

# SAMB for “SrV03”

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- Group: No. 221  $O_h^1$   $Pm-3m$  [ cubic ]
- Associated point group: No. 32  $O_h$   $m-3m$  [ cubic ]
- Generation condition
  - model type: **tight\_binding**
  - time-reversal type: **electric**
  - irrep: **[A1g]**
  - **spinless**

- Unit cell:
  - $a = 3.8409$ ,  $b = 3.8409$ ,  $c = 3.8409$ ,  $\alpha = 90.0$ ,  $\beta = 90.0$ ,  $\gamma = 90.0$
- Lattice vectors:
  - $\mathbf{a}_1 = (3.8409 \ 0 \ 0)$
  - $\mathbf{a}_2 = (0 \ 3.8409 \ 0)$
  - $\mathbf{a}_3 = (0 \ 0 \ 3.8409)$

Table 1: High-symmetry line: R- $\Gamma$ -X-R-M- $\Gamma$ .

	symbol	position	symbol	position	symbol	position
	R	$\begin{pmatrix} \frac{1}{2} & \frac{1}{2} & \frac{1}{2} \end{pmatrix}$	$\Gamma$	$\begin{pmatrix} 0 & 0 & 0 \end{pmatrix}$	X	$\begin{pmatrix} \frac{1}{2} & 0 & 0 \end{pmatrix}$
	M	$\begin{pmatrix} \frac{1}{2} & \frac{1}{2} & 0 \end{pmatrix}$				

- Kets: dimension = 3

Table 2: Hilbert space for full matrix.

No.	ket	No.	ket	No.	ket
1	$d_{yz}@V_1$	2	$d_{zx}@V_1$	3	$d_{xy}@V_1$

- Sites in (primitive) unit cell:

Table 3: Site-clusters.

site	position	mapping
S <sub>1</sub> V <sub>1</sub>	$\begin{pmatrix} 0 & 0 & 0 \end{pmatrix}$	[1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48]

- Bonds in (primitive) unit cell:

Table 4: Bond-clusters.

bond	tail	head	$n$	#	$\mathbf{b@c}$	mapping
B <sub>1</sub>	b <sub>1</sub>	V <sub>1</sub> V <sub>1</sub>	1	1	$\begin{pmatrix} 0 & 0 & 1 \end{pmatrix} @ \begin{pmatrix} 0 & 0 & \frac{1}{2} \end{pmatrix}$	[1,2,-3,-4,-5,-8,19,22,-25,-26,27,28,29,32,-43,-46]
	b <sub>2</sub>	V <sub>1</sub> V <sub>1</sub>	1	1	$\begin{pmatrix} 1 & 0 & 0 \end{pmatrix} @ \begin{pmatrix} \frac{1}{2} & 0 & 0 \end{pmatrix}$	[6,-9,11,-12,13,-14,21,-24,-30,33,-35,36,-37,38,-45,48]
	b <sub>3</sub>	V <sub>1</sub> V <sub>1</sub>	1	1	$\begin{pmatrix} 0 & 1 & 0 \end{pmatrix} @ \begin{pmatrix} 0 & \frac{1}{2} & 0 \end{pmatrix}$	[7,-10,15,16,-17,-18,-20,23,-31,34,-39,-40,41,42,44,-47]
B <sub>2</sub>	b <sub>4</sub>	V <sub>1</sub> V <sub>1</sub>	2	1	$\begin{pmatrix} 0 & 1 & 1 \end{pmatrix} @ \begin{pmatrix} 0 & \frac{1}{2} & \frac{1}{2} \end{pmatrix}$	[1,-3,7,-10,-25,27,-31,34]
	b <sub>5</sub>	V <sub>1</sub> V <sub>1</sub>	2	1	$\begin{pmatrix} 0 & 1 & -1 \end{pmatrix} @ \begin{pmatrix} 0 & \frac{1}{2} & \frac{1}{2} \end{pmatrix}$	[-2,4,-20,23,26,-28,44,-47]
	b <sub>6</sub>	V <sub>1</sub> V <sub>1</sub>	2	1	$\begin{pmatrix} 1 & 0 & -1 \end{pmatrix} @ \begin{pmatrix} \frac{1}{2} & 0 & \frac{1}{2} \end{pmatrix}$	[5,-12,13,-19,-29,36,-37,43]
	b <sub>7</sub>	V <sub>1</sub> V <sub>1</sub>	2	1	$\begin{pmatrix} 1 & -1 & 0 \end{pmatrix} @ \begin{pmatrix} \frac{1}{2} & \frac{1}{2} & 0 \end{pmatrix}$	[6,-16,18,-24,-30,40,-42,48]
	b <sub>8</sub>	V <sub>1</sub> V <sub>1</sub>	2	1	$\begin{pmatrix} 1 & 0 & 1 \end{pmatrix} @ \begin{pmatrix} \frac{1}{2} & 0 & \frac{1}{2} \end{pmatrix}$	[-8,11,-14,22,32,-35,38,-46]
	b <sub>9</sub>	V <sub>1</sub> V <sub>1</sub>	2	1	$\begin{pmatrix} 1 & 1 & 0 \end{pmatrix} @ \begin{pmatrix} \frac{1}{2} & \frac{1}{2} & 0 \end{pmatrix}$	[-9,15,-17,21,33,-39,41,-45]

- SAMB:

$$\boxed{\text{No. 1}} \quad \hat{\mathbb{Q}}_0^{(A_{1g})} [\mathbf{M}_1, \mathbf{S}_1]$$

$$\hat{\mathbb{Z}}_1 = \mathbb{X}_1[\mathbb{Q}_0^{(a, A_{1g})}] \otimes \mathbb{Y}_1[\mathbb{Q}_0^{(s, A_{1g})}]$$

$$\hat{\mathbb{Z}}_1(\mathbf{k}) = \mathbb{X}_1[\mathbb{Q}_0^{(a, A_{1g})}] \otimes \mathbb{U}_1[\mathbb{Q}_0^{(s, A_{1g})}]$$

$$\boxed{\text{No. 2}} \quad \hat{\mathbb{Q}}_0^{(A_{1g})} [\mathbf{M}_1, \mathbf{B}_1]$$

$$\hat{\mathbb{Z}}_2 = \mathbb{X}_1[\mathbb{Q}_0^{(a, A_{1g})}] \otimes \mathbb{Y}_2[\mathbb{Q}_0^{(b, A_{1g})}]$$

$$\hat{\mathbb{Z}}_2(\mathbf{k}) = \mathbb{X}_1[\mathbb{Q}_0^{(a, A_{1g})}] \otimes \mathbb{U}_1[\mathbb{Q}_0^{(s, A_{1g})}] \otimes \mathbb{F}_1[\mathbb{Q}_0^{(k, A_{1g})}]$$

$$\boxed{\text{No. 3}} \quad \hat{\mathbb{Q}}_0^{(A_{1g})} [\mathbf{M}_1, \mathbf{B}_1]$$

