 0 & \frac{5\sqrt{21}}{56} & 0 & 0 \end{bmatrix}$
81	symmetry	$\frac{\sqrt{35}(x^2-2xy-y^2)(x^2+2xy-y^2)}{8}$
	$\mathbb{Q}_{4,0}^{(a)}(E_{2g},1)$	$\begin{bmatrix} 0 & \frac{\sqrt{10}}{8} & 0 & 0 & -\frac{\sqrt{6}}{8} & 0 & 0 \\ 0 & 0 & \frac{\sqrt{10}}{8} & 0 & 0 & \frac{\sqrt{6}}{8} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
82	symmetry	$\frac{\sqrt{35}xy(x-y)(x+y)}{2}$

continued …

Table 7

No.	multipole	matrix
	$\mathbb{Q}_{4,1}^{(a)}(E_{2g},1)$	$\begin{bmatrix} 0 & 0 & -\frac{\sqrt{10}}{8} & 0 & 0 & -\frac{\sqrt{6}}{8} & 0 \\ 0 & \frac{\sqrt{10}}{8} & 0 & 0 & -\frac{\sqrt{6}}{8} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
83	symmetry	$-\frac{\sqrt{5}(x-y)(x+y)\left(x^2+y^2-6z^2\right)}{4}$
	$\mathbb{Q}_{4,0}^{(a)}(E_{2g},2)$	$\begin{bmatrix} 0 & -\frac{\sqrt{70}}{28} & 0 & 0 & -\frac{\sqrt{42}}{28} & 0 & 0 \\ 0 & 0 & \frac{\sqrt{70}}{28} & 0 & 0 & -\frac{\sqrt{42}}{28} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{14} \end{bmatrix}$
84	symmetry	$\frac{\sqrt{5}xy\left(x^2+y^2-6z^2\right)}{2}$
	$\mathbb{Q}_{4,1}^{(a)}(E_{2g},2)$	$\begin{bmatrix} 0 & 0 & \frac{\sqrt{70}}{56} & 0 & 0 & -\frac{3\sqrt{42}}{56} & 0 \\ 0 & \frac{\sqrt{70}}{56} & 0 & 0 & \frac{3\sqrt{42}}{56} & 0 & 0 \\ -\frac{\sqrt{42}}{14} & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
85	symmetry	$-\frac{z\left(3x^2+3y^2-2z^2\right)}{2}$
	$\mathbb{G}_{3}^{(a)}(A_g)$	$\begin{bmatrix} 0 & 0 & -\frac{\sqrt{6}}{8} & 0 & 0 & \frac{\sqrt{10}}{8} & 0 \\ 0 & \frac{\sqrt{6}}{8} & 0 & 0 & \frac{\sqrt{10}}{8} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
86	symmetry	$\frac{\sqrt{10}y\left(3x^2-y^2\right)}{4}$
	$\mathbb{G}_{3}^{(a)}(B_g,1)$	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{4} \\ \frac{1}{4} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{15}}{8} & 0 & 0 & -\frac{3}{8} & 0 & 0 \end{bmatrix}$
87	symmetry	$\frac{\sqrt{10}x\left(x^2-3y^2\right)}{4}$
	$\mathbb{G}_{3}^{(a)}(B_g,2)$	$\begin{bmatrix} \frac{1}{4} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{4} \\ 0 & 0 & \frac{\sqrt{15}}{8} & 0 & 0 & \frac{3}{8} & 0 \end{bmatrix}$
88	symmetry	$-\frac{\sqrt{6}x\left(x^2+y^2-4z^2\right)}{4}$
	$\mathbb{G}_{3,0}^{(a)}(E_{1g})$	$\begin{bmatrix} \frac{\sqrt{15}}{12} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{1}{2} & 0 & 0 & -\frac{\sqrt{15}}{12} \\ 0 & 0 & \frac{1}{8} & 0 & 0 & -\frac{\sqrt{15}}{24} & 0 \end{bmatrix}$
89	symmetry	$-\frac{\sqrt{6}y\left(x^2+y^2-4z^2\right)}{4}$

Table 7

No.	multipole	matrix

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

$$\begin{bmatrix} 0 & 0 & 0 & -\frac{1}{2} & 0 & 0 & -\frac{\sqrt{15}}{12} \\ -\frac{\sqrt{15}}{12} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{1}{8} & 0 & 0 & -\frac{\sqrt{15}}{24} & 0 & 0 \end{bmatrix}$$

90   symmetry $\sqrt{15}xyz$

$\mathbb{G}_{3,0}^{(a)}(E_{2g})$

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

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

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

$$\begin{bmatrix} 0 & 0 & -\frac{\sqrt{10}}{8} & 0 & 0 & \frac{\sqrt{6}}{24} & 0 \\ 0 & -\frac{\sqrt{10}}{8} & 0 & 0 & -\frac{\sqrt{6}}{24} & 0 & 0 \\ -\frac{\sqrt{6}}{6} & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

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

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

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

93   symmetry $\sqrt{3}yz$

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

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

94   symmetry $-\sqrt{3}xz$

$\mathbb{T}_{2,1}^{(a)}(E_{1g})$

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

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

$\mathbb{T}_{2,0}^{(a)}(E_{2g})$

$$\begin{bmatrix} 0 & \frac{3\sqrt{14}i}{28} & 0 & 0 & -\frac{\sqrt{210}i}{84} & 0 & 0 \\ 0 & 0 & -\frac{3\sqrt{14}i}{28} & 0 & 0 & -\frac{\sqrt{210}i}{84} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{42} \end{bmatrix}$$

96   symmetry $-\sqrt{3}xy$

continued ...

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Table 7

No.	multipole	matrix
	$\mathbb{T}_{2,1}^{(a)}(E_{2g})$	$\begin{bmatrix} 0 & 0 & \frac{\sqrt{14}i}{14} & 0 & 0 & \frac{\sqrt{210}i}{42} & 0 \\ 0 & \frac{\sqrt{14}i}{14} & 0 & 0 & -\frac{\sqrt{210}i}{42} & 0 & 0 \\ -\frac{\sqrt{210}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
97	symmetry	$\frac{3x^4}{8} + \frac{3x^2y^2}{4} - 3x^2z^2 + \frac{3y^4}{8} - 3y^2z^2 + z^4$
	$\mathbb{T}_4^{(a)}(A_g)$	$\begin{bmatrix} 0 & \frac{3\sqrt{14}i}{56} & 0 & 0 & \frac{\sqrt{210}i}{56} & 0 & 0 \\ 0 & 0 & \frac{3\sqrt{14}i}{56} & 0 & 0 & -\frac{\sqrt{210}i}{56} & 0 \\ 0 & 0 & 0 & \frac{\sqrt{14}i}{7} & 0 & 0 & 0 \end{bmatrix}$
98	symmetry	$\frac{\sqrt{70}xz(x^2-3y^2)}{4}$
	$\mathbb{T}_4^{(a)}(B_g, 1)$	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{4} \\ -\frac{\sqrt{3}i}{4} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{5}i}{8} & 0 & 0 & -\frac{\sqrt{3}i}{8} & 0 & 0 \end{bmatrix}$
99	symmetry	$\frac{\sqrt{70}yz(3x^2-y^2)}{4}$
	$\mathbb{T}_4^{(a)}(B_g, 2)$	$\begin{bmatrix} \frac{\sqrt{3}i}{4} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}i}{4} \\ 0 & 0 & -\frac{\sqrt{5}i}{8} & 0 & 0 & -\frac{\sqrt{3}i}{8} & 0 \end{bmatrix}$
100	symmetry	$-\frac{\sqrt{10}yz(3x^2+3y^2-4z^2)}{4}$
	$\mathbb{T}_{4,0}^{(a)}(E_{1g})$	$\begin{bmatrix} -\frac{\sqrt{21}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{35}i}{14} & 0 & 0 & \frac{\sqrt{21}i}{28} \\ 0 & 0 & -\frac{3\sqrt{35}i}{56} & 0 & 0 & \frac{5\sqrt{21}i}{56} & 0 \end{bmatrix}$
101	symmetry	$\frac{\sqrt{10}xz(3x^2+3y^2-4z^2)}{4}$
	$\mathbb{T}_{4,1}^{(a)}(E_{1g})$	$\begin{bmatrix} 0 & 0 & 0 & -\frac{\sqrt{35}i}{14} & 0 & 0 & \frac{\sqrt{21}i}{28} \\ \frac{\sqrt{21}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{3\sqrt{35}i}{56} & 0 & 0 & \frac{5\sqrt{21}i}{56} & 0 & 0 \end{bmatrix}$
102	symmetry	$\frac{\sqrt{35}(x^2-2xy-y^2)(x^2+2xy-y^2)}{8}$
	$\mathbb{T}_{4,0}^{(a)}(E_{2g}, 1)$	$\begin{bmatrix} 0 & \frac{\sqrt{10}i}{8} & 0 & 0 & -\frac{\sqrt{6}i}{8} & 0 & 0 \\ 0 & 0 & \frac{\sqrt{10}i}{8} & 0 & 0 & \frac{\sqrt{6}i}{8} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
103	symmetry	$\frac{\sqrt{35}xy(x-y)(x+y)}{2}$

Table 7

No.	multipole	matrix

$$\mathbb{T}_{4,1}^{(a)}(E_{2g},1) \quad \begin{bmatrix} 0 & 0 & -\frac{\sqrt{10}i}{8} & 0 & 0 & -\frac{\sqrt{6}i}{8} & 0 \\ 0 & \frac{\sqrt{10}i}{8} & 0 & 0 & -\frac{\sqrt{6}i}{8} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

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

$$\mathbb{T}_{4,0}^{(a)}(E_{2g},2) \quad \begin{bmatrix} 0 & -\frac{\sqrt{70}i}{28} & 0 & 0 & -\frac{\sqrt{42}i}{28} & 0 & 0 \\ 0 & 0 & \frac{\sqrt{70}i}{28} & 0 & 0 & -\frac{\sqrt{42}i}{28} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{42}i}{14} \end{bmatrix}$$

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

$$\mathbb{T}_{4,1}^{(a)}(E_{2g},2) \quad \begin{bmatrix} 0 & 0 & \frac{\sqrt{70}i}{56} & 0 & 0 & -\frac{3\sqrt{42}i}{56} & 0 \\ 0 & \frac{\sqrt{70}i}{56} & 0 & 0 & \frac{3\sqrt{42}i}{56} & 0 & 0 \\ -\frac{\sqrt{42}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

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

$$\mathbb{M}_3^{(a)}(A_g) \quad \begin{bmatrix} 0 & 0 & \frac{\sqrt{6}i}{8} & 0 & 0 & -\frac{\sqrt{10}i}{8} & 0 \\ 0 & -\frac{\sqrt{6}i}{8} & 0 & 0 & -\frac{\sqrt{10}i}{8} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

107   symmetry $\qquad \frac{\sqrt{10}y\left(3x^2-y^2\right)}{4}$

$$\mathbb{M}_3^{(a)}(B_g,1) \quad \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & \frac{i}{4} \\ -\frac{i}{4} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{15}i}{8} & 0 & 0 & \frac{3i}{8} & 0 & 0 \end{bmatrix}$$

108   symmetry $\qquad \frac{\sqrt{10}x\left(x^2-3y^2\right)}{4}$

$$\mathbb{M}_3^{(a)}(B_g,2) \quad \begin{bmatrix} -\frac{i}{4} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{i}{4} \\ 0 & 0 & -\frac{\sqrt{15}i}{8} & 0 & 0 & -\frac{3i}{8} & 0 \end{bmatrix}$$

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

$$\mathbb{M}_{3,0}^{(a)}(E_{1g}) \quad \begin{bmatrix} -\frac{\sqrt{15}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{i}{2} & 0 & 0 & \frac{\sqrt{15}i}{12} \\ 0 & 0 & -\frac{i}{8} & 0 & 0 & \frac{\sqrt{15}i}{24} & 0 \end{bmatrix}$$

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

Table 7

No.	multipole	matrix
	$\mathbb{M}_{3,1}^{(a)}(E_{1g})$	$\begin{pmatrix} 0 & 0 & 0 & \frac{i}{2} & 0 & 0 & \frac{\sqrt{15}i}{12} \\ \frac{\sqrt{15}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{i}{8} & 0 & 0 & \frac{\sqrt{15}i}{24} & 0 & 0 \end{pmatrix}$
111	symmetry	$\sqrt{15}xyz$
	$\mathbb{M}_{3,0}^{(a)}(E_{2g})$	$\begin{bmatrix} 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{6} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{6} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{6} \end{bmatrix}$
112	symmetry	$\frac{\sqrt{15}z(x-y)(x+y)}{2}$
	$\mathbb{M}_{3,1}^{(a)}(E_{2g})$	$\begin{bmatrix} 0 & 0 & \frac{\sqrt{10}i}{8} & 0 & 0 & -\frac{\sqrt{6}i}{24} & 0 \\ 0 & \frac{\sqrt{10}i}{8} & 0 & 0 & \frac{\sqrt{6}i}{24} & 0 & 0 \\ \frac{\sqrt{6}i}{6} & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$

bra: $= \langle d_u|, \langle d_{xz}|, \langle d_{yz}|, \langle d_{xy}|, \langle d_v|$
ket: $= |d_u\rangle, |d_{xz}\rangle, |d_{yz}\rangle, |d_{xy}\rangle, |d_v\rangle$

Table 8: (d,d) block.

