

# SAMB for “CeCoSi”

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- Group: No. 129  $D_{4h}^7$   $P4/nmm$  [ tetragonal ]
  - Associated point group: No. 15  $D_{4h}$   $4/mmm$  [ tetragonal ]
  - Generation condition
    - model type: **tight\_binding**
    - time-reversal type: **electric**
    - irrep: **[A1g]**
    - **spinful**
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- Unit cell:  
 $a = 4.057$ ,  $b = 4.057$ ,  $c = 6.987$ ,  $\alpha = 90.0$ ,  $\beta = 90.0$ ,  $\gamma = 90.0$
- Lattice vectors:  
 $\mathbf{a}_1 = (4.057 \ 0 \ 0)$   
 $\mathbf{a}_2 = (0 \ 4.057 \ 0)$   
 $\mathbf{a}_3 = (0 \ 0 \ 6.987)$

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

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

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- Kets: dimension = 36

Table 2: Hilbert space for full matrix.

No.	ket	No.	ket	No.	ket	No.	ket	No.	ket
1	$(p_x, \uparrow)@Ce_1$	2	$(p_x, \downarrow)@Ce_1$	3	$(p_y, \uparrow)@Ce_1$	4	$(p_y, \downarrow)@Ce_1$	5	$(p_z, \uparrow)@Ce_1$
6	$(p_z, \downarrow)@Ce_1$	7	$(p_x, \uparrow)@Ce_2$	8	$(p_x, \downarrow)@Ce_2$	9	$(p_y, \uparrow)@Ce_2$	10	$(p_y, \downarrow)@Ce_2$
11	$(p_z, \uparrow)@Ce_2$	12	$(p_z, \downarrow)@Ce_2$	13	$(p_x, \uparrow)@Co_1$	14	$(p_x, \downarrow)@Co_1$	15	$(p_y, \uparrow)@Co_1$
16	$(p_y, \downarrow)@Co_1$	17	$(p_z, \uparrow)@Co_1$	18	$(p_z, \downarrow)@Co_1$	19	$(p_x, \uparrow)@Co_2$	20	$(p_x, \downarrow)@Co_2$
21	$(p_y, \uparrow)@Co_2$	22	$(p_y, \downarrow)@Co_2$	23	$(p_z, \uparrow)@Co_2$	24	$(p_z, \downarrow)@Co_2$	25	$(p_x, \uparrow)@Si_1$
26	$(p_x, \downarrow)@Si_1$	27	$(p_y, \uparrow)@Si_1$	28	$(p_y, \downarrow)@Si_1$	29	$(p_z, \uparrow)@Si_1$	30	$(p_z, \downarrow)@Si_1$
31	$(p_x, \uparrow)@Si_2$	32	$(p_x, \downarrow)@Si_2$	33	$(p_y, \uparrow)@Si_2$	34	$(p_y, \downarrow)@Si_2$	35	$(p_z, \uparrow)@Si_2$
36	$(p_z, \downarrow)@Si_2$								

- Sites in (primitive) unit cell:

Table 3: Site-clusters.

site	position	mapping
S <sub>1</sub>	Ce <sub>1</sub> $\left( \begin{smallmatrix} \frac{1}{4} & \frac{1}{4} & 0.678 \end{smallmatrix} \right)$	[1,2,7,8,11,12,13,14]
	Ce <sub>2</sub> $\left( \begin{smallmatrix} \frac{3}{4} & \frac{3}{4} & 0.322 \end{smallmatrix} \right)$	[3,4,5,6,9,10,15,16]
S <sub>2</sub>	Co <sub>1</sub> $\left( \begin{smallmatrix} \frac{1}{4} & \frac{3}{4} & 0 \end{smallmatrix} \right)$	[1,2,5,6,11,12,15,16]
	Co <sub>2</sub> $\left( \begin{smallmatrix} \frac{3}{4} & \frac{1}{4} & 0 \end{smallmatrix} \right)$	[3,4,7,8,9,10,13,14]
S <sub>3</sub>	Si <sub>1</sub> $\left( \begin{smallmatrix} \frac{1}{4} & \frac{1}{4} & 0.178 \end{smallmatrix} \right)$	[1,2,7,8,11,12,13,14]
	Si <sub>2</sub> $\left( \begin{smallmatrix} \frac{3}{4} & \frac{3}{4} & 0.822 \end{smallmatrix} \right)$	[3,4,5,6,9,10,15,16]