$$\hat{\mathbb{Z}}_3 = \frac{\sqrt{2}\mathbb{X}_2[\mathbb{Q}_{2,0}^{(a, E_g)}] \otimes \mathbb{Y}_3[\mathbb{Q}_{2,0}^{(b, E_g)}]}{2} + \frac{\sqrt{2}\mathbb{X}_3[\mathbb{Q}_{2,1}^{(a, E_g)}] \otimes \mathbb{Y}_4[\mathbb{Q}_{2,1}^{(b, E_g)}]}{2}$$

$$\hat{\mathbb{Z}}_3(\mathbf{k}) = \frac{\sqrt{2}\mathbb{X}_2[\mathbb{Q}_{2,0}^{(a, E_g)}] \otimes \mathbb{U}_1[\mathbb{Q}_0^{(s, A_{1g})}] \otimes \mathbb{F}_2[\mathbb{Q}_{2,0}^{(k, E_g)}]}{2} + \frac{\sqrt{2}\mathbb{X}_3[\mathbb{Q}_{2,1}^{(a, E_g)}] \otimes \mathbb{U}_1[\mathbb{Q}_0^{(s, A_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,1}^{(k, E_g)}]}{2}$$

$$\boxed{\text{No. 4}} \quad \hat{\mathbb{Q}}_0^{(A_{1g})} [\mathbf{M}_1, \mathbf{B}_2]$$

$$\hat{\mathbb{Z}}_4 = \mathbb{X}_1[\mathbb{Q}_0^{(a, A_{1g})}] \otimes \mathbb{Y}_5[\mathbb{Q}_0^{(b, A_{1g})}]$$

$$\hat{\mathbb{Z}}_4(\mathbf{k}) = \mathbb{X}_1[\mathbb{Q}_0^{(a, A_{1g})}] \otimes \mathbb{U}_1[\mathbb{Q}_0^{(s, A_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_0^{(k, A_{1g})}]$$

$$\boxed{\text{No. 5}} \quad \hat{\mathbb{Q}}_0^{(A_{1g})} [\mathbf{M}_1, \mathbf{B}_2]$$

$$\hat{\mathbb{Z}}_5 = \frac{\sqrt{5}\mathbb{X}_2[\mathbb{Q}_{2,0}^{(a, E_g)}] \otimes \mathbb{Y}_6[\mathbb{Q}_{2,0}^{(b, E_g)}]}{5} + \frac{\sqrt{5}\mathbb{X}_3[\mathbb{Q}_{2,1}^{(a, E_g)}] \otimes \mathbb{Y}_7[\mathbb{Q}_{2,1}^{(b, E_g)}]}{5} + \frac{\sqrt{5}\mathbb{X}_4[\mathbb{Q}_{2,0}^{(a, T_{2g})}] \otimes \mathbb{Y}_8[\mathbb{Q}_{2,0}^{(b, T_{2g})}]}{5} + \frac{\sqrt{5}\mathbb{X}_5[\mathbb{Q}_{2,1}^{(a, T_{2g})}] \otimes \mathbb{Y}_9[\mathbb{Q}_{2,1}^{(b, T_{2g})}]}{5} + \frac{\sqrt{5}\mathbb{X}_6[\mathbb{Q}_{2,2}^{(a, T_{2g})}] \otimes \mathbb{Y}_{10}[\mathbb{Q}_{2,2}^{(b, T_{2g})}]}{5}$$

$$\begin{aligned} \hat{\mathbb{Z}}_5(\mathbf{k}) = & \frac{\sqrt{5}\mathbb{X}_2[\mathbb{Q}_{2,0}^{(a, E_g)}] \otimes \mathbb{U}_1[\mathbb{Q}_0^{(s, A_{1g})}] \otimes \mathbb{F}_5[\mathbb{Q}_{2,0}^{(k, E_g)}]}{5} + \frac{\sqrt{5}\mathbb{X}_3[\mathbb{Q}_{2,1}^{(a, E_g)}] \otimes \mathbb{U}_1[\mathbb{Q}_0^{(s, A_{1g})}] \otimes \mathbb{F}_6[\mathbb{Q}_{2,1}^{(k, E_g)}]}{5} + \frac{\sqrt{5}\mathbb{X}_4[\mathbb{Q}_{2,0}^{(a, T_{2g})}] \otimes \mathbb{U}_1[\mathbb{Q}_0^{(s, A_{1g})}] \otimes \mathbb{F}_7[\mathbb{Q}_{2,0}^{(k, T_{2g})}]}{5} \\ & + \frac{\sqrt{5}\mathbb{X}_5[\mathbb{Q}_{2,1}^{(a, T_{2g})}] \otimes \mathbb{U}_1[\mathbb{Q}_0^{(s, A_{1g})}] \otimes \mathbb{F}_8[\mathbb{Q}_{2,1}^{(k, T_{2g})}]}{5} + \frac{\sqrt{5}\mathbb{X}_6[\mathbb{Q}_{2,2}^{(a, T_{2g})}] \otimes \mathbb{U}_1[\mathbb{Q}_0^{(s, A_{1g})}] \otimes \mathbb{F}_9[\mathbb{Q}_{2,2}^{(k, T_{2g})}]}{5} \end{aligned}$$

$$\boxed{\text{No. 6}} \quad \hat{\mathbb{Q}}_4^{(A_{1g})} [\text{M}_1, \text{B}_2]$$

$$\begin{aligned} \hat{\mathbb{Z}}_6 = & \frac{\sqrt{30}\mathbb{X}_2[\mathbb{Q}_{2,0}^{(a,E_g)}] \otimes \mathbb{Y}_6[\mathbb{Q}_{2,0}^{(b,E_g)}]}{10} + \frac{\sqrt{30}\mathbb{X}_3[\mathbb{Q}_{2,1}^{(a,E_g)}] \otimes \mathbb{Y}_7[\mathbb{Q}_{2,1}^{(b,E_g)}]}{10} - \frac{\sqrt{30}\mathbb{X}_4[\mathbb{Q}_{2,0}^{(a,T_{2g})}] \otimes \mathbb{Y}_8[\mathbb{Q}_{2,0}^{(b,T_{2g})}]}{15} \\ & - \frac{\sqrt{30}\mathbb{X}_5[\mathbb{Q}_{2,1}^{(a,T_{2g})}] \otimes \mathbb{Y}_9[\mathbb{Q}_{2,1}^{(b,T_{2g})}]}{15} - \frac{\sqrt{30}\mathbb{X}_6[\mathbb{Q}_{2,2}^{(a,T_{2g})}] \otimes \mathbb{Y}_{10}[\mathbb{Q}_{2,2}^{(b,T_{2g})}]}{15} \\ \hat{\mathbb{Z}}_6(\mathbf{k}) = & \frac{\sqrt{30}\mathbb{X}_2[\mathbb{Q}_{2,0}^{(a,E_g)}] \otimes \mathbb{U}_1[\mathbb{Q}_0^{(s,A_{1g})}] \otimes \mathbb{F}_5[\mathbb{Q}_{2,0}^{(k,E_g)}]}{10} + \frac{\sqrt{30}\mathbb{X}_3[\mathbb{Q}_{2,1}^{(a,E_g)}] \otimes \mathbb{U}_1[\mathbb{Q}_0^{(s,A_{1g})}] \otimes \mathbb{F}_6[\mathbb{Q}_{2,1}^{(k,E_g)}]}{10} - \frac{\sqrt{30}\mathbb{X}_4[\mathbb{Q}_{2,0}^{(a,T_{2g})}] \otimes \mathbb{U}_1[\mathbb{Q}_0^{(s,A_{1g})}] \otimes \mathbb{F}_7[\mathbb{Q}_{2,0}^{(k,T_{2g})}]}{15} \\ & - \frac{\sqrt{30}\mathbb{X}_5[\mathbb{Q}_{2,1}^{(a,T_{2g})}] \otimes \mathbb{U}_1[\mathbb{Q}_0^{(s,A_{1g})}] \otimes \mathbb{F}_8[\mathbb{Q}_{2,1}^{(k,T_{2g})}]}{15} - \frac{\sqrt{30}\mathbb{X}_6[\mathbb{Q}_{2,2}^{(a,T_{2g})}] \otimes \mathbb{U}_1[\mathbb{Q}_0^{(s,A_{1g})}] \otimes \mathbb{F}_9[\mathbb{Q}_{2,2}^{(k,T_{2g})}]}{15} \end{aligned}$$