No.	multipole	matrix
113	symmetry	1
	$\mathbb{Q}_0^{(a)}(A_g)$	$\begin{bmatrix} \frac{\sqrt{5}}{5} & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{5}}{5} & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{5}}{5} & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{5}}{5} & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{5} \end{bmatrix}$
114	symmetry	$-\frac{x^2}{2} - \frac{y^2}{2} + z^2$

continued …

Table 8

No.	multipole	matrix
	$\mathbb{Q}_2^{(a)}(A_g)$	$\begin{bmatrix} \frac{\sqrt{14}}{7} & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{14}}{7} & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{14}}{14} & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{14}}{14} & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{14}}{7} \end{bmatrix}$
115	symmetry	$\sqrt{3}yz$
	$\mathbb{Q}_{2,0}^{(a)}(E_{1g})$	$\begin{bmatrix} 0 & 0 & \frac{\sqrt{14}}{14} & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{42}}{14} & 0 & 0 \\ \frac{\sqrt{14}}{14} & -\frac{\sqrt{42}}{14} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{42}}{14} \\ 0 & 0 & 0 & \frac{\sqrt{42}}{14} & 0 \end{bmatrix}$
116	symmetry	$-\sqrt{3}xz$
	$\mathbb{Q}_{2,1}^{(a)}(E_{1g})$	$\begin{bmatrix} 0 & 0 & 0 & -\frac{\sqrt{14}}{14} & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{42}}{14} & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{42}}{14} \\ -\frac{\sqrt{14}}{14} & -\frac{\sqrt{42}}{14} & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{42}}{14} & 0 & 0 \end{bmatrix}$
117	symmetry	$\frac{\sqrt{3}(x-y)(x+y)}{2}$
	$\mathbb{Q}_{2,0}^{(a)}(E_{2g})$	$\begin{bmatrix} 0 & -\frac{\sqrt{14}}{7} & 0 & 0 & 0 \\ -\frac{\sqrt{14}}{7} & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{42}}{14} & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{42}}{14} & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
118	symmetry	$-\sqrt{3}xy$

Table 8

No.	multipole	matrix
	$\mathbb{Q}_{2,1}^{(a)}(E_{2g})$	$\begin{bmatrix} 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{7} \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{42}}{14} & 0 \\ 0 & 0 & -\frac{\sqrt{42}}{14} & 0 & 0 \\ \frac{\sqrt{14}}{7} & 0 & 0 & 0 & 0 \end{bmatrix}$
119	symmetry	$\frac{3x^4}{8} + \frac{3x^2 y^2}{4} - 3x^2 z^2 + \frac{3y^4}{8} - 3y^2 z^2 + z^4$
	$\mathbb{Q}_4^{(a)}(A_g)$	$\begin{bmatrix} \frac{3\sqrt{70}}{35} & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{70}}{70} & 0 & 0 & 0 \\ 0 & 0 & -\frac{2\sqrt{70}}{35} & 0 & 0 \\ 0 & 0 & 0 & -\frac{2\sqrt{70}}{35} & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{70}}{70} \end{bmatrix}$
120	symmetry	$\frac{\sqrt{70}xz(x^2 - 3y^2)}{4}$
	$\mathbb{Q}_4^{(a)}(B_g, 1)$	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{1}{2} & 0 \\ 0 & 0 & 0 & 0 & -\frac{1}{2} \\ 0 & \frac{1}{2} & 0 & 0 & 0 \\ 0 & 0 & -\frac{1}{2} & 0 & 0 \end{bmatrix}$
121	symmetry	$\frac{\sqrt{70}yz(3x^2 - y^2)}{4}$
	$\mathbb{Q}_4^{(a)}(B_g, 2)$	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{1}{2} & 0 & 0 \\ 0 & \frac{1}{2} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{1}{2} \\ 0 & 0 & 0 & \frac{1}{2} & 0 \end{bmatrix}$
122	symmetry	$-\frac{\sqrt{10}yz(3x^2 + 3y^2 - 4z^2)}{4}$

Table 8

No.	multipole	matrix
	$\mathbb{Q}_{4,0}^{(a)}(E_{1g})$	$\begin{pmatrix} 0 & 0 & \frac{\sqrt{21}}{7} & 0 & 0 \\ 0 & 0 & \frac{\sqrt{7}}{14} & 0 & 0 \\ \frac{\sqrt{21}}{7} & \frac{\sqrt{7}}{14} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{7}}{14} \\ 0 & 0 & 0 & -\frac{\sqrt{7}}{14} & 0 \end{pmatrix}$
123	symmetry	$\frac{\sqrt{10}xz\left(3x^2+3y^2-4z^2\right)}{4}$
	$\mathbb{Q}_{4,1}^{(a)}(E_{1g})$	$\begin{pmatrix} 0 & 0 & 0 & -\frac{\sqrt{21}}{7} & 0 \\ 0 & 0 & 0 & \frac{\sqrt{7}}{14} & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{14} \\ -\frac{\sqrt{21}}{7} & \frac{\sqrt{7}}{14} & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{7}}{14} & 0 & 0 \end{pmatrix}$
124	symmetry	$\frac{\sqrt{35}\left(x^2-2xy-y^2\right)\left(x^2+2xy-y^2\right)}{8}$
	$\mathbb{Q}_{4,0}^{(a)}(E_{2g},1)$	$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{2}}{2} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{2} \end{pmatrix}$
125	symmetry	$\frac{\sqrt{35}xy(x-y)(x+y)}{2}$
	$\mathbb{Q}_{4,1}^{(a)}(E_{2g},1)$	$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{2} \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{2}}{2} & 0 & 0 & 0 \end{pmatrix}$
126	symmetry	$-\frac{\sqrt{5}(x-y)(x+y)\left(x^2+y^2-6z^2\right)}{4}$

No.	multipole	matrix
	$\mathbb{Q}_{4,0}^{(a)}(E_{2g},2)$	$\begin{bmatrix} 0 & \frac{\sqrt{42}}{14} & 0 & 0 & 0 \\ \frac{\sqrt{42}}{14} & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{14}}{7} & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{14}}{7} & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
127	symmetry	$\frac{\sqrt{5}xy(x^2+y^2-6z^2)}{2}$
	$\mathbb{Q}_{4,1}^{(a)}(E_{2g},2)$	$\begin{bmatrix} 0 & 0 & 0 & 0 & -\frac{\sqrt{42}}{14} \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{14}}{7} & 0 \\ 0 & 0 & -\frac{\sqrt{14}}{7} & 0 & 0 \\ -\frac{\sqrt{42}}{14} & 0 & 0 & 0 & 0 \end{bmatrix}$
128	symmetry	z
	$\mathbb{M}_1^{(a)}(A_g)$	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{5} \\ 0 & 0 & 0 & \frac{\sqrt{10}i}{10} & 0 \\ 0 & 0 & -\frac{\sqrt{10}i}{10} & 0 & 0 \\ 0 & \frac{\sqrt{10}i}{5} & 0 & 0 & 0 \end{bmatrix}$
129	symmetry	x
	$\mathbb{M}_{1,0}^{(a)}(E_{1g})$	$\begin{bmatrix} 0 & 0 & \frac{\sqrt{30}i}{10} & 0 & 0 \\ 0 & 0 & \frac{\sqrt{10}i}{10} & 0 & 0 \\ -\frac{\sqrt{30}i}{10} & -\frac{\sqrt{10}i}{10} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{10} \\ 0 & 0 & 0 & -\frac{\sqrt{10}i}{10} & 0 \end{bmatrix}$
130	symmetry	y

continued ...

Table 8

No.	multipole	matrix
	$\mathbb{M}_{1,1}^{(a)}(E_{1g})$	$\begin{bmatrix} 0 & 0 & 0 & -\frac{\sqrt{30}i}{10} & 0 \\ 0 & 0 & 0 & \frac{\sqrt{10}i}{10} & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{10} \\ \frac{\sqrt{30}i}{10} & -\frac{\sqrt{10}i}{10} & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{10}i}{10} & 0 & 0 \end{bmatrix}$
131	symmetry	$-\frac{z\left(3x^2+3y^2-2z^2\right)}{2}$
	$\mathbb{M}_{3}^{(a)}(A_g)$	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{10} \\ 0 & 0 & 0 & \frac{\sqrt{10}i}{5} & 0 \\ 0 & 0 & -\frac{\sqrt{10}i}{5} & 0 & 0 \\ 0 & -\frac{\sqrt{10}i}{10} & 0 & 0 & 0 \end{bmatrix}$
132	symmetry	$\frac{\sqrt{10}y\left(3x^2-y^2\right)}{4}$
	$\mathbb{M}_{3}^{(a)}(B_g,1)$	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{i}{2} & 0 \\ 0 & 0 & 0 & 0 & \frac{i}{2} \\ 0 & -\frac{i}{2} & 0 & 0 & 0 \\ 0 & 0 & -\frac{i}{2} & 0 & 0 \end{bmatrix}$
133	symmetry	$\frac{\sqrt{10}x\left(x^2-3y^2\right)}{4}$
	$\mathbb{M}_{3}^{(a)}(B_g,2)$	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{i}{2} & 0 & 0 \\ 0 & \frac{i}{2} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{i}{2} \\ 0 & 0 & 0 & -\frac{i}{2} & 0 \end{bmatrix}$
134	symmetry	$-\frac{\sqrt{6}x\left(x^2+y^2-4z^2\right)}{4}$

Table 8

No.	multipole	matrix
	$\mathbb{M}_{3,0}^{(a)}(E_{1g})$	$\begin{bmatrix} 0 & 0 & \frac{\sqrt{5}i}{5} & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{15}i}{10} & 0 & 0 \\ -\frac{\sqrt{5}i}{5} & \frac{\sqrt{15}i}{10} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{10} \\ 0 & 0 & 0 & \frac{\sqrt{15}i}{10} & 0 \end{bmatrix}$
135	symmetry	$-\frac{\sqrt{6}y(x^2+y^2-4z^2)}{4}$
	$\mathbb{M}_{3,1}^{(a)}(E_{1g})$	$\begin{bmatrix} 0 & 0 & 0 & -\frac{\sqrt{5}i}{5} & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{15}i}{10} & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{10} \\ \frac{\sqrt{5}i}{5} & \frac{\sqrt{15}i}{10} & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{15}i}{10} & 0 & 0 \end{bmatrix}$
136	symmetry	$\sqrt{15}xyz$
	$\mathbb{M}_{3,0}^{(a)}(E_{2g})$	$\begin{bmatrix} 0 & -\frac{\sqrt{2}i}{2} & 0 & 0 & 0 \\ \frac{\sqrt{2}i}{2} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
137	symmetry	$\frac{\sqrt{15}z(x-y)(x+y)}{2}$
	$\mathbb{M}_{3,1}^{(a)}(E_{2g})$	$\begin{bmatrix} 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{2} \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ -\frac{\sqrt{2}i}{2} & 0 & 0 & 0 & 0 \end{bmatrix}$

bra: $= \langle d_u|, \langle d_{xz}|, \langle d_{yz}|, \langle d_{xy}|, \langle d_v|$

ket: $= |f_{az}\rangle, |f_1\rangle, |f_2\rangle, |f_{3x}\rangle, |f_{3y}\rangle, |f_3\rangle, |f_{bz}\rangle$

No.	multipole	matrix

138   symmetry z

$\mathbb{Q}_1^{(a)}(A_u)$

$$
\begin{bmatrix}
0 & 0 & 0 & \frac{3\sqrt{70}}{70} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{14} \\
0 & 0 & -\frac{\sqrt{210}}{70} & 0 & 0 & \frac{\sqrt{14}}{14} & 0 \\
0 & -\frac{\sqrt{210}}{70} & 0 & 0 & -\frac{\sqrt{14}}{14} & 0 & 0 \\
\frac{\sqrt{14}}{14} & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}
$$

