

SAMB for “grapheneAB”

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- Group: No. 187 D_{3h}^1 $P-6m2$ [hexagonal]
 - Associated point group: No. 26 D_{3h} $-6m2$ (-6m2 setting) [hexagonal]
 - Generation condition
 - model type: **tight_binding**
 - time-reversal type: **electric**
 - irrep: [A1']
 - **spinless**
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- Unit cell:
 $a = 2.435$, $b = 2.435$, $c = 10.0$, $\alpha = 90.0$, $\beta = 90.0$, $\gamma = 120.0$
- Lattice vectors:
 $\mathbf{a}_1 = (2.435 \ 0 \ 0)$
 $\mathbf{a}_2 = (-1.2175 \ 2.10877185821511 \ 0)$
 $\mathbf{a}_3 = (0 \ 0 \ 10.0)$

Table 1: High-symmetry line: Γ -X.

symbol	position	symbol	position
Γ	$\begin{pmatrix} 0 & 0 & 0 \end{pmatrix}$	X	$\begin{pmatrix} \frac{1}{2} & 0 & 0 \end{pmatrix}$

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- Kets: dimension = 3

Table 2: Hilbert space for full matrix.

No.	ket	No.	ket	No.	ket
1	$s@A_1$	2	$p_x@B_1$	3	$p_y@B_1$

- Sites in (primitive) unit cell:

Table 3: Site-clusters.

site	position	mapping
S ₁ A ₁	$\begin{pmatrix} \frac{1}{3} & \frac{2}{3} & 0 \end{pmatrix}$	[1,2,3,4,5,6,7,8,9,10,11,12]
S ₂ B ₁	$\begin{pmatrix} \frac{2}{3} & \frac{1}{3} & 0 \end{pmatrix}$	[1,2,3,4,5,6,7,8,9,10,11,12]

- Bonds in (primitive) unit cell:

Table 4: Bond-clusters.

bond	tail	head	n	#	$\mathbf{b@c}$	mapping
B ₁	b ₁	B ₁ A ₁	1	1	$\begin{pmatrix} \frac{1}{3} & \frac{2}{3} & 0 \end{pmatrix} @ \begin{pmatrix} \frac{1}{2} & 0 & 0 \end{pmatrix}$	[1,2,7,10]
	b ₂	B ₁ A ₁	1	1	$\begin{pmatrix} \frac{1}{3} & -\frac{1}{3} & 0 \end{pmatrix} @ \begin{pmatrix} \frac{1}{2} & \frac{1}{2} & 0 \end{pmatrix}$	[3,6,8,11]
	b ₃	B ₁ A ₁	1	1	$\begin{pmatrix} -\frac{2}{3} & -\frac{1}{3} & 0 \end{pmatrix} @ \begin{pmatrix} 0 & \frac{1}{2} & 0 \end{pmatrix}$	[4,5,9,12]
B ₂	b ₄	A ₁ A ₁	1	1	$\begin{pmatrix} 0 & 1 & 0 \end{pmatrix} @ \begin{pmatrix} \frac{1}{3} & \frac{1}{6} & 0 \end{pmatrix}$	[1,-3,-8,10]
	b ₅	A ₁ A ₁	1	1	$\begin{pmatrix} 1 & 1 & 0 \end{pmatrix} @ \begin{pmatrix} \frac{5}{6} & \frac{1}{6} & 0 \end{pmatrix}$	[2,-5,7,-12]
	b ₆	A ₁ A ₁	1	1	$\begin{pmatrix} 1 & 0 & 0 \end{pmatrix} @ \begin{pmatrix} \frac{5}{6} & \frac{2}{3} & 0 \end{pmatrix}$	[-4,6,-9,11]
B ₃	b ₇	B ₁ B ₁	1	1	$\begin{pmatrix} 1 & 0 & 0 \end{pmatrix} @ \begin{pmatrix} \frac{1}{6} & \frac{1}{3} & 0 \end{pmatrix}$	[1,-2,-7,10]
	b ₈	B ₁ B ₁	1	1	$\begin{pmatrix} 1 & 1 & 0 \end{pmatrix} @ \begin{pmatrix} \frac{1}{6} & \frac{5}{6} & 0 \end{pmatrix}$	[3,-6,8,-11]
	b ₉	B ₁ B ₁	1	1	$\begin{pmatrix} 0 & 1 & 0 \end{pmatrix} @ \begin{pmatrix} \frac{2}{3} & \frac{5}{6} & 0 \end{pmatrix}$	[-4,5,-9,12]