Table 5: Atomic SAMB group.

group	bra	ket
M <sub>1</sub>	$d_{yz}, d_{zx}, d_{xy}$	$d_{yz}, d_{zx}, d_{xy}$

Table 6: Atomic SAMB.

symbol	type	group	form
$\mathbb{X}_1$	$\mathbb{Q}_0^{(a,A_{1g})}$	M <sub>1</sub>	$\begin{pmatrix} \frac{\sqrt{3}}{3} & 0 & 0 \\ 0 & \frac{\sqrt{3}}{3} & 0 \\ 0 & 0 & \frac{\sqrt{3}}{3} \end{pmatrix}$
$\mathbb{X}_2$	$\mathbb{Q}_{2,0}^{(a,E_g)}$	M <sub>1</sub>	$\begin{pmatrix} \frac{\sqrt{6}}{6} & 0 & 0 \\ 0 & \frac{\sqrt{6}}{6} & 0 \\ 0 & 0 & -\frac{\sqrt{6}}{3} \end{pmatrix}$
$\mathbb{X}_3$	$\mathbb{Q}_{2,1}^{(a,E_g)}$	M <sub>1</sub>	$\begin{pmatrix} -\frac{\sqrt{2}}{2} & 0 & 0 \\ 0 & \frac{\sqrt{2}}{2} & 0 \\ 0 & 0 & 0 \end{pmatrix}$

*continued ...*

Table 6

symbol	type	group	form
$\mathbb{X}_4$	$\mathbb{Q}_{2,0}^{(a,T_{2g})}$	$M_1$	$\begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{2}}{2} \\ 0 & \frac{\sqrt{2}}{2} & 0 \end{pmatrix}$
$\mathbb{X}_5$	$\mathbb{Q}_{2,1}^{(a,T_{2g})}$	$M_1$	$\begin{pmatrix} 0 & 0 & \frac{\sqrt{2}}{2} \\ 0 & 0 & 0 \\ \frac{\sqrt{2}}{2} & 0 & 0 \end{pmatrix}$
$\mathbb{X}_6$	$\mathbb{Q}_{2,2}^{(a,T_{2g})}$	$M_1$	$\begin{pmatrix} 0 & \frac{\sqrt{2}}{2} & 0 \\ \frac{\sqrt{2}}{2} & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$

Table 7: Cluster SAMB.

symbol	type	cluster	form
$\mathbb{Y}_1$	$\mathbb{Q}_0^{(s,A_{1g})}$	$S_1$	$\begin{pmatrix} 1 \end{pmatrix}$
$\mathbb{Y}_2$	$\mathbb{Q}_0^{(b,A_{1g})}$	$B_1$	$\begin{pmatrix} \frac{\sqrt{3}}{3} & \frac{\sqrt{3}}{3} & \frac{\sqrt{3}}{3} \end{pmatrix}$
$\mathbb{Y}_3$	$\mathbb{Q}_{2,0}^{(b,E_g)}$	$B_1$	$\begin{pmatrix} -\frac{\sqrt{6}}{3} & \frac{\sqrt{6}}{6} & \frac{\sqrt{6}}{6} \end{pmatrix}$
$\mathbb{Y}_4$	$\mathbb{Q}_{2,1}^{(b,E_g)}$	$B_1$	$\begin{pmatrix} 0 & -\frac{\sqrt{2}}{2} & \frac{\sqrt{2}}{2} \end{pmatrix}$
$\mathbb{Y}_5$	$\mathbb{Q}_0^{(b,A_{1g})}$	$B_2$	$\begin{pmatrix} \frac{\sqrt{6}}{6} & \frac{\sqrt{6}}{6} & \frac{\sqrt{6}}{6} & \frac{\sqrt{6}}{6} & \frac{\sqrt{6}}{6} & \frac{\sqrt{6}}{6} \end{pmatrix}$
$\mathbb{Y}_6$	$\mathbb{Q}_{2,0}^{(b,E_g)}$	$B_2$	$\begin{pmatrix} -\frac{\sqrt{3}}{6} & -\frac{\sqrt{3}}{6} & -\frac{\sqrt{3}}{6} & \frac{\sqrt{3}}{3} & -\frac{\sqrt{3}}{6} & \frac{\sqrt{3}}{3} \end{pmatrix}$
$\mathbb{Y}_7$	$\mathbb{Q}_{2,1}^{(b,E_g)}$	$B_2$	$\begin{pmatrix} \frac{1}{2} & \frac{1}{2} & -\frac{1}{2} & 0 & -\frac{1}{2} & 0 \end{pmatrix}$
$\mathbb{Y}_8$	$\mathbb{Q}_{2,0}^{(b,T_{2g})}$	$B_2$	$\begin{pmatrix} \frac{\sqrt{2}}{2} & -\frac{\sqrt{2}}{2} & 0 & 0 & 0 & 0 \end{pmatrix}$
$\mathbb{Y}_9$	$\mathbb{Q}_{2,1}^{(b,T_{2g})}$	$B_2$	$\begin{pmatrix} 0 & 0 & -\frac{\sqrt{2}}{2} & 0 & \frac{\sqrt{2}}{2} & 0 \end{pmatrix}$
$\mathbb{Y}_{10}$	$\mathbb{Q}_{2,2}^{(b,T_{2g})}$	$B_2$	$\begin{pmatrix} 0 & 0 & 0 & -\frac{\sqrt{2}}{2} & 0 & \frac{\sqrt{2}}{2} \end{pmatrix}$

Table 8: Uniform SAMB.