- 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>	Co <sub>1</sub>	Ce <sub>1</sub>	1	1	$\begin{pmatrix} 0 & -\frac{1}{2} & 0.322 \end{pmatrix} @ \begin{pmatrix} \frac{1}{4} & 0 & 0.839 \end{pmatrix}$	[1,11]
	b <sub>2</sub>	Co <sub>1</sub>	Ce <sub>1</sub>	1	1	$\begin{pmatrix} 0 & \frac{1}{2} & 0.322 \end{pmatrix} @ \begin{pmatrix} \frac{1}{4} & \frac{1}{2} & 0.839 \end{pmatrix}$	[2,12]
	b <sub>3</sub>	Co <sub>2</sub>	Ce <sub>2</sub>	1	1	$\begin{pmatrix} 0 & \frac{1}{2} & -0.322 \end{pmatrix} @ \begin{pmatrix} \frac{3}{4} & 0 & 0.161 \end{pmatrix}$	[3,9]
	b <sub>4</sub>	Co <sub>2</sub>	Ce <sub>2</sub>	1	1	$\begin{pmatrix} 0 & -\frac{1}{2} & -0.322 \end{pmatrix} @ \begin{pmatrix} \frac{3}{4} & \frac{1}{2} & 0.161 \end{pmatrix}$	[4,10]
	b <sub>5</sub>	Co <sub>1</sub>	Ce <sub>2</sub>	1	1	$\begin{pmatrix} -\frac{1}{2} & 0 & -0.322 \end{pmatrix} @ \begin{pmatrix} \frac{1}{2} & \frac{3}{4} & 0.161 \end{pmatrix}$	[5,15]
	b <sub>6</sub>	Co <sub>1</sub>	Ce <sub>2</sub>	1	1	$\begin{pmatrix} \frac{1}{2} & 0 & -0.322 \end{pmatrix} @ \begin{pmatrix} 0 & \frac{3}{4} & 0.161 \end{pmatrix}$	[6,16]
	b <sub>7</sub>	Co <sub>2</sub>	Ce <sub>1</sub>	1	1	$\begin{pmatrix} \frac{1}{2} & 0 & 0.322 \end{pmatrix} @ \begin{pmatrix} \frac{1}{2} & \frac{1}{4} & 0.839 \end{pmatrix}$	[7,13]
	b <sub>8</sub>	Co <sub>2</sub>	Ce <sub>1</sub>	1	1	$\begin{pmatrix} -\frac{1}{2} & 0 & 0.322 \end{pmatrix} @ \begin{pmatrix} 0 & \frac{1}{4} & 0.839 \end{pmatrix}$	[8,14]
B <sub>2</sub>	b <sub>9</sub>	Si <sub>2</sub>	Ce <sub>1</sub>	1	1	$\begin{pmatrix} -\frac{1}{2} & -\frac{1}{2} & 0.144 \end{pmatrix} @ \begin{pmatrix} 0 & 0 & \frac{3}{4} \end{pmatrix}$	[1,14]
	b <sub>10</sub>	Si <sub>2</sub>	Ce <sub>1</sub>	1	1	$\begin{pmatrix} \frac{1}{2} & \frac{1}{2} & 0.144 \end{pmatrix} @ \begin{pmatrix} \frac{1}{2} & \frac{1}{2} & \frac{3}{4} \end{pmatrix}$	[2,13]
	b <sub>11</sub>	Si <sub>1</sub>	Ce <sub>2</sub>	1	1	$\begin{pmatrix} -\frac{1}{2} & \frac{1}{2} & -0.144 \end{pmatrix} @ \begin{pmatrix} \frac{1}{2} & 0 & \frac{1}{4} \end{pmatrix}$	[3,15]