- SAMB:

$$\boxed{\text{No. 1}} \quad \hat{Q}_0^{(A'_1)} [M_1, S_1]$$

$$\hat{Z}_1 = X_1[Q_0^{(a, A'_1)}] \otimes Y_1[Q_0^{(s, A'_1)}]$$

$$\hat{Z}_1(\mathbf{k}) = X_1[Q_0^{(a, A'_1)}] \otimes U_1[Q_0^{(s, A'_1)}]$$

$$\boxed{\text{No. 2}} \quad \hat{Q}_0^{(A'_1)} [M_2, S_2]$$

$$\hat{Z}_2 = X_2[Q_0^{(a, A'_1)}] \otimes Y_2[Q_0^{(s, A'_1)}]$$

$$\hat{Z}_2(\mathbf{k}) = X_2[Q_0^{(a, A'_1)}] \otimes U_2[Q_0^{(s, A'_1)}]$$

$$\boxed{\text{No. 3}} \quad \hat{Q}_0^{(A'_1)} [M_3, B_1]$$

$$\hat{Z}_3 = \frac{\sqrt{2}X_6[Q_{1,0}^{(a, E')}] \otimes Y_3[Q_{1,0}^{(b, E')}] }{2} + \frac{\sqrt{2}X_7[Q_{1,1}^{(a, E')}] \otimes Y_4[Q_{1,1}^{(b, E')}] }{2}$$

$$\begin{aligned} \hat{Z}_3(\mathbf{k}) = & \frac{X_6[Q_{1,0}^{(a, E')}] \otimes U_3[Q_0^{(u, A'_1)}] \otimes F_1[Q_{1,0}^{(k, E')}] }{2} - \frac{X_6[Q_{1,0}^{(a, E')}] \otimes U_4[T_0^{(u, A'_1)}] \otimes F_3[T_{1,0}^{(k, E')}] }{2} \\ & + \frac{X_7[Q_{1,1}^{(a, E')}] \otimes U_3[Q_0^{(u, A'_1)}] \otimes F_2[Q_{1,1}^{(k, E')}] }{2} - \frac{X_7[Q_{1,1}^{(a, E')}] \otimes U_4[T_0^{(u, A'_1)}] \otimes F_4[T_{1,1}^{(k, E')}] }{2} \end{aligned}$$

$$\boxed{\text{No. 4}} \quad \hat{Q}_0^{(A'_1)} [M_1, B_2]$$

$$\hat{Z}_4 = X_1[Q_0^{(a, A'_1)}] \otimes Y_5[Q_0^{(b, A'_1)}]$$

$$\hat{Z}_4(\mathbf{k}) = X_1[Q_0^{(a, A'_1)}] \otimes U_1[Q_0^{(s, A'_1)}] \otimes F_5[Q_0^{(k, A'_1)}]$$

$$\boxed{\text{No. 5}} \quad \hat{Q}_0^{(A'_1)} [M_2, B_3]$$

$$\hat{Z}_5 = X_2[Q_0^{(a, A'_1)}] \otimes Y_6[Q_0^{(b, A'_1)}]$$

$$\hat{\mathbb{Z}}_5(\mathbf{k}) = \mathbb{X}_2[\mathbb{Q}_0^{(a,A'_1)}] \otimes \mathbb{U}_2[\mathbb{Q}_0^{(s,A'_1)}] \otimes \mathbb{F}_6[\mathbb{Q}_0^{(k,A'_1)}]$$

$$\boxed{\text{No. 6}} \quad \hat{\mathbb{Q}}_3^{(A'_1)} [\mathbb{M}_2, \mathbb{B}_3]$$

$$\hat{\mathbb{Z}}_6 = -\frac{\sqrt{2}\mathbb{X}_3[\mathbb{Q}_{2,0}^{(a,E')}] \otimes \mathbb{Y}_7[\mathbb{Q}_{1,0}^{(b,E')}] }{2} - \frac{\sqrt{2}\mathbb{X}_4[\mathbb{Q}_{2,1}^{(a,E')}] \otimes \mathbb{Y}_8[\mathbb{Q}_{1,1}^{(b,E')}] }{2}$$