symbol	type	cluster	form
$\mathbb{U}_1$	$\mathbb{Q}_0^{(s, A_{1g})}$	$S_1$	$\begin{pmatrix} 1 \end{pmatrix}$

Table 9: Structure SAMB.

symbol	type	cluster	form
$\mathbb{F}_1$	$\mathbb{Q}_0^{(k, A_{1g})}$	$B_1$	$\frac{\sqrt{6}c_{001}}{3} + \frac{\sqrt{6}c_{002}}{3} + \frac{\sqrt{6}c_{003}}{3}$
$\mathbb{F}_2$	$\mathbb{Q}_{2,0}^{(k, E_g)}$	$B_1$	$-\frac{2\sqrt{3}c_{001}}{3} + \frac{\sqrt{3}c_{002}}{3} + \frac{\sqrt{3}c_{003}}{3}$
$\mathbb{F}_3$	$\mathbb{Q}_{2,1}^{(k, E_g)}$	$B_1$	$-c_{002} + c_{003}$
$\mathbb{F}_4$	$\mathbb{Q}_0^{(k, A_{1g})}$	$B_2$	$\frac{\sqrt{3}c_{004}}{3} + \frac{\sqrt{3}c_{005}}{3} + \frac{\sqrt{3}c_{006}}{3} + \frac{\sqrt{3}c_{007}}{3} + \frac{\sqrt{3}c_{008}}{3} + \frac{\sqrt{3}c_{009}}{3}$
$\mathbb{F}_5$	$\mathbb{Q}_{2,0}^{(k, E_g)}$	$B_2$	$-\frac{\sqrt{6}c_{004}}{6} - \frac{\sqrt{6}c_{005}}{6} - \frac{\sqrt{6}c_{006}}{6} + \frac{\sqrt{6}c_{007}}{3} - \frac{\sqrt{6}c_{008}}{6} + \frac{\sqrt{6}c_{009}}{3}$
$\mathbb{F}_6$	$\mathbb{Q}_{2,1}^{(k, E_g)}$	$B_2$	$\frac{\sqrt{2}c_{004}}{2} + \frac{\sqrt{2}c_{005}}{2} - \frac{\sqrt{2}c_{006}}{2} - \frac{\sqrt{2}c_{008}}{2}$
$\mathbb{F}_7$	$\mathbb{Q}_{2,0}^{(k, T_{2g})}$	$B_2$	$c_{004} - c_{005}$
$\mathbb{F}_8$	$\mathbb{Q}_{2,1}^{(k, T_{2g})}$	$B_2$	$-c_{006} + c_{008}$
$\mathbb{F}_9$	$\mathbb{Q}_{2,2}^{(k, T_{2g})}$	$B_2$	$-c_{007} + c_{009}$

Table 10: Polar harmonics.

No.	symbol	rank	irrep.	mul.	comp.	form
1	$\mathbb{Q}_0^{(A_{1g})}$	0	$A_{1g}$	—	—	1
2	$\mathbb{Q}_{2,0}^{(E_g)}$	2	$E_g$	—	0	$-\frac{x^2}{2} - \frac{y^2}{2} + z^2$
3	$\mathbb{Q}_{2,1}^{(E_g)}$	2	$E_g$	—	1	$\frac{\sqrt{3}(x-y)(x+y)}{2}$
4	$\mathbb{Q}_{2,0}^{(T_{2g})}$	2	$T_{2g}$	—	0	$\sqrt{3}yz$
5	$\mathbb{Q}_{2,1}^{(T_{2g})}$	2	$T_{2g}$	—	1	$\sqrt{3}xz$

continued ...

Table 10

No.	symbol	rank	irrep.	mul.	comp.	form
6	$\mathbb{Q}_{2,2}^{(T_{2g})}$	2	$T_{2g}$	—	2	$\sqrt{3}xy$

- Group info.: Generator =  $\{2_{001}|0\}$ ,  $\{2_{010}|0\}$ ,  $\{3_{111}^+|0\}$ ,  $\{2_{110}|0\}$ ,  $\{-1|0\}$

Table 11: Conjugacy class (point-group part).

rep. SO	symmetry operations
$\{1 0\}$	$\{1 0\}$
$\{2_{001} 0\}$	$\{2_{001} 0\}$ , $\{2_{100} 0\}$ , $\{2_{010} 0\}$
$\{2_{110} 0\}$	$\{2_{110} 0\}$ , $\{2_{101} 0\}$ , $\{2_{011} 0\}$ , $\{2_{1-10} 0\}$ , $\{2_{-101} 0\}$ , $\{2_{01-1} 0\}$
$\{3_{111}^+ 0\}$	$\{3_{111}^+ 0\}$ , $\{3_{1-1-1}^+ 0\}$ , $\{3_{-11-1}^+ 0\}$ , $\{3_{-1-11}^+ 0\}$ , $\{3_{-111}^- 0\}$ , $\{3_{1-1-1}^- 0\}$ , $\{3_{-11-1}^- 0\}$ , $\{3_{-1-11}^- 0\}$
$\{4_{001}^+ 0\}$	$\{4_{001}^+ 0\}$ , $\{4_{100}^+ 0\}$ , $\{4_{010}^+ 0\}$ , $\{4_{001}^- 0\}$ , $\{4_{100}^- 0\}$ , $\{4_{010}^- 0\}$
$\{-1 0\}$	$\{-1 0\}$
$\{m_{001} 0\}$	$\{m_{001} 0\}$ , $\{m_{100} 0\}$ , $\{m_{010} 0\}$
$\{m_{110} 0\}$	$\{m_{110} 0\}$ , $\{m_{101} 0\}$ , $\{m_{011} 0\}$ , $\{m_{1-10} 0\}$ , $\{m_{-101} 0\}$ , $\{m_{01-1} 0\}$
$\{-3_{111}^+ 0\}$	$\{-3_{111}^+ 0\}$ , $\{-3_{1-1-1}^+ 0\}$ , $\{-3_{-11-1}^+ 0\}$ , $\{-3_{-1-11}^+ 0\}$ , $\{-3_{-111}^- 0\}$ , $\{-3_{1-1-1}^- 0\}$ , $\{-3_{-11-1}^- 0\}$ , $\{-3_{-1-11}^- 0\}$
$\{-4_{001}^+ 0\}$	$\{-4_{001}^+ 0\}$ , $\{-4_{100}^+ 0\}$ , $\{-4_{010}^+ 0\}$ , $\{-4_{001}^- 0\}$ , $\{-4_{100}^- 0\}$ , $\{-4_{010}^- 0\}$

Table 12: Symmetry operations.