139   symmetry x

$\mathbb{Q}_{1,0}^{(a)}(E_{1u})$

$$
\begin{bmatrix}
0 & -\frac{3\sqrt{70}}{140} & 0 & 0 & -\frac{\sqrt{42}}{28} & 0 & 0 \\
0 & \frac{3\sqrt{210}}{140} & 0 & 0 & -\frac{\sqrt{14}}{28} & 0 & 0 \\
\frac{\sqrt{14}}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{\sqrt{210}}{70} & 0 & 0 & \frac{\sqrt{14}}{14} \\
0 & 0 & -\frac{\sqrt{210}}{70} & 0 & 0 & -\frac{\sqrt{14}}{14} & 0
\end{bmatrix}
$$

140   symmetry y

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

$$
\begin{bmatrix}
0 & 0 & -\frac{3\sqrt{70}}{140} & 0 & 0 & \frac{\sqrt{42}}{28} & 0 \\
0 & 0 & -\frac{3\sqrt{210}}{140} & 0 & 0 & -\frac{\sqrt{14}}{28} & 0 \\
0 & 0 & 0 & -\frac{\sqrt{210}}{70} & 0 & 0 & -\frac{\sqrt{14}}{14} \\
\frac{\sqrt{14}}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{210}}{70} & 0 & 0 & \frac{\sqrt{14}}{14} & 0 & 0
\end{bmatrix}
$$

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

$\mathbb{Q}_3^{(a)}(A_u)$

$$
\begin{bmatrix}
0 & 0 & 0 & \frac{\sqrt{30}}{15} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{6} \\
0 & 0 & -\frac{\sqrt{10}}{40} & 0 & 0 & \frac{\sqrt{6}}{24} & 0 \\
0 & -\frac{\sqrt{10}}{40} & 0 & 0 & -\frac{\sqrt{6}}{24} & 0 & 0 \\
-\frac{\sqrt{6}}{6} & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}
$$

142   symmetry $\frac{\sqrt{10}y\left(3x^2-y^2\right)}{4}$

Table 9

No.	multipole	matrix
	$\mathbb{Q}_3^{(a)}(B_u,1)$	$\begin{pmatrix} 0 & 0 & \frac{5\sqrt{3}}{24} & 0 & 0 & \frac{\sqrt{5}}{8} & 0 \\ 0 & 0 & \frac{1}{8} & 0 & 0 & -\frac{\sqrt{15}}{24} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{12} \\ \frac{\sqrt{15}}{12} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{1}{8} & 0 & 0 & \frac{\sqrt{15}}{24} & 0 & 0 \end{pmatrix}$
143	symmetry	$\frac{\sqrt{10}x\left(x^2-3y^2\right)}{4}$
	$\mathbb{Q}_3^{(a)}(B_u,2)$	$\begin{pmatrix} 0 & -\frac{5\sqrt{3}}{24} & 0 & 0 & \frac{\sqrt{5}}{8} & 0 & 0 \\ 0 & \frac{1}{8} & 0 & 0 & \frac{\sqrt{15}}{24} & 0 & 0 \\ -\frac{\sqrt{15}}{12} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{12} \\ 0 & 0 & -\frac{1}{8} & 0 & 0 & \frac{\sqrt{15}}{24} & 0 \end{pmatrix}$
144	symmetry	$-\frac{\sqrt{6}x\left(x^2+y^2-4z^2\right)}{4}$
	$\mathbb{Q}_{3,0}^{(a)}(E_{1u})$	$\begin{pmatrix} 0 & -\frac{3\sqrt{5}}{40} & 0 & 0 & -\frac{\sqrt{3}}{8} & 0 & 0 \\ 0 & -\frac{11\sqrt{15}}{120} & 0 & 0 & -\frac{1}{8} & 0 & 0 \\ \frac{1}{4} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{15}}{30} & 0 & 0 & \frac{1}{4} \\ 0 & 0 & -\frac{\sqrt{15}}{120} & 0 & 0 & \frac{3}{8} & 0 \end{pmatrix}$
145	symmetry	$-\frac{\sqrt{6}y\left(x^2+y^2-4z^2\right)}{4}$
	$\mathbb{Q}_{3,1}^{(a)}(E_{1u})$	$\begin{pmatrix} 0 & 0 & -\frac{3\sqrt{5}}{40} & 0 & 0 & \frac{\sqrt{3}}{8} & 0 \\ 0 & 0 & \frac{11\sqrt{15}}{120} & 0 & 0 & -\frac{1}{8} & 0 \\ 0 & 0 & 0 & \frac{\sqrt{15}}{30} & 0 & 0 & -\frac{1}{4} \\ \frac{1}{4} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{15}}{120} & 0 & 0 & -\frac{3}{8} & 0 & 0 \end{pmatrix}$
146	symmetry	$\sqrt{15}xyz$

Table 9

No.	multipole	matrix
	$\mathbb{Q}_{3,0}^{(a)}(E_{2u})$	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{6}}{6} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{6}}{6} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{6}}{6} & 0 & 0 & 0 \end{bmatrix}$
147	symmetry	$\frac{\sqrt{15}z(x-y)(x+y)}{2}$
	$\mathbb{Q}_{3,1}^{(a)}(E_{2u})$	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{6}}{6} & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{6}}{24} & 0 & 0 & -\frac{\sqrt{10}}{8} & 0 \\ 0 & \frac{\sqrt{6}}{24} & 0 & 0 & -\frac{\sqrt{10}}{8} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
148	symmetry	$\frac{z\left(15x^4+30x^2y^2-40x^2z^2+15y^4-40y^2z^2+8z^4\right)}{8}$
	$\mathbb{Q}_{5}^{(a)}(A_u)$	$\begin{bmatrix} 0 & 0 & 0 & \frac{\sqrt{105}}{21} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}}{42} \\ 0 & 0 & \frac{\sqrt{35}}{28} & 0 & 0 & -\frac{5\sqrt{21}}{84} & 0 \\ 0 & \frac{\sqrt{35}}{28} & 0 & 0 & \frac{5\sqrt{21}}{84} & 0 & 0 \\ \frac{\sqrt{21}}{42} & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
149	symmetry	$-\frac{\sqrt{70}y\left(3x^2-y^2\right)\left(x^2+y^2-8z^2\right)}{16}$
	$\mathbb{Q}_{5}^{(a)}(B_u,1)$	$\begin{bmatrix} 0 & 0 & -\frac{\sqrt{6}}{12} & 0 & 0 & -\frac{\sqrt{10}}{20} & 0 \\ 0 & 0 & -\frac{\sqrt{2}}{8} & 0 & 0 & \frac{\sqrt{30}}{24} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{15} \\ \frac{\sqrt{30}}{15} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{2}}{8} & 0 & 0 & -\frac{\sqrt{30}}{24} & 0 & 0 \end{bmatrix}$
150	symmetry	$-\frac{\sqrt{70}x\left(x^2-3y^2\right)\left(x^2+y^2-8z^2\right)}{16}$

Table 9

No.	multipole	matrix

$\mathbb{Q}_5^{(a)}(B_u,2)$

$$\begin{bmatrix} 0 & \frac{\sqrt{6}}{12} & 0 & 0 & -\frac{\sqrt{10}}{20} & 0 & 0 \\ 0 & -\frac{\sqrt{2}}{8} & 0 & 0 & -\frac{\sqrt{30}}{24} & 0 & 0 \\ -\frac{\sqrt{30}}{15} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}}{15} \\ 0 & 0 & \frac{\sqrt{2}}{8} & 0 & 0 & -\frac{\sqrt{30}}{24} & 0 \end{bmatrix}$$

151 symmetry

$$\frac{3\sqrt{14}x(x^4-10x^2y^2+5y^4)}{16}$$

$\mathbb{Q}_{5,0}^{(a)}(E_{1u},1)$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{10}}{8} & 0 & 0 & -\frac{\sqrt{6}}{8} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{10}}{8} & 0 & 0 & \frac{\sqrt{6}}{8} & 0 \end{bmatrix}$$

152 symmetry

$$-\frac{3\sqrt{14}y(5x^4-10x^2y^2+y^4)}{16}$$

$\mathbb{Q}_{5,1}^{(a)}(E_{1u},1)$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{10}}{8} & 0 & 0 & \frac{\sqrt{6}}{8} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{10}}{8} & 0 & 0 & \frac{\sqrt{6}}{8} & 0 & 0 \end{bmatrix}$$

153 symmetry

$$\frac{\sqrt{15}x(x^4+2x^2y^2-12x^2z^2+y^4-12y^2z^2+8z^4)}{8}$$

$\mathbb{Q}_{5,0}^{(a)}(E_{1u},2)$

$$\begin{bmatrix} 0 & -\frac{3\sqrt{7}}{28} & 0 & 0 & -\frac{\sqrt{105}}{28} & 0 & 0 \\ 0 & \frac{\sqrt{21}}{42} & 0 & 0 & \frac{\sqrt{35}}{70} & 0 & 0 \\ -\frac{\sqrt{35}}{35} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{2\sqrt{21}}{21} & 0 & 0 & -\frac{\sqrt{35}}{35} \\ 0 & 0 & \frac{\sqrt{21}}{84} & 0 & 0 & -\frac{3\sqrt{35}}{140} & 0 \end{bmatrix}$$

154 symmetry

$$\frac{\sqrt{15}y(x^4+2x^2y^2-12x^2z^2+y^4-12y^2z^2+8z^4)}{8}$$

Table 9

No.	multipole	matrix
	$\mathbb{Q}_{5,1}^{(a)}(E_{1u},2)$	$\begin{pmatrix} 0 & 0 & -\frac{3\sqrt{7}}{28} & 0 & 0 & \frac{\sqrt{105}}{28} & 0 \\ 0 & 0 & -\frac{\sqrt{21}}{42} & 0 & 0 & \frac{\sqrt{35}}{70} & 0 \\ 0 & 0 & 0 & \frac{2\sqrt{21}}{21} & 0 & 0 & \frac{\sqrt{35}}{35} \\ -\frac{\sqrt{35}}{35} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{21}}{84} & 0 & 0 & \frac{3\sqrt{35}}{140} & 0 & 0 \end{pmatrix}$
155	symmetry	$-\frac{3\sqrt{35}xyz(x-y)(x+y)}{2}$
	$\mathbb{Q}_{5,0}^{(a)}(E_{2u},1)$	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ -\frac{\sqrt{15}}{10} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{1}{4} & 0 & 0 & \frac{\sqrt{15}}{20} & 0 & 0 \\ 0 & 0 & \frac{1}{4} & 0 & 0 & \frac{\sqrt{15}}{20} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}}{10} \end{bmatrix}$
156	symmetry	$\frac{3\sqrt{35}z(x^2-2xy-y^2)(x^2+2xy-y^2)}{8}$
	$\mathbb{Q}_{5,1}^{(a)}(E_{2u},1)$	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{10} \\ 0 & 0 & \frac{1}{4} & 0 & 0 & \frac{\sqrt{15}}{20} & 0 \\ 0 & \frac{1}{4} & 0 & 0 & -\frac{\sqrt{15}}{20} & 0 & 0 \\ -\frac{\sqrt{15}}{10} & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
157	symmetry	$-\frac{\sqrt{105}xyz(x^2+y^2-2z^2)}{2}$
	$\mathbb{Q}_{5,0}^{(a)}(E_{2u},2)$	$\begin{bmatrix} \frac{\sqrt{15}}{10} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{3}}{12} & 0 & 0 & -\frac{3\sqrt{5}}{20} & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{3}}{12} & 0 & 0 & \frac{3\sqrt{5}}{20} & 0 \\ 0 & 0 & 0 & \frac{\sqrt{3}}{6} & 0 & 0 & 0 \end{bmatrix}$
158	symmetry	$-\frac{\sqrt{105}z(x-y)(x+y)(x^2+y^2-2z^2)}{4}$