$$\hat{\mathbb{Z}}_6(\mathbf{k}) = -\frac{\sqrt{2}\mathbb{X}_3[\mathbb{Q}_{2,0}^{(a,E')}] \otimes \mathbb{U}_2[\mathbb{Q}_0^{(s,A'_1)}] \otimes \mathbb{F}_7[\mathbb{Q}_{1,0}^{(k,E')}] }{2} - \frac{\sqrt{2}\mathbb{X}_4[\mathbb{Q}_{2,1}^{(a,E')}] \otimes \mathbb{U}_2[\mathbb{Q}_0^{(s,A'_1)}] \otimes \mathbb{F}_8[\mathbb{Q}_{1,1}^{(k,E')}] }{2}$$

$$\boxed{\text{No. 7}} \quad \hat{\mathbb{Q}}_3^{(A'_1)} [\mathbb{M}_2, \mathbb{B}_3]$$

$$\hat{\mathbb{Z}}_7 = \mathbb{X}_5[\mathbb{M}_1^{(a,A'_2)}] \otimes \mathbb{Y}_9[\mathbb{T}_3^{(b,A'_2)}]$$

$$\hat{\mathbb{Z}}_7(\mathbf{k}) = \mathbb{X}_5[\mathbb{M}_1^{(a,A'_2)}] \otimes \mathbb{U}_2[\mathbb{Q}_0^{(s,A'_1)}] \otimes \mathbb{F}_9[\mathbb{T}_3^{(k,A'_2)}]$$

Table 5: Atomic SAMB group.

group	bra	ket
M ₁	s	s
M ₂	p_x, p_y	p_x, p_y
M ₃	p_x, p_y	s

Table 6: Atomic SAMB.

symbol	type	group	form
X ₁	$\mathbb{Q}_0^{(a,A'_1)}$	M ₁	$\begin{pmatrix} 1 \end{pmatrix}$
X ₂	$\mathbb{Q}_0^{(a,A'_1)}$	M ₂	$\begin{pmatrix} \frac{\sqrt{2}}{2} & 0 \\ 0 & \frac{\sqrt{2}}{2} \end{pmatrix}$

continued ...

Table 6

symbol	type	group	form
\mathbb{X}_3	$\mathbb{Q}_{2,0}^{(a,E')}$	M_2	$\begin{pmatrix} 0 & -\frac{\sqrt{2}}{2} \\ -\frac{\sqrt{2}}{2} & 0 \end{pmatrix}$
\mathbb{X}_4	$\mathbb{Q}_{2,1}^{(a,E')}$	M_2	$\begin{pmatrix} -\frac{\sqrt{2}}{2} & 0 \\ 0 & \frac{\sqrt{2}}{2} \end{pmatrix}$
\mathbb{X}_5	$\mathbb{M}_1^{(a,A'_2)}$	M_2	$\begin{pmatrix} 0 & -\frac{\sqrt{2}i}{2} \\ \frac{\sqrt{2}i}{2} & 0 \end{pmatrix}$
\mathbb{X}_6	$\mathbb{Q}_{1,0}^{(a,E')}$	M_3	$\begin{pmatrix} 1 \\ 0 \end{pmatrix}$
\mathbb{X}_7	$\mathbb{Q}_{1,1}^{(a,E')}$	M_3	$\begin{pmatrix} 0 \\ 1 \end{pmatrix}$

Table 7: Cluster SAMB.