No.	SO	No.	SO	No.	SO	No.	SO	No.	SO
1	$\{1 0\}$	2	$\{2_{001} 0\}$	3	$\{2_{100} 0\}$	4	$\{2_{010} 0\}$	5	$\{2_{110} 0\}$
6	$\{2_{101} 0\}$	7	$\{2_{011} 0\}$	8	$\{2_{1-10} 0\}$	9	$\{2_{-101} 0\}$	10	$\{2_{01-1} 0\}$
11	$\{3_{111}^+ 0\}$	12	$\{3_{1-1-1}^+ 0\}$	13	$\{3_{-11-1}^+ 0\}$	14	$\{3_{-1-11}^+ 0\}$	15	$\{3_{-111}^- 0\}$
16	$\{3_{1-1-1}^- 0\}$	17	$\{3_{-11-1}^- 0\}$	18	$\{3_{-1-11}^- 0\}$	19	$\{4_{001}^+ 0\}$	20	$\{4_{100}^+ 0\}$

continued ...

Table 12

No.	SO	No.	SO	No.	SO	No.	SO	No.	SO
21	$\{4^+_{010} 0\}$	22	$\{4^-_{001} 0\}$	23	$\{4^-_{100} 0\}$	24	$\{4^-_{010} 0\}$	25	$\{-1 0\}$
26	$\{m_{001} 0\}$	27	$\{m_{100} 0\}$	28	$\{m_{010} 0\}$	29	$\{m_{110} 0\}$	30	$\{m_{101} 0\}$
31	$\{m_{011} 0\}$	32	$\{m_{1-10} 0\}$	33	$\{m_{-101} 0\}$	34	$\{m_{01-1} 0\}$	35	$\{-3^+_{111} 0\}$
36	$\{-3^+_{1-1-1} 0\}$	37	$\{-3^+_{-11-1} 0\}$	38	$\{-3^+_{-1-11} 0\}$	39	$\{-3^-_{111} 0\}$	40	$\{-3^-_{1-1-1} 0\}$
41	$\{-3^-_{-11-1} 0\}$	42	$\{-3^-_{-1-11} 0\}$	43	$\{-4^+_{001} 0\}$	44	$\{-4^+_{100} 0\}$	45	$\{-4^+_{010} 0\}$
46	$\{-4^-_{001} 0\}$	47	$\{-4^-_{100} 0\}$	48	$\{-4^-_{010} 0\}$				

Table 13: Character table (point-group part).

	1	2 <sub>001</sub>	2 <sub>110</sub>	3 <sup>+</sup> <sub>111</sub>	4 <sup>+</sup> <sub>001</sub>	-1	m <sub>001</sub>	m <sub>110</sub>	-3 <sup>+</sup> <sub>111</sub>	-4 <sup>+</sup> <sub>001</sub>
$A_{1g}$	1	1	1	1	1	1	1	1	1	1
$A_{2g}$	1	1	-1	1	-1	1	1	-1	1	-1
$E_g$	2	2	0	-1	0	2	2	0	-1	0
$T_{1g}$	3	-1	-1	0	1	3	-1	-1	0	1
$T_{2g}$	3	-1	1	0	-1	3	-1	1	0	-1
$A_{1u}$	1	1	1	1	1	-1	-1	-1	-1	-1
$A_{2u}$	1	1	-1	1	-1	-1	-1	1	-1	1
$E_u$	2	2	0	-1	0	-2	-2	0	1	0
$T_{1u}$	3	-1	-1	0	1	-3	1	1	0	-1
$T_{2u}$	3	-1	1	0	-1	-3	1	-1	0	1

Table 14: Parity conversion.

$\leftrightarrow$	$\leftrightarrow$	$\leftrightarrow$	$\leftrightarrow$	$\leftrightarrow$
$A_{1g} (A_{1u})$	$A_{2g} (A_{2u})$	$E_g (E_u)$	$T_{1g} (T_{1u})$	$T_{2g} (T_{2u})$
$A_{1u} (A_{1g})$	$A_{2u} (A_{2g})$	$E_u (E_g)$	$T_{1u} (T_{1g})$	$T_{2u} (T_{2g})$



Table 15: Symmetric product,  $[\Gamma \otimes \Gamma']_+$ .

	$A_{1g}$	$A_{2g}$	$E_g$	$T_{1g}$	$T_{2g}$	$A_{1u}$	$A_{2u}$	$E_u$	$T_{1u}$	$T_{2u}$
$A_{1g}$	$A_{1g}$	$A_{2g}$	$E_g$	$T_{1g}$	$T_{2g}$	$A_{1u}$	$A_{2u}$	$E_u$	$T_{1u}$	$T_{2u}$
$A_{2g}$		$A_{1g}$	$E_g$	$T_{2g}$	$T_{1g}$	$A_{2u}$	$A_{1u}$	$E_u$	$T_{2u}$	$T_{1u}$
$E_g$			$A_{1g} + E_g$	$T_{1g} + T_{2g}$	$T_{1g} + T_{2g}$	$E_u$	$E_u$	$A_{1u} + A_{2u} + E_u$	$T_{1u} + T_{2u}$	$T_{1u} + T_{2u}$
$T_{1g}$				$A_{1g} + E_g + T_{2g}$	$A_{2g} + E_g + T_{1g} + T_{2g}$	$T_{1u}$	$T_{2u}$	$T_{1u} + T_{2u}$	$A_{1u} + E_u + T_{1u} + T_{2u}$	$A_{2u} + E_u + T_{1u} + T_{2u}$
$T_{2g}$					$A_{1g} + E_g + T_{2g}$	$T_{2u}$	$T_{1u}$	$T_{1u} + T_{2u}$	$A_{2u} + E_u + T_{1u} + T_{2u}$	$A_{1u} + E_u + T_{1u} + T_{2u}$
$A_{1u}$						$A_{1g}$	$A_{2g}$	$E_g$	$T_{1g}$	$T_{2g}$
$A_{2u}$							$A_{1g}$	$E_g$	$T_{2g}$	$T_{1g}$
$E_u$								$A_{1g} + E_g$	$T_{1g} + T_{2g}$	$T_{1g} + T_{2g}$
$T_{1u}$									$A_{1g} + E_g + T_{2g}$	$A_{2g} + E_g + T_{1g} + T_{2g}$
$T_{2u}$										$A_{1g} + E_g + T_{2g}$

Table 16: Anti-symmetric product,  $[\Gamma \otimes \Gamma]_-$ .

$A_{1g}$	$A_{2g}$	$E_g$	$T_{1g}$	$T_{2g}$	$A_{1u}$	$A_{2u}$	$E_u$	$T_{1u}$	$T_{2u}$
$-$	$-$	$A_{2g}$	$T_{1g}$	$T_{1g}$	$-$	$-$	$A_{2g}$	$T_{1g}$	$T_{1g}$

Table 17: Virtual-cluster sites.