Table 9

No.	multipole	matrix
	$\mathbb{Q}_{5,1}^{(a)}(E_{2u}, 2)$	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}}{10} \\ 0 & 0 & 0 & \frac{\sqrt{3}}{6} & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{3}}{6} & 0 & 0 & -\frac{\sqrt{5}}{10} & 0 \\ 0 & -\frac{\sqrt{3}}{6} & 0 & 0 & -\frac{\sqrt{5}}{10} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
159	symmetry	$-\frac{x^2}{2} - \frac{y^2}{2} + z^2$
	$\mathbb{G}_2^{(a)}(A_u)$	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \frac{\sqrt{35}}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{21}}{28} & 0 & 0 & \frac{\sqrt{35}}{28} & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{21}}{28} & 0 & 0 & \frac{\sqrt{35}}{28} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{35}}{14} \end{bmatrix}$
160	symmetry	$\sqrt{3}yz$
	$\mathbb{G}_{2,0}^{(a)}(E_{1u})$	$\begin{bmatrix} 0 & -\frac{\sqrt{21}}{28} & 0 & 0 & -\frac{\sqrt{35}}{28} & 0 & 0 \\ 0 & -\frac{\sqrt{7}}{28} & 0 & 0 & \frac{\sqrt{105}}{28} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{7}}{7} & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{7}}{7} & 0 & 0 & 0 & 0 \end{bmatrix}$
161	symmetry	$-\sqrt{3}xz$
	$\mathbb{G}_{2,1}^{(a)}(E_{1u})$	$\begin{bmatrix} 0 & 0 & -\frac{\sqrt{21}}{28} & 0 & 0 & \frac{\sqrt{35}}{28} & 0 \\ 0 & 0 & \frac{\sqrt{7}}{28} & 0 & 0 & \frac{\sqrt{105}}{28} & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{7}}{7} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{7}}{7} & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
162	symmetry	$\frac{\sqrt{3}(x-y)(x+y)}{2}$

28

Table 9

No.	multipole	matrix

$$\mathbb{G}_{2,0}^{(a)}(E_{2u}) \quad \begin{bmatrix} -\frac{\sqrt{35}}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{7}}{28} & 0 & 0 & -\frac{\sqrt{105}}{28} & 0 & 0 \\ 0 & 0 & \frac{\sqrt{7}}{28} & 0 & 0 & \frac{\sqrt{105}}{28} & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{7}}{14} & 0 & 0 & 0 \end{bmatrix}$$

163   symmetry $-\sqrt{3}xy$

$$\mathbb{G}_{2,1}^{(a)}(E_{2u}) \quad \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{35}}{14} \\ 0 & 0 & 0 & -\frac{\sqrt{7}}{14} & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{7}}{7} & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{7}}{7} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

164   symmetry $\frac{3x^4}{8}+\frac{3x^2y^2}{4}-3x^2z^2+\frac{3y^4}{8}-3y^2z^2+z^4$

$$\mathbb{G}_{4}^{(a)}(A_u) \quad \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ -\frac{\sqrt{14}}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{210}}{56} & 0 & 0 & \frac{5\sqrt{14}}{56} & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{210}}{56} & 0 & 0 & \frac{5\sqrt{14}}{56} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}}{14} \end{bmatrix}$$

165   symmetry $\frac{\sqrt{70}xz\left(x^2-3y^2\right)}{4}$

$$\mathbb{G}_{4}^{(a)}(B_u,1) \quad \begin{bmatrix} 0 & 0 & \frac{3}{8} & 0 & 0 & \frac{3\sqrt{15}}{40} & 0 \\ 0 & 0 & -\frac{\sqrt{3}}{8} & 0 & 0 & \frac{\sqrt{5}}{8} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}}{20} \\ -\frac{\sqrt{5}}{20} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{3}}{8} & 0 & 0 & -\frac{\sqrt{5}}{8} & 0 & 0 \end{bmatrix}$$

166   symmetry $\frac{\sqrt{70}yz\left(3x^2-y^2\right)}{4}$

Table 9

No.	multipole	matrix
	$\mathbb{G}_4^{(a)}(B_u,2)$	$\begin{bmatrix} 0 & \frac{3}{8} & 0 & 0 & -\frac{3\sqrt{15}}{40} & 0 & 0 \\ 0 & \frac{\sqrt{3}}{8} & 0 & 0 & \frac{\sqrt{5}}{8} & 0 & 0 \\ -\frac{\sqrt{5}}{20} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{5}}{20} \\ 0 & 0 & -\frac{\sqrt{3}}{8} & 0 & 0 & \frac{\sqrt{5}}{8} & 0 \end{bmatrix}$
167	symmetry	$-\frac{\sqrt{10}yz\left(3x^2+3y^2-4z^2\right)}{4}$
	$\mathbb{G}_{4,0}^{(a)}(E_{1u})$	$\begin{bmatrix} 0 & -\frac{3\sqrt{7}}{56} & 0 & 0 & -\frac{\sqrt{105}}{56} & 0 & 0 \\ 0 & -\frac{\sqrt{21}}{56} & 0 & 0 & -\frac{13\sqrt{35}}{280} & 0 & 0 \\ -\frac{\sqrt{35}}{20} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{21}}{14} & 0 & 0 & -\frac{\sqrt{35}}{20} \\ 0 & 0 & -\frac{3\sqrt{21}}{56} & 0 & 0 & \frac{\sqrt{35}}{40} & 0 \end{bmatrix}$
168	symmetry	$\frac{\sqrt{10}xz\left(3x^2+3y^2-4z^2\right)}{4}$
	$\mathbb{G}_{4,1}^{(a)}(E_{1u})$	$\begin{bmatrix} 0 & 0 & -\frac{3\sqrt{7}}{56} & 0 & 0 & \frac{\sqrt{105}}{56} & 0 \\ 0 & 0 & \frac{\sqrt{21}}{56} & 0 & 0 & -\frac{13\sqrt{35}}{280} & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{21}}{14} & 0 & 0 & \frac{\sqrt{35}}{20} \\ -\frac{\sqrt{35}}{20} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{3\sqrt{21}}{56} & 0 & 0 & -\frac{\sqrt{35}}{40} & 0 & 0 \end{bmatrix}$
169	symmetry	$\frac{\sqrt{35}\left(x^2-2xy-y^2\right)\left(x^2+2xy-y^2\right)}{8}$
	$\mathbb{G}_{4,0}^{(a)}(E_{2u},1)$	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \frac{\sqrt{10}}{10} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{6}}{8} & 0 & 0 & \frac{3\sqrt{10}}{40} & 0 & 0 \\ 0 & 0 & \frac{\sqrt{6}}{8} & 0 & 0 & \frac{3\sqrt{10}}{40} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{10} \end{bmatrix}$
170	symmetry	$\frac{\sqrt{35}xy(x-y)(x+y)}{2}$

Table 9

No.	multipole	matrix

$\mathbb{G}_{4,1}^{(a)}(E_{2u},1)$

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

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

$\mathbb{G}_{4,0}^{(a)}(E_{2u},2)$

$$\begin{pmatrix} -\frac{\sqrt{210}}{35} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{42}}{28} & 0 & 0 & \frac{\sqrt{70}}{140} & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{42}}{28} & 0 & 0 & -\frac{\sqrt{70}}{140} & 0 \\ 0 & 0 & 0 & \frac{\sqrt{42}}{14} & 0 & 0 & 0 \end{pmatrix}$$

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

$\mathbb{G}_{4,1}^{(a)}(E_{2u},2)$

$$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{210}}{35} \\ 0 & 0 & 0 & \frac{\sqrt{42}}{14} & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{42}}{56} & 0 & 0 & -\frac{\sqrt{70}}{40} & 0 \\ 0 & \frac{\sqrt{42}}{56} & 0 & 0 & -\frac{\sqrt{70}}{40} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

173	symmetry	z

$\mathbb{T}_{1}^{(a)}(A_u)$

$$\begin{pmatrix} 0 & 0 & 0 & \frac{3\sqrt{70}i}{70} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{14}i}{14} \\ 0 & 0 & -\frac{\sqrt{210}i}{70} & 0 & 0 & \frac{\sqrt{14}i}{14} & 0 \\ 0 & -\frac{\sqrt{210}i}{70} & 0 & 0 & -\frac{\sqrt{14}i}{14} & 0 & 0 \\ \frac{\sqrt{14}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

174	symmetry	x

Table 9

No.	multipole	matrix

$\mathbb{T}_{1,0}^{(a)}(E_{1u})$

$$\begin{bmatrix} 0 & -\frac{3\sqrt{70}i}{140} & 0 & 0 & -\frac{\sqrt{42}i}{28} & 0 & 0 \\ 0 & \frac{3\sqrt{210}i}{140} & 0 & 0 & -\frac{\sqrt{14}i}{28} & 0 & 0 \\ \frac{\sqrt{14}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{210}i}{70} & 0 & 0 & \frac{\sqrt{14}i}{14} \\ 0 & 0 & -\frac{\sqrt{210}i}{70} & 0 & 0 & -\frac{\sqrt{14}i}{14} & 0 \end{bmatrix}$$

175 symmetry $\quad y$

$\mathbb{T}_{1,1}^{(a)}(E_{1u})$

$$\begin{bmatrix} 0 & 0 & -\frac{3\sqrt{70}i}{140} & 0 & 0 & \frac{\sqrt{42}i}{28} & 0 \\ 0 & 0 & -\frac{3\sqrt{210}i}{140} & 0 & 0 & -\frac{\sqrt{14}i}{28} & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{210}i}{70} & 0 & 0 & -\frac{\sqrt{14}i}{14} \\ \frac{\sqrt{14}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{210}i}{70} & 0 & 0 & \frac{\sqrt{14}i}{14} & 0 & 0 \end{bmatrix}$$

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

$\mathbb{T}_3^{(a)}(A_u)$

$$\begin{bmatrix} 0 & 0 & 0 & \frac{\sqrt{30}i}{15} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{6} \\ 0 & 0 & -\frac{\sqrt{10}i}{40} & 0 & 0 & \frac{\sqrt{6}i}{24} & 0 \\ 0 & -\frac{\sqrt{10}i}{40} & 0 & 0 & -\frac{\sqrt{6}i}{24} & 0 & 0 \\ -\frac{\sqrt{6}i}{6} & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

177 symmetry $\quad \frac{\sqrt{10}y\left(3x^2-y^2\right)}{4}$

$\mathbb{T}_3^{(a)}(B_u,1)$

$$\begin{bmatrix} 0 & 0 & \frac{5\sqrt{3}i}{24} & 0 & 0 & \frac{\sqrt{5}i}{8} & 0 \\ 0 & 0 & \frac{i}{8} & 0 & 0 & -\frac{\sqrt{15}i}{24} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{12} \\ \frac{\sqrt{15}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{i}{8} & 0 & 0 & \frac{\sqrt{15}i}{24} & 0 & 0 \end{bmatrix}$$

178 symmetry $\quad \frac{\sqrt{10}x\left(x^2-3y^2\right)}{4}$

Table 9

No.	multipole	matrix

$$\mathbb{T}_3^{(a)}(B_u,2)$$

$$\begin{bmatrix} 0 & -\frac{5\sqrt{3}i}{24} & 0 & 0 & \frac{\sqrt{5}i}{8} & 0 & 0 \\ 0 & \frac{i}{8} & 0 & 0 & \frac{\sqrt{15}i}{24} & 0 & 0 \\ -\frac{\sqrt{15}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{12} \\ 0 & 0 & -\frac{i}{8} & 0 & 0 & \frac{\sqrt{15}i}{24} & 0 \end{bmatrix}$$

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

$$\mathbb{T}_{3,0}^{(a)}(E_{1u})$$

$$\begin{bmatrix} 0 & -\frac{3\sqrt{5}i}{40} & 0 & 0 & -\frac{\sqrt{3}i}{8} & 0 & 0 \\ 0 & -\frac{11\sqrt{15}i}{120} & 0 & 0 & -\frac{i}{8} & 0 & 0 \\ \frac{i}{4} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{15}i}{30} & 0 & 0 & \frac{i}{4} \\ 0 & 0 & -\frac{\sqrt{15}i}{120} & 0 & 0 & \frac{3i}{8} & 0 \end{bmatrix}$$

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

$$\mathbb{T}_{3,1}^{(a)}(E_{1u})$$

$$\begin{bmatrix} 0 & 0 & -\frac{3\sqrt{5}i}{40} & 0 & 0 & \frac{\sqrt{3}i}{8} & 0 \\ 0 & 0 & \frac{11\sqrt{15}i}{120} & 0 & 0 & -\frac{i}{8} & 0 \\ 0 & 0 & 0 & \frac{\sqrt{15}i}{30} & 0 & 0 & -\frac{i}{4} \\ \frac{i}{4} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{15}i}{120} & 0 & 0 & -\frac{3i}{8} & 0 & 0 \end{bmatrix}$$

181 symmetry $\sqrt{15}xyz$

$$\mathbb{T}_{3,0}^{(a)}(E_{2u})$$

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

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

Table 9

No.	multipole	matrix

$$\mathbb{T}_{3,1}^{(a)}(E_{2u}) \quad \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{6}i}{6} & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{6}i}{24} & 0 & 0 & -\frac{\sqrt{10}i}{8} & 0 \\ 0 & \frac{\sqrt{6}i}{24} & 0 & 0 & -\frac{\sqrt{10}i}{8} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