symbol	type	cluster	form
\mathbb{Y}_1	$\mathbb{Q}_0^{(s,A'_1)}$	S_1	$\begin{pmatrix} 1 \end{pmatrix}$
\mathbb{Y}_2	$\mathbb{Q}_0^{(s,A'_1)}$	S_2	$\begin{pmatrix} 1 \end{pmatrix}$
\mathbb{Y}_3	$\mathbb{Q}_{1,0}^{(b,E')}$	B_1	$\begin{pmatrix} 0 & -\frac{\sqrt{2}}{2} & \frac{\sqrt{2}}{2} \end{pmatrix}$
\mathbb{Y}_4	$\mathbb{Q}_{1,1}^{(b,E')}$	B_1	$\begin{pmatrix} -\frac{\sqrt{6}}{3} & \frac{\sqrt{6}}{6} & \frac{\sqrt{6}}{6} \end{pmatrix}$
\mathbb{Y}_5	$\mathbb{Q}_0^{(b,A'_1)}$	B_2	$\begin{pmatrix} \frac{\sqrt{3}}{3} & \frac{\sqrt{3}}{3} & \frac{\sqrt{3}}{3} \end{pmatrix}$
\mathbb{Y}_6	$\mathbb{Q}_0^{(b,A'_1)}$	B_3	$\begin{pmatrix} \frac{\sqrt{3}}{3} & \frac{\sqrt{3}}{3} & \frac{\sqrt{3}}{3} \end{pmatrix}$
\mathbb{Y}_7	$\mathbb{Q}_{1,0}^{(b,E')}$	B_3	$\begin{pmatrix} 0 & -\frac{\sqrt{2}}{2} & \frac{\sqrt{2}}{2} \end{pmatrix}$
\mathbb{Y}_8	$\mathbb{Q}_{1,1}^{(b,E')}$	B_3	$\begin{pmatrix} -\frac{\sqrt{6}}{3} & \frac{\sqrt{6}}{6} & \frac{\sqrt{6}}{6} \end{pmatrix}$
\mathbb{Y}_9	$\mathbb{T}_3^{(b,A'_2)}$	B_3	$\begin{pmatrix} \frac{\sqrt{3}i}{3} & -\frac{\sqrt{3}i}{3} & \frac{\sqrt{3}i}{3} \end{pmatrix}$

Table 8: Uniform SAMB.

symbol	type	cluster	form
\mathbb{U}_1	$\mathbb{Q}_0^{(s,A'_1)}$	S_1	$\begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix}$
\mathbb{U}_2	$\mathbb{Q}_0^{(s,A'_1)}$	S_2	$\begin{pmatrix} 0 & 0 \\ 0 & 1 \end{pmatrix}$
\mathbb{U}_3	$\mathbb{Q}_0^{(u,A'_1)}$	B_1	$\begin{pmatrix} 0 & \frac{\sqrt{2}}{2} \\ \frac{\sqrt{2}}{2} & 0 \end{pmatrix}$
\mathbb{U}_4	$\mathbb{T}_0^{(u,A'_1)}$	B_1	$\begin{pmatrix} 0 & -\frac{\sqrt{2}i}{2} \\ \frac{\sqrt{2}i}{2} & 0 \end{pmatrix}$

Table 9: Structure SAMB.

symbol	type	cluster	form
\mathbb{F}_1	$\mathbb{Q}_{1,0}^{(k,E')}$	B_1	$-c_{002} + c_{003}$
\mathbb{F}_2	$\mathbb{Q}_{1,1}^{(k,E')}$	B_1	$-\frac{2\sqrt{3}c_{001}}{3} + \frac{\sqrt{3}c_{002}}{3} + \frac{\sqrt{3}c_{003}}{3}$
\mathbb{F}_3	$\mathbb{T}_{1,0}^{(k,E')}$	B_1	$-s_{002} + s_{003}$
\mathbb{F}_4	$\mathbb{T}_{1,1}^{(k,E')}$	B_1	$-\frac{2\sqrt{3}s_{001}}{3} + \frac{\sqrt{3}s_{002}}{3} + \frac{\sqrt{3}s_{003}}{3}$
\mathbb{F}_5	$\mathbb{Q}_0^{(k,A'_1)}$	B_2	$\frac{\sqrt{6}c_{004}}{3} + \frac{\sqrt{6}c_{005}}{3} + \frac{\sqrt{6}c_{006}}{3}$
\mathbb{F}_6	$\mathbb{Q}_0^{(k,A'_1)}$	B_3	$\frac{\sqrt{6}c_{007}}{3} + \frac{\sqrt{6}c_{008}}{3} + \frac{\sqrt{6}c_{009}}{3}$
\mathbb{F}_7	$\mathbb{Q}_{1,0}^{(k,E')}$	B_3	$-c_{008} + c_{009}$
\mathbb{F}_8	$\mathbb{Q}_{1,1}^{(k,E')}$	B_3	$-\frac{2\sqrt{3}c_{007}}{3} + \frac{\sqrt{3}c_{008}}{3} + \frac{\sqrt{3}c_{009}}{3}$
\mathbb{F}_9	$\mathbb{T}_3^{(k,A'_2)}$	B_3	$\frac{\sqrt{6}s_{007}}{3} - \frac{\sqrt{6}s_{008}}{3} + \frac{\sqrt{6}s_{009}}{3}$

Table 10: Polar harmonics.