No.	position	No.	position	No.	position	No.	position
1	$\begin{pmatrix} 3 & 2 & 1 \end{pmatrix}$	2	$\begin{pmatrix} -3 & -2 & 1 \end{pmatrix}$	3	$\begin{pmatrix} 3 & -2 & -1 \end{pmatrix}$	4	$\begin{pmatrix} -3 & 2 & -1 \end{pmatrix}$
5	$\begin{pmatrix} 2 & 3 & -1 \end{pmatrix}$	6	$\begin{pmatrix} 1 & -2 & 3 \end{pmatrix}$	7	$\begin{pmatrix} -3 & 1 & 2 \end{pmatrix}$	8	$\begin{pmatrix} -2 & -3 & -1 \end{pmatrix}$
9	$\begin{pmatrix} -1 & -2 & -3 \end{pmatrix}$	10	$\begin{pmatrix} -3 & -1 & -2 \end{pmatrix}$	11	$\begin{pmatrix} 1 & 3 & 2 \end{pmatrix}$	12	$\begin{pmatrix} -1 & -3 & 2 \end{pmatrix}$
13	$\begin{pmatrix} 1 & -3 & -2 \end{pmatrix}$	14	$\begin{pmatrix} -1 & 3 & -2 \end{pmatrix}$	15	$\begin{pmatrix} 2 & 1 & 3 \end{pmatrix}$	16	$\begin{pmatrix} -2 & 1 & -3 \end{pmatrix}$
17	$\begin{pmatrix} -2 & -1 & 3 \end{pmatrix}$	18	$\begin{pmatrix} 2 & -1 & -3 \end{pmatrix}$	19	$\begin{pmatrix} -2 & 3 & 1 \end{pmatrix}$	20	$\begin{pmatrix} 3 & -1 & 2 \end{pmatrix}$
21	$\begin{pmatrix} 1 & 2 & -3 \end{pmatrix}$	22	$\begin{pmatrix} 2 & -3 & 1 \end{pmatrix}$	23	$\begin{pmatrix} 3 & 1 & -2 \end{pmatrix}$	24	$\begin{pmatrix} -1 & 2 & 3 \end{pmatrix}$
25	$\begin{pmatrix} -3 & -2 & -1 \end{pmatrix}$	26	$\begin{pmatrix} 3 & 2 & -1 \end{pmatrix}$	27	$\begin{pmatrix} -3 & 2 & 1 \end{pmatrix}$	28	$\begin{pmatrix} 3 & -2 & 1 \end{pmatrix}$

continued ...

Table 17

No.	position	No.	position	No.	position	No.	position
29	$\begin{pmatrix} -2 & -3 & 1 \end{pmatrix}$	30	$\begin{pmatrix} -1 & 2 & -3 \end{pmatrix}$	31	$\begin{pmatrix} 3 & -1 & -2 \end{pmatrix}$	32	$\begin{pmatrix} 2 & 3 & 1 \end{pmatrix}$
33	$\begin{pmatrix} 1 & 2 & 3 \end{pmatrix}$	34	$\begin{pmatrix} 3 & 1 & 2 \end{pmatrix}$	35	$\begin{pmatrix} -1 & -3 & -2 \end{pmatrix}$	36	$\begin{pmatrix} 1 & 3 & -2 \end{pmatrix}$
37	$\begin{pmatrix} -1 & 3 & 2 \end{pmatrix}$	38	$\begin{pmatrix} 1 & -3 & 2 \end{pmatrix}$	39	$\begin{pmatrix} -2 & -1 & -3 \end{pmatrix}$	40	$\begin{pmatrix} 2 & -1 & 3 \end{pmatrix}$
41	$\begin{pmatrix} 2 & 1 & -3 \end{pmatrix}$	42	$\begin{pmatrix} -2 & 1 & 3 \end{pmatrix}$	43	$\begin{pmatrix} 2 & -3 & -1 \end{pmatrix}$	44	$\begin{pmatrix} -3 & 1 & -2 \end{pmatrix}$
45	$\begin{pmatrix} -1 & -2 & 3 \end{pmatrix}$	46	$\begin{pmatrix} -2 & 3 & -1 \end{pmatrix}$	47	$\begin{pmatrix} -3 & -1 & 2 \end{pmatrix}$	48	$\begin{pmatrix} 1 & -2 & -3 \end{pmatrix}$

Table 18: Virtual-cluster basis.

symbol	1	2	3	4	5	6	7	8	9	10
$Q_0^{(A_{1g})}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$
	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$
	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$
	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$
	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$
$Q_{1,0}^{(T_{1u})}$	$\frac{3\sqrt{14}}{56}$	$-\frac{3\sqrt{14}}{56}$	$\frac{3\sqrt{14}}{56}$	$-\frac{3\sqrt{14}}{56}$	$\frac{\sqrt{14}}{28}$	$\frac{\sqrt{14}}{56}$	$-\frac{3\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{28}$	$-\frac{\sqrt{14}}{56}$	$-\frac{3\sqrt{14}}{56}$
	$\frac{\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{56}$	$\frac{\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{56}$	$\frac{\sqrt{14}}{28}$	$-\frac{\sqrt{14}}{28}$	$-\frac{\sqrt{14}}{28}$	$\frac{\sqrt{14}}{28}$	$-\frac{\sqrt{14}}{28}$	$\frac{3\sqrt{14}}{56}$
	$\frac{\sqrt{14}}{56}$	$\frac{\sqrt{14}}{28}$	$\frac{3\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{56}$	$-\frac{3\sqrt{14}}{56}$	$\frac{3\sqrt{14}}{56}$	$-\frac{3\sqrt{14}}{56}$	$\frac{3\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{28}$	$-\frac{\sqrt{14}}{56}$
	$\frac{3\sqrt{14}}{56}$	$\frac{\sqrt{14}}{28}$	$\frac{\sqrt{14}}{56}$	$\frac{3\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{56}$	$\frac{\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{56}$	$\frac{\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{28}$	$\frac{\sqrt{14}}{28}$
	$\frac{\sqrt{14}}{28}$	$-\frac{\sqrt{14}}{28}$	$\frac{\sqrt{14}}{28}$	$-\frac{3\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{28}$	$-\frac{3\sqrt{14}}{56}$	$\frac{\sqrt{14}}{56}$		
$Q_{1,1}^{(T_{1u})}$	$\frac{\sqrt{14}}{28}$	$-\frac{\sqrt{14}}{28}$	$-\frac{\sqrt{14}}{28}$	$\frac{\sqrt{14}}{28}$	$\frac{3\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{28}$	$\frac{\sqrt{14}}{56}$	$-\frac{3\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{28}$	$-\frac{\sqrt{14}}{56}$
	$\frac{3\sqrt{14}}{56}$	$-\frac{3\sqrt{14}}{56}$	$-\frac{3\sqrt{14}}{56}$	$\frac{3\sqrt{14}}{56}$	$\frac{\sqrt{14}}{56}$	$\frac{\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{56}$	$\frac{3\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{56}$
	$\frac{\sqrt{14}}{28}$	$-\frac{3\sqrt{14}}{56}$	$\frac{\sqrt{14}}{56}$	$\frac{\sqrt{14}}{28}$	$-\frac{\sqrt{14}}{28}$	$\frac{\sqrt{14}}{28}$	$\frac{\sqrt{14}}{28}$	$-\frac{\sqrt{14}}{28}$	$-\frac{3\sqrt{14}}{56}$	$\frac{\sqrt{14}}{28}$
	$-\frac{\sqrt{14}}{56}$	$\frac{3\sqrt{14}}{56}$	$\frac{\sqrt{14}}{28}$	$\frac{\sqrt{14}}{56}$	$-\frac{3\sqrt{14}}{56}$	$\frac{3\sqrt{14}}{56}$	$\frac{3\sqrt{14}}{56}$	$-\frac{3\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{56}$
	$\frac{\sqrt{14}}{56}$	$\frac{\sqrt{14}}{56}$	$-\frac{3\sqrt{14}}{56}$	$\frac{\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{28}$	$\frac{3\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{28}$		
$Q_{1,2}^{(T_{1u})}$	$\frac{\sqrt{14}}{56}$	$\frac{\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{56}$	$\frac{3\sqrt{14}}{56}$	$\frac{\sqrt{14}}{28}$	$-\frac{\sqrt{14}}{56}$	$-\frac{3\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{28}$
	$\frac{\sqrt{14}}{28}$	$\frac{\sqrt{14}}{28}$	$-\frac{\sqrt{14}}{28}$	$-\frac{\sqrt{14}}{28}$	$\frac{3\sqrt{14}}{56}$	$-\frac{3\sqrt{14}}{56}$	$\frac{3\sqrt{14}}{56}$	$-\frac{3\sqrt{14}}{56}$	$\frac{\sqrt{14}}{56}$	$\frac{\sqrt{14}}{28}$
	$-\frac{3\sqrt{14}}{56}$	$\frac{\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{28}$	$\frac{3\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{56}$	$\frac{\sqrt{14}}{56}$	$\frac{\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{56}$	$-\frac{3\sqrt{14}}{56}$