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

$$\mathbb{T}_5^{(a)}(A_u) \quad \begin{bmatrix} 0 & 0 & 0 & \frac{\sqrt{105}i}{21} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{21}i}{42} \\ 0 & 0 & \frac{\sqrt{35}i}{28} & 0 & 0 & -\frac{5\sqrt{21}i}{84} & 0 \\ 0 & \frac{\sqrt{35}i}{28} & 0 & 0 & \frac{5\sqrt{21}i}{84} & 0 & 0 \\ \frac{\sqrt{21}i}{42} & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

184 symmetry $\quad -\dfrac{\sqrt{70}y\left(3x^2-y^2\right)\left(x^2+y^2-8z^2\right)}{16}$

$$\mathbb{T}_5^{(a)}(B_u,1) \quad \begin{bmatrix} 0 & 0 & -\frac{\sqrt{6}i}{12} & 0 & 0 & -\frac{\sqrt{10}i}{20} & 0 \\ 0 & 0 & -\frac{\sqrt{2}i}{8} & 0 & 0 & \frac{\sqrt{30}i}{24} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{15} \\ \frac{\sqrt{30}i}{15} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{2}i}{8} & 0 & 0 & -\frac{\sqrt{30}i}{24} & 0 & 0 \end{bmatrix}$$

185 symmetry $\quad -\dfrac{\sqrt{70}x\left(x^2-3y^2\right)\left(x^2+y^2-8z^2\right)}{16}$

$$\mathbb{T}_5^{(a)}(B_u,2) \quad \begin{bmatrix} 0 & \frac{\sqrt{6}i}{12} & 0 & 0 & -\frac{\sqrt{10}i}{20} & 0 & 0 \\ 0 & -\frac{\sqrt{2}i}{8} & 0 & 0 & -\frac{\sqrt{30}i}{24} & 0 & 0 \\ -\frac{\sqrt{30}i}{15} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{30}i}{15} \\ 0 & 0 & \frac{\sqrt{2}i}{8} & 0 & 0 & -\frac{\sqrt{30}i}{24} & 0 \end{bmatrix}$$

186 symmetry $\quad \dfrac{3\sqrt{14}x\left(x^4-10x^2y^2+5y^4\right)}{16}$

Table 9

No.	multipole	matrix
	$\mathbb{T}_{5,0}^{(a)}(E_{1u},1)$	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{10}i}{8} & 0 & 0 & -\frac{\sqrt{6}i}{8} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{10}i}{8} & 0 & 0 & \frac{\sqrt{6}i}{8} & 0 \end{bmatrix}$
187	symmetry	$-\frac{3\sqrt{14}y\left(5x^4-10x^2y^2+y^4\right)}{16}$
	$\mathbb{T}_{5,1}^{(a)}(E_{1u},1)$	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{10}i}{8} & 0 & 0 & \frac{\sqrt{6}i}{8} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{10}i}{8} & 0 & 0 & \frac{\sqrt{6}i}{8} & 0 & 0 \end{bmatrix}$
188	symmetry	$\frac{\sqrt{15}x\left(x^4+2x^2y^2-12x^2z^2+y^4-12y^2z^2+8z^4\right)}{8}$
	$\mathbb{T}_{5,0}^{(a)}(E_{1u},2)$	$\begin{bmatrix} 0 & -\frac{3\sqrt{7}i}{28} & 0 & 0 & -\frac{\sqrt{105}i}{28} & 0 & 0 \\ 0 & \frac{\sqrt{21}i}{42} & 0 & 0 & \frac{\sqrt{35}i}{70} & 0 & 0 \\ -\frac{\sqrt{35}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{2\sqrt{21}i}{21} & 0 & 0 & -\frac{\sqrt{35}i}{35} \\ 0 & 0 & \frac{\sqrt{21}i}{84} & 0 & 0 & -\frac{3\sqrt{35}i}{140} & 0 \end{bmatrix}$
189	symmetry	$\frac{\sqrt{15}y\left(x^4+2x^2y^2-12x^2z^2+y^4-12y^2z^2+8z^4\right)}{8}$
	$\mathbb{T}_{5,1}^{(a)}(E_{1u},2)$	$\begin{bmatrix} 0 & 0 & -\frac{3\sqrt{7}i}{28} & 0 & 0 & \frac{\sqrt{105}i}{28} & 0 \\ 0 & 0 & -\frac{\sqrt{21}i}{42} & 0 & 0 & \frac{\sqrt{35}i}{70} & 0 \\ 0 & 0 & 0 & \frac{2\sqrt{21}i}{21} & 0 & 0 & \frac{\sqrt{35}i}{35} \\ -\frac{\sqrt{35}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{21}i}{84} & 0 & 0 & \frac{3\sqrt{35}i}{140} & 0 & 0 \end{bmatrix}$
190	symmetry	$-\frac{3\sqrt{35}xyz(x-y)(x+y)}{2}$

Table 9

No.	multipole	matrix

$\mathbb{T}_{5,0}^{(a)}(E_{2u}, 1)$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ -\frac{\sqrt{15}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{i}{4} & 0 & 0 & \frac{\sqrt{15}i}{20} & 0 & 0 \\ 0 & 0 & \frac{i}{4} & 0 & 0 & \frac{\sqrt{15}i}{20} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{15}i}{10} \end{bmatrix}$$

| 191 | symmetry | $\frac{3\sqrt{35}z\left(x^2-2xy-y^2\right)\left(x^2+2xy-y^2\right)}{8}$ |

$\mathbb{T}_{5,1}^{(a)}(E_{2u}, 1)$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{15}i}{10} \\ 0 & 0 & \frac{i}{4} & 0 & 0 & \frac{\sqrt{15}i}{20} & 0 \\ 0 & \frac{i}{4} & 0 & 0 & -\frac{\sqrt{15}i}{20} & 0 & 0 \\ -\frac{\sqrt{15}i}{10} & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

| 192 | symmetry | $-\frac{\sqrt{105}xyz\left(x^2+y^2-2z^2\right)}{2}$ |

$\mathbb{T}_{5,0}^{(a)}(E_{2u}, 2)$

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

| 193 | symmetry | $-\frac{\sqrt{105}z(x-y)(x+y)\left(x^2+y^2-2z^2\right)}{4}$ |

$\mathbb{T}_{5,1}^{(a)}(E_{2u}, 2)$

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

| 194 | symmetry | $-\frac{x^2}{2} - \frac{y^2}{2} + z^2$ |

Table 9

No.	multipole	matrix
	$\mathbb{M}_2^{(a)}(A_u)$	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ -\frac{\sqrt{35}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{21}i}{28} & 0 & 0 & -\frac{\sqrt{35}i}{28} & 0 & 0 \\ 0 & 0 & \frac{\sqrt{21}i}{28} & 0 & 0 & -\frac{\sqrt{35}i}{28} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{35}i}{14} \end{bmatrix}$
195	symmetry	$\sqrt{3}yz$
	$\mathbb{M}_{2,0}^{(a)}(E_{1u})$	$\begin{bmatrix} 0 & \frac{\sqrt{21}i}{28} & 0 & 0 & \frac{\sqrt{35}i}{28} & 0 & 0 \\ 0 & \frac{\sqrt{7}i}{28} & 0 & 0 & -\frac{\sqrt{105}i}{28} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{7}i}{7} & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{7}i}{7} & 0 & 0 & 0 & 0 \end{bmatrix}$
196	symmetry	$-\sqrt{3}xz$
	$\mathbb{M}_{2,1}^{(a)}(E_{1u})$	$\begin{bmatrix} 0 & 0 & \frac{\sqrt{21}i}{28} & 0 & 0 & -\frac{\sqrt{35}i}{28} & 0 \\ 0 & 0 & -\frac{\sqrt{7}i}{28} & 0 & 0 & -\frac{\sqrt{105}i}{28} & 0 \\ 0 & 0 & 0 & \frac{\sqrt{7}i}{7} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{7}i}{7} & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
197	symmetry	$\frac{\sqrt{3}(x-y)(x+y)}{2}$
	$\mathbb{M}_{2,0}^{(a)}(E_{2u})$	$\begin{bmatrix} \frac{\sqrt{35}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{7}i}{28} & 0 & 0 & \frac{\sqrt{105}i}{28} & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{7}i}{28} & 0 & 0 & -\frac{\sqrt{105}i}{28} & 0 \\ 0 & 0 & 0 & \frac{\sqrt{7}i}{14} & 0 & 0 & 0 \end{bmatrix}$
198	symmetry	$-\sqrt{3}xy$

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Table 9

No.	multipole	matrix

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

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{35}i}{14} \\ 0 & 0 & 0 & \frac{\sqrt{7}i}{14} & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{7}i}{7} & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{7}i}{7} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

---

199 symmetry

$$\frac{3x^4}{8} + \frac{3x^2y^2}{4} - 3x^2z^2 + \frac{3y^4}{8} - 3y^2z^2 + z^4$$

$\mathbb{M}_4^{(a)}(A_u)$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \frac{\sqrt{14}i}{14} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{210}i}{56} & 0 & 0 & -\frac{5\sqrt{14}i}{56} & 0 & 0 \\ 0 & 0 & \frac{\sqrt{210}i}{56} & 0 & 0 & -\frac{5\sqrt{14}i}{56} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{14}i}{14} \end{bmatrix}$$

---

200 symmetry

$$\frac{\sqrt{70}xz(x^2 - 3y^2)}{4}$$

$\mathbb{M}_4^{(a)}(B_u, 1)$

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

---

201 symmetry

$$\frac{\sqrt{70}yz(3x^2 - y^2)}{4}$$

$\mathbb{M}_4^{(a)}(B_u, 2)$

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

---

202 symmetry

$$-\frac{\sqrt{10}yz(3x^2 + 3y^2 - 4z^2)}{4}$$

continued ...

Table 9

No.	multipole	matrix						
	$\mathbb{M}_{4,0}^{(a)}(E_{1u})$	0	$\frac{3\sqrt{7}i}{56}$	0	0	$\frac{\sqrt{105}i}{56}$	0	0
		0	$\frac{\sqrt{21}i}{56}$	0	0	$\frac{13\sqrt{35}i}{280}$	0	0
		$\frac{\sqrt{35}i}{20}$	0	0	0	0	0	0
		0	0	0	$\frac{\sqrt{21}i}{14}$	0	0	$\frac{\sqrt{35}i}{20}$
		0	0	$\frac{3\sqrt{21}i}{56}$	0	0	$-\frac{\sqrt{35}i}{40}$	0
203	symmetry	$\frac{\sqrt{10}xz\left(3x^2+3y^2-4z^2\right)}{4}$						
	$\mathbb{M}_{4,1}^{(a)}(E_{1u})$	0	0	$\frac{3\sqrt{7}i}{56}$	0	0	$-\frac{\sqrt{105}i}{56}$	0
		0	0	$-\frac{\sqrt{21}i}{56}$	0	0	$\frac{13\sqrt{35}i}{280}$	0
		0	0	0	$\frac{\sqrt{21}i}{14}$	0	0	$-\frac{\sqrt{35}i}{20}$
		$\frac{\sqrt{35}i}{20}$	0	0	0	0	0	0
		0	$\frac{3\sqrt{21}i}{56}$	0	0	$\frac{\sqrt{35}i}{40}$	0	0
204	symmetry	$\frac{\sqrt{35}\left(x^2-2xy-y^2\right)\left(x^2+2xy-y^2\right)}{8}$						
	$\mathbb{M}_{4,0}^{(a)}(E_{2u},1)$	0	0	0	0	0	0	0
		$-\frac{\sqrt{10}i}{10}$	0	0	0	0	0	0
		0	$\frac{\sqrt{6}i}{8}$	0	0	$-\frac{3\sqrt{10}i}{40}$	0	0
		0	0	$-\frac{\sqrt{6}i}{8}$	0	0	$-\frac{3\sqrt{10}i}{40}$	0
		0	0	0	0	0	0	$-\frac{\sqrt{10}i}{10}$
205	symmetry	$\frac{\sqrt{35}xy(x-y)(x+y)}{2}$						
	$\mathbb{M}_{4,1}^{(a)}(E_{2u},1)$	0	0	0	0	0	0	0
		0	0	0	0	0	0	$\frac{\sqrt{10}i}{10}$
		0	0	$-\frac{\sqrt{6}i}{8}$	0	0	$-\frac{3\sqrt{10}i}{40}$	0
		0	$-\frac{\sqrt{6}i}{8}$	0	0	$\frac{3\sqrt{10}i}{40}$	0	0
		$-\frac{\sqrt{10}i}{10}$	0	0	0	0	0	0
206	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
	$\mathbb{M}_{4,0}^{(a)}(E_{2u},2)$	$\begin{pmatrix} \frac{\sqrt{210}i}{35} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{42}i}{28} & 0 & 0 & -\frac{\sqrt{70}i}{140} & 0 & 0 \\ 0 & 0 & \frac{\sqrt{42}i}{28} & 0 & 0 & \frac{\sqrt{70}i}{140} & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{42}i}{14} & 0 & 0 & 0 \end{pmatrix}$
207	symmetry	$\frac{\sqrt{5}xy\left(x^2+y^2-6z^2\right)}{2}$
	$\mathbb{M}_{4,1}^{(a)}(E_{2u},2)$	$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{210}i}{35} \\ 0 & 0 & 0 & -\frac{\sqrt{42}i}{14} & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{42}i}{56} & 0 & 0 & \frac{\sqrt{70}i}{40} & 0 \\ 0 & -\frac{\sqrt{42}i}{56} & 0 & 0 & \frac{\sqrt{70}i}{40} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$

bra: $= \langle f_{az}| , \langle f_1| , \langle f_2| , \langle f_{3x}| , \langle f_{3y}| , \langle f_3| , \langle f_{bz}|$

ket: $= |f_{az}\rangle , |f_1\rangle , |f_2\rangle , |f_{3x}\rangle , |f_{3y}\rangle , |f_3\rangle , |f_{bz}\rangle$

Table 10: (f,f) block.