No.	symbol	rank	irrep.	mul.	comp.	form
1	$\mathbb{Q}_0^{(A'_1)}$	0	A'_1	—	—	1
2	$\mathbb{Q}_{1,0}^{(E')}$	1	E'	—	0	x
3	$\mathbb{Q}_{1,1}^{(E')}$	1	E'	—	1	y
4	$\mathbb{Q}_{2,0}^{(E')}$	2	E'	—	0	$-\sqrt{3}xy$
5	$\mathbb{Q}_{2,1}^{(E')}$	2	E'	—	1	$-\frac{\sqrt{3}(x-y)(x+y)}{2}$
6	$\mathbb{Q}_3^{(A'_2)}$	3	A'_2	—	—	$\frac{\sqrt{10}x(x^2-3y^2)}{4}$

Table 11: Axial harmonics.

No.	symbol	rank	irrep.	mul.	comp.	form
1	$\mathbb{G}_1^{(A'_2)}$	1	A'_2	—	—	Z

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

Table 12: Conjugacy class (point-group part).

rep. SO	symmetry operations
$\{1 0\}$	$\{1 0\}$
$\{2_{120} 0\}$	$\{2_{120} 0\}$, $\{2_{210} 0\}$, $\{2_{1-10} 0\}$
$\{3_{001}^+ 0\}$	$\{3_{001}^+ 0\}$, $\{3_{001}^- 0\}$
$\{m_{100} 0\}$	$\{m_{100} 0\}$, $\{m_{010} 0\}$, $\{m_{110} 0\}$
$\{m_{001} 0\}$	$\{m_{001} 0\}$
$\{-6_{001}^+ 0\}$	$\{-6_{001}^+ 0\}$, $\{-6_{001}^- 0\}$

Table 13: Symmetry operations.

No.	SO	No.	SO	No.	SO	No.	SO	No.	SO
1	$\{1 0\}$	2	$\{2_{120} 0\}$	3	$\{2_{210} 0\}$	4	$\{2_{1-10} 0\}$	5	$\{3_{001}^+ 0\}$
6	$\{3_{001}^- 0\}$	7	$\{m_{100} 0\}$	8	$\{m_{010} 0\}$	9	$\{m_{110} 0\}$	10	$\{m_{001} 0\}$
11	$\{-6_{001}^+ 0\}$	12	$\{-6_{001}^- 0\}$						

Table 14: Character table (point-group part).

	1	2_{120}	3_{001}^+	m_{100}	m_{001}	-6_{001}^+
A_1'	1	1	1	1	1	1
A_2'	1	-1	1	-1	1	1
A_1''	1	1	1	-1	-1	-1
A_2''	1	-1	1	1	-1	-1
E'	2	0	-1	0	2	-1
E''	2	0	-1	0	-2	1

Table 15: Parity conversion.

\leftrightarrow	\leftrightarrow	\leftrightarrow	\leftrightarrow	\leftrightarrow
$A_1' (A_1'')$	$A_2' (A_2'')$	$A_1'' (A_1')$	$A_2'' (A_2')$	$E'' (E')$
$E' (E'')$				

Table 16: Symmetric product, $[\Gamma \otimes \Gamma']_+$.

	A_1'	A_2'	A_1''	A_2''	E'	E''
A_1'	A_1'	A_2'	A_1''	A_2''	E'	E''
A_2'		A_1'	A_2''	A_1''	E'	E''
A_1''			A_1'	A_2'	E''	E'

continued ...

Table 16

	A'_1	A'_2	A''_1	A''_2	E'	E''
A''_2				A'_1	E''	E'
E'					$A'_1 + E'$	$A'_1 + A''_2 + E''$
E''						$A'_1 + E'$

Table 17: Anti-symmetric product, $[\Gamma \otimes \Gamma]_-$.