continued ...

[illegible]

11

Table 18

[illegible]

*continued ...*

Table 18

[illegible]

*continued ...*

[illegible]

14

Table 18

[illegible]

*continued ...*

[illegible]

*continued ...*



symbol	1	2	3	4	5	6	7	8	9	10
	$\frac{\sqrt{6}}{84}$	$\frac{11\sqrt{6}}{168}$	$-\frac{13\sqrt{6}}{168}$	$\frac{\sqrt{6}}{84}$	$\frac{\sqrt{6}}{84}$	$\frac{\sqrt{6}}{84}$	$\frac{\sqrt{6}}{84}$	$\frac{\sqrt{6}}{84}$	$-\frac{13\sqrt{6}}{168}$	$-\frac{13\sqrt{6}}{168}$
	$-\frac{13\sqrt{6}}{168}$	$-\frac{13\sqrt{6}}{168}$	$\frac{11\sqrt{6}}{168}$	$\frac{\sqrt{6}}{84}$	$-\frac{13\sqrt{6}}{168}$	$\frac{11\sqrt{6}}{168}$	$\frac{\sqrt{6}}{84}$	$-\frac{13\sqrt{6}}{168}$		
$\mathbb{Q}_{7,1}^{(Eu)}$	$\frac{5\sqrt{2}}{56}$	$\frac{5\sqrt{2}}{56}$	$\frac{5\sqrt{2}}{56}$	$\frac{5\sqrt{2}}{56}$	$-\frac{5\sqrt{2}}{56}$	$-\frac{3\sqrt{2}}{56}$	$\frac{\sqrt{2}}{7}$	$-\frac{5\sqrt{2}}{56}$	$-\frac{3\sqrt{2}}{56}$	$\frac{\sqrt{2}}{7}$
	$-\frac{\sqrt{2}}{7}$	$-\frac{\sqrt{2}}{7}$	$-\frac{\sqrt{2}}{7}$	$-\frac{\sqrt{2}}{7}$	$\frac{3\sqrt{2}}{56}$	$\frac{3\sqrt{2}}{56}$	$\frac{3\sqrt{2}}{56}$	$\frac{3\sqrt{2}}{56}$	$-\frac{5\sqrt{2}}{56}$	$\frac{\sqrt{2}}{7}$
	$-\frac{3\sqrt{2}}{56}$	$-\frac{5\sqrt{2}}{56}$	$\frac{\sqrt{2}}{7}$	$-\frac{3\sqrt{2}}{56}$	$-\frac{5\sqrt{2}}{56}$	$-\frac{5\sqrt{2}}{56}$	$-\frac{5\sqrt{2}}{56}$	$-\frac{5\sqrt{2}}{56}$	$\frac{5\sqrt{2}}{56}$	$\frac{3\sqrt{2}}{56}$
	$-\frac{\sqrt{2}}{7}$	$\frac{5\sqrt{2}}{56}$	$\frac{3\sqrt{2}}{56}$	$-\frac{\sqrt{2}}{7}$	$\frac{\sqrt{2}}{7}$	$\frac{\sqrt{2}}{7}$	$\frac{\sqrt{2}}{7}$	$\frac{\sqrt{2}}{7}$	$-\frac{3\sqrt{2}}{56}$	$-\frac{3\sqrt{2}}{56}$
	$-\frac{3\sqrt{2}}{56}$	$-\frac{3\sqrt{2}}{56}$	$\frac{5\sqrt{2}}{56}$	$-\frac{\sqrt{2}}{7}$	$\frac{3\sqrt{2}}{56}$	$\frac{5\sqrt{2}}{56}$	$-\frac{\sqrt{2}}{7}$	$\frac{3\sqrt{2}}{56}$		
$\mathbb{Q}_{7,0}^{(T_{2u},1)}$	$-\frac{1}{14}$	$\frac{1}{14}$	$-\frac{1}{14}$	$\frac{1}{14}$	$\frac{3}{28}$	$\frac{3}{14}$	$-\frac{1}{14}$	$-\frac{3}{28}$	$-\frac{3}{14}$	$-\frac{1}{14}$
	$-\frac{3}{14}$	$\frac{3}{14}$	$-\frac{3}{14}$	$\frac{3}{14}$	$-\frac{3}{28}$	$\frac{3}{28}$	$\frac{3}{28}$	$-\frac{3}{28}$	$-\frac{3}{28}$	$\frac{1}{14}$
	$\frac{3}{14}$	$\frac{3}{28}$	$\frac{1}{14}$	$-\frac{3}{14}$	$\frac{1}{14}$	$-\frac{1}{14}$	$\frac{1}{14}$	$-\frac{1}{14}$	$-\frac{3}{28}$	$-\frac{3}{14}$
	$\frac{1}{14}$	$\frac{3}{28}$	$\frac{3}{14}$	$\frac{1}{14}$	$\frac{3}{14}$	$-\frac{3}{14}$	$\frac{3}{14}$	$-\frac{3}{14}$	$\frac{3}{28}$	$-\frac{3}{28}$
	$-\frac{3}{28}$	$\frac{3}{28}$	$\frac{3}{28}$	$-\frac{1}{14}$	$-\frac{3}{14}$	$-\frac{3}{28}$	$-\frac{1}{14}$	$\frac{3}{14}$		
$\mathbb{Q}_{7,1}^{(T_{2u},1)}$	$-\frac{3}{28}$	$\frac{3}{28}$	$\frac{3}{28}$	$-\frac{3}{28}$	$\frac{1}{14}$	$-\frac{3}{28}$	$\frac{3}{14}$	$-\frac{1}{14}$	$-\frac{3}{28}$	$-\frac{3}{14}$
	$-\frac{1}{14}$	$\frac{1}{14}$	$\frac{1}{14}$	$-\frac{1}{14}$	$-\frac{3}{14}$	$-\frac{3}{14}$	$\frac{3}{14}$	$\frac{3}{14}$	$\frac{1}{14}$	$-\frac{3}{14}$
	$\frac{3}{28}$	$-\frac{1}{14}$	$\frac{3}{14}$	$\frac{3}{28}$	$\frac{3}{28}$	$-\frac{3}{28}$	$-\frac{3}{28}$	$\frac{3}{28}$	$-\frac{1}{14}$	$\frac{3}{28}$
	$-\frac{3}{14}$	$\frac{1}{14}$	$\frac{3}{28}$	$\frac{3}{14}$	$\frac{1}{14}$	$-\frac{1}{14}$	$-\frac{1}{14}$	$\frac{1}{14}$	$\frac{3}{14}$	$\frac{3}{14}$
	$-\frac{3}{14}$	$-\frac{3}{14}$	$-\frac{1}{14}$	$\frac{3}{14}$	$-\frac{3}{28}$	$\frac{1}{14}$	$-\frac{3}{14}$	$-\frac{3}{28}$		
$\mathbb{Q}_{7,2}^{(T_{2u},1)}$	$-\frac{3}{14}$	$-\frac{3}{14}$	$\frac{3}{14}$	$\frac{3}{14}$	$-\frac{3}{14}$	$\frac{1}{14}$	$\frac{3}{28}$	$-\frac{3}{14}$	$-\frac{1}{14}$	$-\frac{3}{28}$
	$-\frac{3}{28}$	$-\frac{3}{28}$	$\frac{3}{28}$	$\frac{3}{28}$	$-\frac{1}{14}$	$\frac{1}{14}$	$-\frac{1}{14}$	$\frac{1}{14}$	$\frac{3}{14}$	$\frac{3}{28}$
	$-\frac{1}{14}$	$\frac{3}{14}$	$-\frac{3}{28}$	$\frac{1}{14}$	$\frac{3}{14}$	$\frac{3}{14}$	$-\frac{3}{14}$	$-\frac{3}{14}$	$\frac{3}{14}$	$-\frac{1}{14}$
	$-\frac{3}{28}$	$\frac{3}{14}$	$\frac{1}{14}$	$\frac{3}{28}$	$\frac{3}{28}$	$\frac{3}{28}$	$-\frac{3}{28}$	$-\frac{3}{28}$	$\frac{1}{14}$	$-\frac{1}{14}$
	$\frac{1}{14}$	$-\frac{1}{14}$	$-\frac{3}{14}$	$-\frac{3}{28}$						