No.	multipole	matrix
208	symmetry	1
	$\mathbb{Q}_0^{(a)}(A_g)$	$\begin{pmatrix} \frac{\sqrt{7}}{7} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{7}}{7} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{7}}{7} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{7}}{7} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{7} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{7} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}}{7} \end{pmatrix}$
209	symmetry	$-\frac{x^2}{2} - \frac{y^2}{2} + z^2$

continued ...

Table 10

No.	multipole	matrix

$$\mathbb{Q}_2^{(a)}(A_g) \quad \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{21}}{21} & 0 & 0 & \frac{\sqrt{35}}{14} & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{21}}{21} & 0 & 0 & -\frac{\sqrt{35}}{14} & 0 \\ 0 & 0 & 0 & \frac{2\sqrt{21}}{21} & 0 & 0 & 0 \\ 0 & \frac{\sqrt{35}}{14} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{35}}{14} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

210	symmetry	$\sqrt{3}yz$

$$\mathbb{Q}_{2,0}^{(a)}(E_{1g}) \quad \begin{bmatrix} 0 & -\frac{\sqrt{105}}{21} & 0 & 0 & 0 & 0 & 0 \\ -\frac{\sqrt{105}}{21} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{7}}{28} & 0 & 0 & -\frac{\sqrt{105}}{84} \\ 0 & 0 & -\frac{\sqrt{7}}{28} & 0 & 0 & \frac{\sqrt{105}}{84} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{105}}{84} & 0 & 0 & -\frac{5\sqrt{7}}{28} \\ 0 & 0 & -\frac{\sqrt{105}}{84} & 0 & 0 & -\frac{5\sqrt{7}}{28} & 0 \end{bmatrix}$$

211	symmetry	$-\sqrt{3}xz$

$$\mathbb{Q}_{2,1}^{(a)}(E_{1g}) \quad \begin{bmatrix} 0 & 0 & \frac{\sqrt{105}}{21} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{7}}{28} & 0 & 0 & -\frac{\sqrt{105}}{84} \\ \frac{\sqrt{105}}{21} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{7}}{28} & 0 & 0 & \frac{\sqrt{105}}{84} & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{105}}{84} & 0 & 0 & \frac{5\sqrt{7}}{28} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{105}}{84} & 0 & 0 & \frac{5\sqrt{7}}{28} & 0 & 0 \end{bmatrix}$$

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

Table 10

No.	multipole	matrix

$$\mathbb{Q}^{(a)}_{2,0}(E_{2g}) \qquad \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{7}}{7} & 0 & 0 & \frac{\sqrt{105}}{42} & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{7}}{7} & 0 & 0 & \frac{\sqrt{105}}{42} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{105}}{21} \\ 0 & \frac{\sqrt{105}}{42} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{105}}{42} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{105}}{21} & 0 & 0 & 0 \end{pmatrix}$$

| 213 | symmetry | $-\sqrt{3}xy$ |

$$\mathbb{Q}^{(a)}_{2,1}(E_{2g}) \qquad \begin{pmatrix} 0 & 0 & 0 & \frac{\sqrt{105}}{21} & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{7}}{28} & 0 & 0 & \frac{\sqrt{105}}{84} & 0 \\ 0 & \frac{\sqrt{7}}{28} & 0 & 0 & -\frac{\sqrt{105}}{84} & 0 & 0 \\ \frac{\sqrt{105}}{21} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{105}}{84} & 0 & 0 & \frac{5\sqrt{7}}{28} & 0 \\ 0 & \frac{\sqrt{105}}{84} & 0 & 0 & \frac{5\sqrt{7}}{28} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

| 214 | symmetry | $\frac{3x^4}{8} + \frac{3x^2y^2}{4} - 3x^2z^2 + \frac{3y^4}{8} - 3y^2z^2 + z^4$ |

$$\mathbb{Q}^{(a)}_4(A_g) \qquad \begin{pmatrix} -\frac{\sqrt{154}}{22} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{9\sqrt{154}}{616} & 0 & 0 & -\frac{\sqrt{2310}}{616} & 0 & 0 \\ 0 & 0 & \frac{9\sqrt{154}}{616} & 0 & 0 & \frac{\sqrt{2310}}{616} & 0 \\ 0 & 0 & 0 & \frac{3\sqrt{154}}{77} & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{2310}}{616} & 0 & 0 & \frac{\sqrt{154}}{88} & 0 & 0 \\ 0 & 0 & \frac{\sqrt{2310}}{616} & 0 & 0 & \frac{\sqrt{154}}{88} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{154}}{22} \end{pmatrix}$$

| 215 | symmetry | $\frac{\sqrt{70}xz(x^2-3y^2)}{4}$ |

continued ...

Table 10

No.	multipole	matrix

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

$$\begin{bmatrix} 0 & 0 & \frac{\sqrt{33}}{44} & 0 & 0 & -\frac{\sqrt{55}}{44} & 0 \\ 0 & 0 & 0 & -\frac{3\sqrt{55}}{44} & 0 & 0 & -\frac{\sqrt{33}}{44} \\ \frac{\sqrt{33}}{44} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{3\sqrt{55}}{44} & 0 & 0 & \frac{3\sqrt{33}}{44} & 0 & 0 \\ 0 & 0 & 0 & \frac{3\sqrt{33}}{44} & 0 & 0 & -\frac{\sqrt{55}}{44} \\ -\frac{\sqrt{55}}{44} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{33}}{44} & 0 & 0 & -\frac{\sqrt{55}}{44} & 0 & 0 \end{bmatrix}$$

216	symmetry	$\dfrac{\sqrt{70}yz\left(3x^2-y^2\right)}{4}$

$\mathbb{Q}_4^{(a)}(B_g,2)$

$$\begin{bmatrix} 0 & -\frac{\sqrt{33}}{44} & 0 & 0 & -\frac{\sqrt{55}}{44} & 0 & 0 \\ -\frac{\sqrt{33}}{44} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{3\sqrt{55}}{44} & 0 & 0 & -\frac{\sqrt{33}}{44} \\ 0 & 0 & \frac{3\sqrt{55}}{44} & 0 & 0 & \frac{3\sqrt{33}}{44} & 0 \\ -\frac{\sqrt{55}}{44} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{3\sqrt{33}}{44} & 0 & 0 & \frac{\sqrt{55}}{44} \\ 0 & 0 & -\frac{\sqrt{33}}{44} & 0 & 0 & \frac{\sqrt{55}}{44} & 0 \end{bmatrix}$$

217	symmetry	$-\dfrac{\sqrt{10}yz\left(3x^2+3y^2-4z^2\right)}{4}$

$\mathbb{Q}_{4,0}^{(a)}(E_{1g})$

$$\begin{bmatrix} 0 & \frac{\sqrt{231}}{308} & 0 & 0 & -\frac{\sqrt{385}}{44} & 0 & 0 \\ \frac{\sqrt{231}}{308} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{3\sqrt{385}}{308} & 0 & 0 & \frac{9\sqrt{231}}{308} \\ 0 & 0 & -\frac{3\sqrt{385}}{308} & 0 & 0 & \frac{5\sqrt{231}}{308} & 0 \\ -\frac{\sqrt{385}}{44} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{5\sqrt{231}}{308} & 0 & 0 & -\frac{\sqrt{385}}{308} \\ 0 & 0 & \frac{9\sqrt{231}}{308} & 0 & 0 & -\frac{\sqrt{385}}{308} & 0 \end{bmatrix}$$

218	symmetry	$\dfrac{\sqrt{10}xz\left(3x^2+3y^2-4z^2\right)}{4}$

continued ...

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Table 10

No.	multipole	matrix						
	$\mathbb{Q}_{4,1}^{(a)}(E_{1g})$	0	0	$-\frac{\sqrt{231}}{308}$	0	0	$-\frac{\sqrt{385}}{44}$	0
		0	0	0	$\frac{3\sqrt{385}}{308}$	0	0	$\frac{9\sqrt{231}}{308}$
		$-\frac{\sqrt{231}}{308}$	0	0	0	0	0	0
		0	$\frac{3\sqrt{385}}{308}$	0	0	$\frac{5\sqrt{231}}{308}$	0	0
		0	0	0	$\frac{5\sqrt{231}}{308}$	0	0	$\frac{\sqrt{385}}{308}$
		$-\frac{\sqrt{385}}{44}$	0	0	0	0	0	0
		0	$\frac{9\sqrt{231}}{308}$	0	0	$\frac{\sqrt{385}}{308}$	0	0

| 219 | symmetry | $\frac{\sqrt{35}\left(x^2-2xy-y^2\right)\left(x^2+2xy-y^2\right)}{8}$ |

No.	multipole	matrix						
	$\mathbb{Q}_{4,0}^{(a)}(E_{2g},1)$	$-\frac{\sqrt{110}}{22}$	0	0	0	0	0	0
		0	$\frac{3\sqrt{110}}{88}$	0	0	$\frac{\sqrt{66}}{88}$	0	0
		0	0	$\frac{3\sqrt{110}}{88}$	0	0	$-\frac{\sqrt{66}}{88}$	0
		0	0	0	0	0	0	0
		0	$\frac{\sqrt{66}}{88}$	0	0	$-\frac{3\sqrt{110}}{88}$	0	0
		0	0	$-\frac{\sqrt{66}}{88}$	0	0	$-\frac{3\sqrt{110}}{88}$	0
		0	0	0	0	0	0	$\frac{\sqrt{110}}{22}$

| 220 | symmetry | $\frac{\sqrt{35}xy(x-y)(x+y)}{2}$ |

No.	multipole	matrix						
	$\mathbb{Q}_{4,1}^{(a)}(E_{2g},1)$	0	0	0	0	0	0	$\frac{\sqrt{110}}{22}$
		0	0	0	0	0	$-\frac{\sqrt{66}}{22}$	0
		0	0	0	0	$-\frac{\sqrt{66}}{22}$	0	0
		0	0	0	0	0	0	0
		0	0	$-\frac{\sqrt{66}}{22}$	0	0	0	0
		0	$-\frac{\sqrt{66}}{22}$	0	0	0	0	0
		$\frac{\sqrt{110}}{22}$	0	0	0	0	0	0

| 221 | symmetry | $-\frac{\sqrt{5}(x-y)(x+y)\left(x^2+y^2-6z^2\right)}{4}$ |

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Table 10

No.	multipole	matrix

$\mathbb{Q}_{4,0}^{(a)}(E_{2g}, 2)$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{3\sqrt{770}}{308} & 0 & 0 & \frac{\sqrt{462}}{308} & 0 & 0 \\ 0 & 0 & \frac{3\sqrt{770}}{308} & 0 & 0 & \frac{\sqrt{462}}{308} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{462}}{154} \\ 0 & \frac{\sqrt{462}}{308} & 0 & 0 & \frac{\sqrt{770}}{44} & 0 & 0 \\ 0 & 0 & \frac{\sqrt{462}}{308} & 0 & 0 & -\frac{\sqrt{770}}{44} & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{462}}{154} & 0 & 0 & 0 \end{bmatrix}$$