A'_1	A'_2	A''_1	A''_2	E'	E''
$-$	$-$	$-$	$-$	A'_2	A'_2

Table 18: Virtual-cluster sites.

No.	position	No.	position	No.	position	No.	position
1	$\begin{pmatrix} -1 & -1 & 1 \end{pmatrix}$	2	$\begin{pmatrix} 0 & -1 & -1 \end{pmatrix}$	3	$\begin{pmatrix} -1 & 0 & -1 \end{pmatrix}$	4	$\begin{pmatrix} 1 & 1 & -1 \end{pmatrix}$
5	$\begin{pmatrix} 1 & 0 & 1 \end{pmatrix}$	6	$\begin{pmatrix} 0 & 1 & 1 \end{pmatrix}$	7	$\begin{pmatrix} 0 & -1 & 1 \end{pmatrix}$	8	$\begin{pmatrix} -1 & 0 & 1 \end{pmatrix}$
9	$\begin{pmatrix} 1 & 1 & 1 \end{pmatrix}$	10	$\begin{pmatrix} -1 & -1 & -1 \end{pmatrix}$	11	$\begin{pmatrix} 0 & 1 & -1 \end{pmatrix}$	12	$\begin{pmatrix} 1 & 0 & -1 \end{pmatrix}$

Table 19: Virtual-cluster basis.

symbol	1	2	3	4	5	6	7	8	9	10
$\mathbb{Q}_0^{(A'_1)}$	$\frac{\sqrt{3}}{6}$	$\frac{\sqrt{3}}{6}$	$\frac{\sqrt{3}}{6}$	$\frac{\sqrt{3}}{6}$	$\frac{\sqrt{3}}{6}$	$\frac{\sqrt{3}}{6}$	$\frac{\sqrt{3}}{6}$	$\frac{\sqrt{3}}{6}$	$\frac{\sqrt{3}}{6}$	$\frac{\sqrt{3}}{6}$
	$\frac{\sqrt{3}}{6}$	$\frac{\sqrt{3}}{6}$								

continued ...