17

Table 18

symbol	1	2	3	4	5	6	7	8	9	10
$\mathbb{Q}_{8,2}^{(T_{1g},1)}$	$-\frac{\sqrt{14}}{56}$	$\frac{3\sqrt{14}}{56}$	$\frac{\sqrt{14}}{28}$	$\frac{\sqrt{14}}{56}$	$-\frac{3\sqrt{14}}{56}$	$\frac{3\sqrt{14}}{56}$	$\frac{3\sqrt{14}}{56}$	$-\frac{3\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{56}$
	$\frac{\sqrt{14}}{56}$	$\frac{\sqrt{14}}{56}$	$-\frac{3\sqrt{14}}{56}$	$\frac{\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{28}$	$\frac{3\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{28}$		
	$-\frac{\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{56}$	$\frac{\sqrt{14}}{56}$	$\frac{\sqrt{14}}{56}$	$\frac{\sqrt{14}}{56}$	$-\frac{3\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{28}$	$\frac{\sqrt{14}}{56}$	$\frac{3\sqrt{14}}{56}$	$\frac{\sqrt{14}}{28}$
	$-\frac{\sqrt{14}}{28}$	$-\frac{\sqrt{14}}{28}$	$\frac{\sqrt{14}}{28}$	$\frac{\sqrt{14}}{28}$	$-\frac{3\sqrt{14}}{56}$	$\frac{3\sqrt{14}}{56}$	$-\frac{3\sqrt{14}}{56}$	$\frac{3\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{28}$
	$\frac{3\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{56}$	$\frac{\sqrt{14}}{28}$	$-\frac{3\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{56}$	$\frac{\sqrt{14}}{56}$	$\frac{\sqrt{14}}{56}$	$\frac{\sqrt{14}}{56}$	$-\frac{3\sqrt{14}}{56}$
	$-\frac{\sqrt{14}}{28}$	$\frac{\sqrt{14}}{56}$	$\frac{3\sqrt{14}}{56}$	$\frac{\sqrt{14}}{28}$	$-\frac{\sqrt{14}}{28}$	$-\frac{\sqrt{14}}{28}$	$\frac{\sqrt{14}}{28}$	$\frac{\sqrt{14}}{28}$	$-\frac{3\sqrt{14}}{56}$	$\frac{3\sqrt{14}}{56}$
	$-\frac{3\sqrt{14}}{56}$	$\frac{3\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{28}$	$\frac{3\sqrt{14}}{56}$	$-\frac{\sqrt{14}}{56}$	$\frac{\sqrt{14}}{28}$	$-\frac{3\sqrt{14}}{56}$		
$\mathbb{Q}_9^{(A_{1u})}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$
	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$
	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$\frac{\sqrt{3}}{12}$	$-\frac{\sqrt{3}}{12}$	$-\frac{\sqrt{3}}{12}$	$-\frac{\sqrt{3}}{12}$	$-\frac{\sqrt{3}}{12}$	$-\frac{\sqrt{3}}{12}$	$-\frac{\sqrt{3}}{12}$
	$-\frac{\sqrt{3}}{12}$	$-\frac{\sqrt{3}}{12}$	$-\frac{\sqrt{3}}{12}$	$-\frac{\sqrt{3}}{12}$	$-\frac{\sqrt{3}}{12}$	$-\frac{\sqrt{3}}{12}$	$-\frac{\sqrt{3}}{12}$	$-\frac{\sqrt{3}}{12}$	$-\frac{\sqrt{3}}{12}$	$-\frac{\sqrt{3}}{12}$
	$-\frac{\sqrt{3}}{12}$	$-\frac{\sqrt{3}}{12}$	$-\frac{\sqrt{3}}{12}$	$-\frac{\sqrt{3}}{12}$	$-\frac{\sqrt{3}}{12}$	$-\frac{\sqrt{3}}{12}$	$-\frac{\sqrt{3}}{12}$	$-\frac{\sqrt{3}}{12}$		