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

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

$$\begin{bmatrix} 0 & 0 & 0 & \frac{\sqrt{462}}{154} & 0 & 0 & 0 \\ 0 & 0 & -\frac{3\sqrt{770}}{154} & 0 & 0 & \frac{\sqrt{462}}{77} & 0 \\ 0 & -\frac{3\sqrt{770}}{154} & 0 & 0 & -\frac{\sqrt{462}}{77} & 0 & 0 \\ \frac{\sqrt{462}}{154} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{462}}{77} & 0 & 0 & -\frac{\sqrt{770}}{154} & 0 \\ 0 & \frac{\sqrt{462}}{77} & 0 & 0 & -\frac{\sqrt{770}}{154} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

223	symmetry	$-\frac{5x^6}{16}-\frac{15x^4y^2}{16}+\frac{45x^4z^2}{8}-\frac{15x^2y^4}{16}+\frac{45x^2y^2z^2}{4}-\frac{15x^2z^4}{2}-\frac{5y^6}{16}+\frac{45y^4z^2}{8}-\frac{15y^2z^4}{2}+z^6$

$\mathbb{Q}_{6}^{(a)}(A_g, 1)$

$$\begin{bmatrix} \frac{\sqrt{231}}{77} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{25\sqrt{231}}{1848} & 0 & 0 & -\frac{\sqrt{385}}{88} & 0 & 0 \\ 0 & 0 & -\frac{25\sqrt{231}}{1848} & 0 & 0 & \frac{\sqrt{385}}{88} & 0 \\ 0 & 0 & 0 & \frac{10\sqrt{231}}{231} & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{385}}{88} & 0 & 0 & -\frac{13\sqrt{231}}{616} & 0 & 0 \\ 0 & 0 & \frac{\sqrt{385}}{88} & 0 & 0 & -\frac{13\sqrt{231}}{616} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{231}}{77} \end{bmatrix}$$

224	symmetry	$\frac{\sqrt{462}(x-y)(x+y)\left(x^2-4xy+y^2\right)\left(x^2+4xy+y^2\right)}{32}$

Table 10

No.	multipole	matrix

$$\mathbb{Q}_6^{(a)}(A_g,2)$$

$$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{5\sqrt{2}}{16} & 0 & 0 & -\frac{\sqrt{30}}{16} & 0 & 0 \\ 0 & 0 & -\frac{5\sqrt{2}}{16} & 0 & 0 & -\frac{\sqrt{30}}{16} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{30}}{16} & 0 & 0 & \frac{3\sqrt{2}}{16} & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{30}}{16} & 0 & 0 & -\frac{3\sqrt{2}}{16} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

| 225 | symmetry | $\dfrac{\sqrt{462}xy\left(x^2-3y^2\right)\left(3x^2-y^2\right)}{16}$ |

$$\mathbb{Q}_6^{(a)}(A_g,3)$$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{5\sqrt{2}}{16} & 0 & 0 & -\frac{\sqrt{30}}{16} & 0 \\ 0 & -\frac{5\sqrt{2}}{16} & 0 & 0 & \frac{\sqrt{30}}{16} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{30}}{16} & 0 & 0 & \frac{3\sqrt{2}}{16} & 0 \\ 0 & -\frac{\sqrt{30}}{16} & 0 & 0 & \frac{3\sqrt{2}}{16} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

| 226 | symmetry | $-\dfrac{\sqrt{210}xz\left(x^2-3y^2\right)\left(3x^2+3y^2-8z^2\right)}{16}$ |

$$\mathbb{Q}_6^{(a)}(B_g,1)$$

$$\begin{bmatrix} 0 & 0 & \frac{3\sqrt{66}}{88} & 0 & 0 & -\frac{3\sqrt{110}}{88} & 0 \\ 0 & 0 & 0 & \frac{\sqrt{110}}{44} & 0 & 0 & -\frac{3\sqrt{66}}{88} \\ \frac{3\sqrt{66}}{88} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{110}}{44} & 0 & 0 & -\frac{\sqrt{66}}{44} & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{66}}{44} & 0 & 0 & -\frac{3\sqrt{110}}{88} \\ -\frac{3\sqrt{110}}{88} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{3\sqrt{66}}{88} & 0 & 0 & -\frac{3\sqrt{110}}{88} & 0 & 0 \end{bmatrix}$$

| 227 | symmetry | $-\dfrac{\sqrt{210}yz\left(3x^2-y^2\right)\left(3x^2+3y^2-8z^2\right)}{16}$ |

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Table 10

No.	multipole	matrix

$\mathbb{Q}_6^{(a)}(B_g, 2)$

$$\begin{bmatrix} 0 & -\frac{3\sqrt{66}}{88} & 0 & 0 & -\frac{3\sqrt{110}}{88} & 0 & 0 \\ -\frac{3\sqrt{66}}{88} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{110}}{44} & 0 & 0 & -\frac{3\sqrt{66}}{88} \\ 0 & 0 & -\frac{\sqrt{110}}{44} & 0 & 0 & -\frac{\sqrt{66}}{44} & 0 \\ -\frac{3\sqrt{110}}{88} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{66}}{44} & 0 & 0 & \frac{3\sqrt{110}}{88} \\ 0 & 0 & -\frac{3\sqrt{66}}{88} & 0 & 0 & \frac{3\sqrt{110}}{88} & 0 \end{bmatrix}$$

228   symmetry

$$\frac{3\sqrt{154}\,yz\left(5x^4-10x^2y^2+y^4\right)}{16}$$

$\mathbb{Q}_{6,0}^{(a)}(E_{1g}, 1)$

$$\begin{bmatrix} 0 & \frac{\sqrt{10}}{8} & 0 & 0 & -\frac{\sqrt{6}}{8} & 0 & 0 \\ \frac{\sqrt{10}}{8} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}}{8} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ -\frac{\sqrt{6}}{8} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{8} \\ 0 & 0 & -\frac{\sqrt{10}}{8} & 0 & 0 & -\frac{\sqrt{6}}{8} & 0 \end{bmatrix}$$

229   symmetry

$$\frac{3\sqrt{154}\,xz\left(x^4-10x^2y^2+5y^4\right)}{16}$$

$\mathbb{Q}_{6,1}^{(a)}(E_{1g}, 1)$

$$\begin{bmatrix} 0 & 0 & \frac{\sqrt{10}}{8} & 0 & 0 & \frac{\sqrt{6}}{8} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}}{8} \\ \frac{\sqrt{10}}{8} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{8} \\ \frac{\sqrt{6}}{8} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{10}}{8} & 0 & 0 & -\frac{\sqrt{6}}{8} & 0 & 0 \end{bmatrix}$$

230   symmetry

$$\frac{\sqrt{21}\,yz\left(5x^4+10x^2y^2-20x^2z^2+5y^4-20y^2z^2+8z^4\right)}{8}$$

Table 10

No.	multipole	matrix

$\mathbb{Q}_{6,0}^{(a)}(E_{1g},2)$

$$\begin{bmatrix}
0 & \frac{\sqrt{165}}{132} & 0 & 0 & \frac{3\sqrt{11}}{44} & 0 & 0 \\
\frac{\sqrt{165}}{132} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & -\frac{5\sqrt{11}}{44} & 0 & 0 & -\frac{\sqrt{165}}{66} \\
0 & 0 & -\frac{5\sqrt{11}}{44} & 0 & 0 & \frac{5\sqrt{165}}{132} & 0 \\
\frac{3\sqrt{11}}{44} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{5\sqrt{165}}{132} & 0 & 0 & \frac{\sqrt{11}}{22} \\
0 & 0 & -\frac{\sqrt{165}}{66} & 0 & 0 & \frac{\sqrt{11}}{22} & 0
\end{bmatrix}$$

231   symmetry
$$-\frac{\sqrt{21}xz\left(5x^4+10x^2y^2-20x^2z^2+5y^4-20y^2z^2+8z^4\right)}{8}$$

$\mathbb{Q}_{6,1}^{(a)}(E_{1g},2)$

$$\begin{bmatrix}
0 & 0 & -\frac{\sqrt{165}}{132} & 0 & 0 & \frac{3\sqrt{11}}{44} & 0 \\
0 & 0 & 0 & \frac{5\sqrt{11}}{44} & 0 & 0 & -\frac{\sqrt{165}}{66} \\
-\frac{\sqrt{165}}{132} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{5\sqrt{11}}{44} & 0 & 0 & \frac{5\sqrt{165}}{132} & 0 & 0 \\
0 & 0 & 0 & \frac{5\sqrt{165}}{132} & 0 & 0 & -\frac{\sqrt{11}}{22} \\
\frac{3\sqrt{11}}{44} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{165}}{66} & 0 & 0 & -\frac{\sqrt{11}}{22} & 0 & 0
\end{bmatrix}$$

232   symmetry
$$-\frac{3\sqrt{7}\left(x^2+y^2-10z^2\right)\left(x^2-2xy-y^2\right)\left(x^2+2xy-y^2\right)}{16}$$

$\mathbb{Q}_{6,0}^{(a)}(E_{2g},1)$

$$\begin{bmatrix}
-\frac{\sqrt{33}}{11} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{5\sqrt{33}}{88} & 0 & 0 & -\frac{\sqrt{55}}{88} & 0 & 0 \\
0 & 0 & -\frac{5\sqrt{33}}{88} & 0 & 0 & \frac{\sqrt{55}}{88} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -\frac{\sqrt{55}}{88} & 0 & 0 & \frac{5\sqrt{33}}{88} & 0 & 0 \\
0 & 0 & \frac{\sqrt{55}}{88} & 0 & 0 & \frac{5\sqrt{33}}{88} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{33}}{11}
\end{bmatrix}$$

233   symmetry
$$-\frac{3\sqrt{7}xy(x-y)(x+y)\left(x^2+y^2-10z^2\right)}{4}$$

continued ...

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Table 10

No.	multipole	matrix

$\mathbb{Q}_{6,1}^{(a)}(E_{2g}, 1)$

$$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{33}}{11} \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{55}}{22} & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{55}}{22} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{55}}{22} & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{55}}{22} & 0 & 0 & 0 & 0 & 0 \\ \frac{\sqrt{33}}{11} & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

| 234 | symmetry | $\dfrac{\sqrt{210}(x-y)(x+y)\left(x^4+2x^2y^2-16x^2z^2+y^4-16y^2z^2+16z^4\right)}{32}$ |

$\mathbb{Q}_{6,0}^{(a)}(E_{2g}, 2)$

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{5\sqrt{110}}{176} & 0 & 0 & \frac{17\sqrt{66}}{528} & 0 & 0 \\ 0 & 0 & -\frac{5\sqrt{110}}{176} & 0 & 0 & \frac{17\sqrt{66}}{528} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{2\sqrt{66}}{33} \\ 0 & \frac{17\sqrt{66}}{528} & 0 & 0 & \frac{3\sqrt{110}}{176} & 0 & 0 \\ 0 & 0 & \frac{17\sqrt{66}}{528} & 0 & 0 & -\frac{3\sqrt{110}}{176} & 0 \\ 0 & 0 & 0 & \frac{2\sqrt{66}}{33} & 0 & 0 & 0 \end{bmatrix}$$

| 235 | symmetry | $-\dfrac{\sqrt{210}xy\left(x^4+2x^2y^2-16x^2z^2+y^4-16y^2z^2+16z^4\right)}{16}$ |

$\mathbb{Q}_{6,1}^{(a)}(E_{2g}, 2)$

$$\begin{bmatrix} 0 & 0 & 0 & -\frac{2\sqrt{66}}{33} & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{110}}{176} & 0 & 0 & \frac{13\sqrt{66}}{528} & 0 \\ 0 & -\frac{\sqrt{110}}{176} & 0 & 0 & -\frac{13\sqrt{66}}{528} & 0 & 0 \\ -\frac{2\sqrt{66}}{33} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{13\sqrt{66}}{528} & 0 & 0 & \frac{7\sqrt{110}}{176} & 0 \\ 0 & \frac{13\sqrt{66}}{528} & 0 & 0 & \frac{7\sqrt{110}}{176} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

| 236 | symmetry | z |

Table 10

No.	multipole	matrix

$$\mathbb{M}_1^{(a)}(A_g) = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{7} \\ 0 & 0 & \frac{3\sqrt{7}i}{28} & 0 & 0 & \frac{\sqrt{105}i}{28} & 0 \\ 0 & -\frac{3\sqrt{7}i}{28} & 0 & 0 & \frac{\sqrt{105}i}{28} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{105}i}{28} & 0 & 0 & -\frac{\sqrt{7}i}{28} & 0 \\ 0 & -\frac{\sqrt{105}i}{28} & 0 & 0 & \frac{\sqrt{7}i}{28} & 0 & 0 \\ -\frac{\sqrt{7}i}{7} & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