Table 19

symbol	1	2	3	4	5	6	7	8	9	10
$\mathbb{Q}_1^{(A_2'')}$	$\frac{\sqrt{3}}{6}$ $-\frac{\sqrt{3}}{6}$	$-\frac{\sqrt{3}}{6}$ $-\frac{\sqrt{3}}{6}$	$-\frac{\sqrt{3}}{6}$	$-\frac{\sqrt{3}}{6}$	$\frac{\sqrt{3}}{6}$	$\frac{\sqrt{3}}{6}$	$\frac{\sqrt{3}}{6}$	$\frac{\sqrt{3}}{6}$	$\frac{\sqrt{3}}{6}$	$-\frac{\sqrt{3}}{6}$
$\mathbb{Q}_{1,0}^{(E')}$	$-\frac{\sqrt{6}}{12}$ $-\frac{\sqrt{6}}{12}$	$\frac{\sqrt{6}}{12}$ $\frac{\sqrt{6}}{6}$	$-\frac{\sqrt{6}}{6}$	$\frac{\sqrt{6}}{12}$	$\frac{\sqrt{6}}{6}$	$-\frac{\sqrt{6}}{12}$	$\frac{\sqrt{6}}{12}$	$-\frac{\sqrt{6}}{6}$	$\frac{\sqrt{6}}{12}$	$-\frac{\sqrt{6}}{12}$
$\mathbb{Q}_{1,1}^{(E')}$	$-\frac{\sqrt{2}}{4}$ $\frac{\sqrt{2}}{4}$	$-\frac{\sqrt{2}}{4}$ 0	0	$\frac{\sqrt{2}}{4}$	0	$\frac{\sqrt{2}}{4}$	$-\frac{\sqrt{2}}{4}$	0	$\frac{\sqrt{2}}{4}$	$-\frac{\sqrt{2}}{4}$
$\mathbb{Q}_{2,0}^{(E')}$	$-\frac{\sqrt{2}}{4}$ $\frac{\sqrt{2}}{4}$	$\frac{\sqrt{2}}{4}$ 0	0	$-\frac{\sqrt{2}}{4}$	0	$\frac{\sqrt{2}}{4}$	$\frac{\sqrt{2}}{4}$	0	$-\frac{\sqrt{2}}{4}$	$-\frac{\sqrt{2}}{4}$
$\mathbb{Q}_{2,1}^{(E')}$	$\frac{\sqrt{6}}{12}$ $\frac{\sqrt{6}}{12}$	$\frac{\sqrt{6}}{12}$ $-\frac{\sqrt{6}}{6}$	$-\frac{\sqrt{6}}{6}$	$\frac{\sqrt{6}}{12}$	$-\frac{\sqrt{6}}{6}$	$\frac{\sqrt{6}}{12}$	$\frac{\sqrt{6}}{12}$	$-\frac{\sqrt{6}}{6}$	$\frac{\sqrt{6}}{12}$	$\frac{\sqrt{6}}{12}$
$\mathbb{Q}_{2,0}^{(E'')}$	$-\frac{\sqrt{6}}{12}$ $\frac{\sqrt{6}}{12}$	$-\frac{\sqrt{6}}{12}$ $-\frac{\sqrt{6}}{6}$	$\frac{\sqrt{6}}{6}$	$-\frac{\sqrt{6}}{12}$	$\frac{\sqrt{6}}{6}$	$-\frac{\sqrt{6}}{12}$	$\frac{\sqrt{6}}{12}$	$-\frac{\sqrt{6}}{6}$	$\frac{\sqrt{6}}{12}$	$\frac{\sqrt{6}}{12}$
$\mathbb{Q}_{2,1}^{(E'')}$	$-\frac{\sqrt{2}}{4}$ $-\frac{\sqrt{2}}{4}$	$\frac{\sqrt{2}}{4}$ 0	0	$-\frac{\sqrt{2}}{4}$	0	$\frac{\sqrt{2}}{4}$	$-\frac{\sqrt{2}}{4}$	0	$\frac{\sqrt{2}}{4}$	$\frac{\sqrt{2}}{4}$
$\mathbb{Q}_3^{(A_2')}$	$\frac{\sqrt{3}}{6}$ $\frac{\sqrt{3}}{6}$	$-\frac{\sqrt{3}}{6}$ $\frac{\sqrt{3}}{6}$	$-\frac{\sqrt{3}}{6}$	$-\frac{\sqrt{3}}{6}$	$\frac{\sqrt{3}}{6}$	$\frac{\sqrt{3}}{6}$	$-\frac{\sqrt{3}}{6}$	$-\frac{\sqrt{3}}{6}$	$-\frac{\sqrt{3}}{6}$	$\frac{\sqrt{3}}{6}$
$\mathbb{Q}_{3,0}^{(E'')}$	$-\frac{\sqrt{2}}{4}$ $-\frac{\sqrt{2}}{4}$	$-\frac{\sqrt{2}}{4}$ 0	0	$\frac{\sqrt{2}}{4}$	0	$\frac{\sqrt{2}}{4}$	$\frac{\sqrt{2}}{4}$	0	$-\frac{\sqrt{2}}{4}$	$\frac{\sqrt{2}}{4}$
$\mathbb{Q}_{3,1}^{(E'')}$	$\frac{\sqrt{6}}{12}$ $-\frac{\sqrt{6}}{12}$	$-\frac{\sqrt{6}}{12}$ $\frac{\sqrt{6}}{6}$	$\frac{\sqrt{6}}{6}$	$-\frac{\sqrt{6}}{12}$	$-\frac{\sqrt{6}}{6}$	$\frac{\sqrt{6}}{12}$	$\frac{\sqrt{6}}{12}$	$-\frac{\sqrt{6}}{6}$	$\frac{\sqrt{6}}{12}$	$-\frac{\sqrt{6}}{12}$
$\mathbb{Q}_4^{(A_1'')}$	$\frac{\sqrt{3}}{6}$ $-\frac{\sqrt{3}}{6}$	$\frac{\sqrt{3}}{6}$ $-\frac{\sqrt{3}}{6}$	$\frac{\sqrt{3}}{6}$	$\frac{\sqrt{3}}{6}$	$\frac{\sqrt{3}}{6}$	$\frac{\sqrt{3}}{6}$	$-\frac{\sqrt{3}}{6}$	$-\frac{\sqrt{3}}{6}$	$-\frac{\sqrt{3}}{6}$	$-\frac{\sqrt{3}}{6}$