237	symmetry	x

$$\mathbb{M}_{1,0}^{(a)}(E_{1g}) = \begin{bmatrix} 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{7} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{3\sqrt{7}i}{28} & 0 & 0 & \frac{\sqrt{105}i}{28} \\ 0 & 0 & -\frac{3\sqrt{7}i}{28} & 0 & 0 & \frac{\sqrt{105}i}{28} & 0 \\ -\frac{\sqrt{7}i}{7} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{105}i}{28} & 0 & 0 & -\frac{\sqrt{7}i}{28} \\ 0 & 0 & -\frac{\sqrt{105}i}{28} & 0 & 0 & \frac{\sqrt{7}i}{28} & 0 \end{bmatrix}$$

238	symmetry	y

$$\mathbb{M}_{1,1}^{(a)}(E_{1g}) = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{7}i}{7} & 0 \\ 0 & 0 & 0 & -\frac{3\sqrt{7}i}{28} & 0 & 0 & \frac{\sqrt{105}i}{28} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{3\sqrt{7}i}{28} & 0 & 0 & \frac{\sqrt{105}i}{28} & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{105}i}{28} & 0 & 0 & \frac{\sqrt{7}i}{28} \\ -\frac{\sqrt{7}i}{7} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{105}i}{28} & 0 & 0 & -\frac{\sqrt{7}i}{28} & 0 & 0 \end{bmatrix}$$

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

Table 10

No.	multipole	matrix

<table>
<tr><td></td><td></td><td colspan="2">matrix</td></tr>
</table>

No.	multipole	matrix
	$\mathbb{M}_3^{(a)}(A_g)$	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{6} \\ 0 & 0 & -\frac{\sqrt{6}i}{6} & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{6}i}{6} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{6} & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{6} & 0 & 0 \\ -\frac{\sqrt{6}i}{6} & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
240	symmetry	$\frac{\sqrt{10}y(3x^2-y^2)}{4}$
	$\mathbb{M}_3^{(a)}(B_g,1)$	$\begin{bmatrix} 0 & 0 & \frac{i}{4} & 0 & 0 & -\frac{\sqrt{15}i}{12} & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{15}i}{12} & 0 & 0 & \frac{i}{4} \\ -\frac{i}{4} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{15}i}{12} & 0 & 0 & -\frac{i}{4} & 0 & 0 \\ 0 & 0 & 0 & \frac{i}{4} & 0 & 0 & \frac{\sqrt{15}i}{12} \\ \frac{\sqrt{15}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{i}{4} & 0 & 0 & -\frac{\sqrt{15}i}{12} & 0 & 0 \end{bmatrix}$
241	symmetry	$\frac{\sqrt{10}x(x^2-3y^2)}{4}$
	$\mathbb{M}_3^{(a)}(B_g,2)$	$\begin{bmatrix} 0 & \frac{i}{4} & 0 & 0 & \frac{\sqrt{15}i}{12} & 0 & 0 \\ -\frac{i}{4} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{15}i}{12} & 0 & 0 & -\frac{i}{4} \\ 0 & 0 & \frac{\sqrt{15}i}{12} & 0 & 0 & \frac{i}{4} & 0 \\ -\frac{\sqrt{15}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{i}{4} & 0 & 0 & \frac{\sqrt{15}i}{12} \\ 0 & 0 & \frac{i}{4} & 0 & 0 & -\frac{\sqrt{15}i}{12} & 0 \end{bmatrix}$
242	symmetry	$-\frac{\sqrt{6}x(x^2+y^2-4z^2)}{4}$

Table 10

No.	multipole	matrix

$$\mathbb{M}_{3,0}^{(a)}(E_{1g})$$

$$\begin{bmatrix} 0 & \frac{\sqrt{15}i}{12} & 0 & 0 & -\frac{i}{4} & 0 & 0 \\ -\frac{\sqrt{15}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{i}{4} & 0 & 0 & -\frac{\sqrt{15}i}{12} \\ 0 & 0 & -\frac{i}{4} & 0 & 0 & \frac{\sqrt{15}i}{12} & 0 \\ \frac{i}{4} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{15}i}{12} & 0 & 0 & -\frac{i}{4} \\ 0 & 0 & \frac{\sqrt{15}i}{12} & 0 & 0 & \frac{i}{4} & 0 \end{bmatrix}$$

| 243 | symmetry | $-\frac{\sqrt{6}y\left(x^2+y^2-4z^2\right)}{4}$ |

$$\mathbb{M}_{3,1}^{(a)}(E_{1g})$$

$$\begin{bmatrix} 0 & 0 & -\frac{\sqrt{15}i}{12} & 0 & 0 & -\frac{i}{4} & 0 \\ 0 & 0 & 0 & -\frac{i}{4} & 0 & 0 & -\frac{\sqrt{15}i}{12} \\ \frac{\sqrt{15}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{i}{4} & 0 & 0 & \frac{\sqrt{15}i}{12} & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{15}i}{12} & 0 & 0 & \frac{i}{4} \\ \frac{i}{4} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{15}i}{12} & 0 & 0 & -\frac{i}{4} & 0 & 0 \end{bmatrix}$$

| 244 | symmetry | $\sqrt{15}xyz$ |

$$\mathbb{M}_{3,0}^{(a)}(E_{2g})$$

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

| 245 | symmetry | $\frac{\sqrt{15}z(x-y)(x+y)}{2}$ |

continued ...

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Table 10

No.	multipole	matrix
	$\mathbb{M}_{3,1}^{(a)}(E_{2g})$	$\begin{bmatrix} 0 & 0 & 0 & -\frac{\sqrt{6}i}{6} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{6} & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{6} & 0 & 0 \\ \frac{\sqrt{6}i}{6} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{6}i}{6} & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{6}i}{6} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
246	symmetry	$\dfrac{z\left(15x^4+30x^2y^2-40x^2z^2+15y^4-40y^2z^2+8z^4\right)}{8}$
	$\mathbb{M}_5^{(a)}(A_g)$	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{21}i}{21} \\ 0 & 0 & -\frac{5\sqrt{21}i}{168} & 0 & 0 & \frac{3\sqrt{35}i}{56} & 0 \\ 0 & \frac{5\sqrt{21}i}{168} & 0 & 0 & \frac{3\sqrt{35}i}{56} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{3\sqrt{35}i}{56} & 0 & 0 & \frac{11\sqrt{21}i}{168} & 0 \\ 0 & -\frac{3\sqrt{35}i}{56} & 0 & 0 & -\frac{11\sqrt{21}i}{168} & 0 & 0 \\ \frac{2\sqrt{21}i}{21} & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
247	symmetry	$-\dfrac{\sqrt{70}y\left(3x^2-y^2\right)\left(x^2+y^2-8z^2\right)}{16}$
	$\mathbb{M}_5^{(a)}(B_g,1)$	$\begin{bmatrix} 0 & 0 & \frac{\sqrt{2}i}{8} & 0 & 0 & -\frac{\sqrt{30}i}{24} & 0 \\ 0 & 0 & 0 & \frac{\sqrt{30}i}{12} & 0 & 0 & \frac{\sqrt{2}i}{8} \\ -\frac{\sqrt{2}i}{8} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{30}i}{12} & 0 & 0 & \frac{\sqrt{2}i}{4} & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{2}i}{4} & 0 & 0 & \frac{\sqrt{30}i}{24} \\ \frac{\sqrt{30}i}{24} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{2}i}{8} & 0 & 0 & -\frac{\sqrt{30}i}{24} & 0 & 0 \end{bmatrix}$
248	symmetry	$-\dfrac{\sqrt{70}x\left(x^2-3y^2\right)\left(x^2+y^2-8z^2\right)}{16}$

Table 10

No.	multipole	matrix

$\mathbb{M}_5^{(a)}(B_g, 2)$

$$\begin{bmatrix} 0 & \frac{\sqrt{2}i}{8} & 0 & 0 & \frac{\sqrt{30}i}{24} & 0 & 0 \\ -\frac{\sqrt{2}i}{8} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{30}i}{12} & 0 & 0 & -\frac{\sqrt{2}i}{8} \\ 0 & 0 & -\frac{\sqrt{30}i}{12} & 0 & 0 & -\frac{\sqrt{2}i}{4} & 0 \\ -\frac{\sqrt{30}i}{24} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{2}i}{4} & 0 & 0 & \frac{\sqrt{30}i}{24} \\ 0 & 0 & \frac{\sqrt{2}i}{8} & 0 & 0 & -\frac{\sqrt{30}i}{24} & 0 \end{bmatrix}$$

249   symmetry $\frac{3\sqrt{14}x\left(x^4-10x^2y^2+5y^4\right)}{16}$

$\mathbb{M}_{5,0}^{(a)}(E_{1g}, 1)$

$$\begin{bmatrix} 0 & \frac{\sqrt{10}i}{8} & 0 & 0 & -\frac{\sqrt{6}i}{8} & 0 & 0 \\ -\frac{\sqrt{10}i}{8} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{10}i}{8} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \frac{\sqrt{6}i}{8} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{8} \\ 0 & 0 & -\frac{\sqrt{10}i}{8} & 0 & 0 & -\frac{\sqrt{6}i}{8} & 0 \end{bmatrix}$$

250   symmetry $-\frac{3\sqrt{14}y\left(5x^4-10x^2y^2+y^4\right)}{16}$

$\mathbb{M}_{5,1}^{(a)}(E_{1g}, 1)$

$$\begin{bmatrix} 0 & 0 & \frac{\sqrt{10}i}{8} & 0 & 0 & \frac{\sqrt{6}i}{8} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{10}i}{8} \\ -\frac{\sqrt{10}i}{8} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{8} \\ -\frac{\sqrt{6}i}{8} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{10}i}{8} & 0 & 0 & -\frac{\sqrt{6}i}{8} & 0 & 0 \end{bmatrix}$$

251   symmetry $\frac{\sqrt{15}x\left(x^4+2x^2y^2-12x^2z^2+y^4-12y^2z^2+8z^4\right)}{8}$

Table 10

No.	multipole	matrix

$\mathbb{M}_{5,0}^{(a)}(E_{1g}, 2)$

$$\begin{bmatrix} 0 & -\frac{\sqrt{21}i}{12} & 0 & 0 & -\frac{\sqrt{35}i}{28} & 0 & 0 \\ \frac{\sqrt{21}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{35}i}{28} & 0 & 0 & -\frac{\sqrt{21}i}{42} \\ 0 & 0 & -\frac{\sqrt{35}i}{28} & 0 & 0 & \frac{5\sqrt{21}i}{84} & 0 \\ \frac{\sqrt{35}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{5\sqrt{21}i}{84} & 0 & 0 & \frac{\sqrt{35}i}{14} \\ 0 & 0 & \frac{\sqrt{21}i}{42} & 0 & 0 & -\frac{\sqrt{35}i}{14} & 0 \end{bmatrix}$$

| 252 | symmetry | $\frac{\sqrt{15}y\left(x^4+2x^2y^2-12x^2z^2+y^4-12y^2z^2+8z^4\right)}{8}$ |

$\mathbb{M}_{5,1}^{(a)}(E_{1g}, 2)$

$$\begin{bmatrix} 0 & 0 & \frac{\sqrt{21}i}{12} & 0 & 0 & -\frac{\sqrt{35}i}{28} & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{35}i}{28} & 0 & 0 & -\frac{\sqrt{21}i}{42} \\ -\frac{\sqrt{21}i}{12} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{35}i}{28} & 0 & 0 & \frac{5\sqrt{21}i}{84} & 0 & 0 \\ 0 & 0 & 0 & -\frac{5\sqrt{21}i}{84} & 0 & 0 & -\frac{\sqrt{35}i}{14} \\ \frac{\sqrt{35}i}{28} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{21}i}{42} & 0 & 0 & \frac{\sqrt{35}i}{14} & 0 & 0 \end{bmatrix}$$

| 253 | symmetry | $-\frac{3\sqrt{35}xyz(x-y)(x+y)}{2}$ |

$\mathbb{M}_{5,0}^{(a)}(E_{2g}, 1)$

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

| 254 | 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

$\mathbb{M}_{5,1}^{(a)}(E_{2g},1)$

$$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{15}i}{8} & 0 & 0 & -\frac{i}{8} & 0 \\ 0 & -\frac{\sqrt{15}i}{8} & 0 & 0 & -\frac{i}{8} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{i}{8} & 0 & 0 & \frac{\sqrt{15}i}{8} & 0 \\ 0 & \frac{i}{8} & 0 & 0 & -\frac{\sqrt{15}i}{8} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

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

$\mathbb{M}_{5,0}^{(a)}(E_{2g},2)$

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

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

$\mathbb{M}_{5,1}^{(a)}(E_{2g},2)$

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