	b <sub>12</sub>	Si <sub>1</sub>	Ce <sub>2</sub>	1	1	$\begin{pmatrix} \frac{1}{2} & -\frac{1}{2} & -0.144 \end{pmatrix} @ \begin{pmatrix} 0 & \frac{1}{2} & \frac{1}{4} \end{pmatrix}$	[4,16]
	b <sub>13</sub>	Si <sub>1</sub>	Ce <sub>2</sub>	1	1	$\begin{pmatrix} -\frac{1}{2} & -\frac{1}{2} & -0.144 \end{pmatrix} @ \begin{pmatrix} \frac{1}{2} & \frac{1}{2} & \frac{1}{4} \end{pmatrix}$	[5,10]
	b <sub>14</sub>	Si <sub>1</sub>	Ce <sub>2</sub>	1	1	$\begin{pmatrix} \frac{1}{2} & \frac{1}{2} & -0.144 \end{pmatrix} @ \begin{pmatrix} 0 & 0 & \frac{1}{4} \end{pmatrix}$	[6,9]
	b <sub>15</sub>	Si <sub>2</sub>	Ce <sub>1</sub>	1	1	$\begin{pmatrix} \frac{1}{2} & -\frac{1}{2} & 0.144 \end{pmatrix} @ \begin{pmatrix} \frac{1}{2} & 0 & \frac{3}{4} \end{pmatrix}$	[7,11]
	b <sub>16</sub>	Si <sub>2</sub>	Ce <sub>1</sub>	1	1	$\begin{pmatrix} -\frac{1}{2} & \frac{1}{2} & 0.144 \end{pmatrix} @ \begin{pmatrix} 0 & \frac{1}{2} & \frac{3}{4} \end{pmatrix}$	[8,12]
B <sub>3</sub>	b <sub>17</sub>	Si <sub>1</sub>	Co <sub>1</sub>	1	1	$\begin{pmatrix} 0 & \frac{1}{2} & 0.178 \end{pmatrix} @ \begin{pmatrix} \frac{1}{4} & 0 & 0.089 \end{pmatrix}$	[1,11]
	b <sub>18</sub>	Si <sub>1</sub>	Co <sub>1</sub>	1	1	$\begin{pmatrix} 0 & -\frac{1}{2} & 0.178 \end{pmatrix} @ \begin{pmatrix} \frac{1}{4} & \frac{1}{2} & 0.089 \end{pmatrix}$	[2,12]
	b <sub>19</sub>	Si <sub>2</sub>	Co <sub>2</sub>	1	1	$\begin{pmatrix} 0 & -\frac{1}{2} & -0.178 \end{pmatrix} @ \begin{pmatrix} \frac{3}{4} & 0 & 0.911 \end{pmatrix}$	[3,9]
	b <sub>20</sub>	Si <sub>2</sub>	Co <sub>2</sub>	1	1	$\begin{pmatrix} 0 & \frac{1}{2} & -0.178 \end{pmatrix} @ \begin{pmatrix} \frac{3}{4} & \frac{1}{2} & 0.911 \end{pmatrix}$	[4,10]
	b <sub>21</sub>	Si <sub>2</sub>	Co <sub>1</sub>	1	1	$\begin{pmatrix} \frac{1}{2} & 0 & -0.178 \end{pmatrix} @ \begin{pmatrix} \frac{1}{2} & \frac{3}{4} & 0.911 \end{pmatrix}$	[5,15]
	b <sub>22</sub>	Si <sub>2</sub>	Co <sub>1</sub>	1	1	$\begin{pmatrix} -\frac{1}{2} & 0 & -0.178 \end{pmatrix} @ \begin{pmatrix} 0 & \frac{3}{4} & 0.911 \end{pmatrix}$	[6,16]
	b <sub>23</sub>	Si <sub>1</sub>	Co <sub>2</sub>	1	1	$\begin{pmatrix} -\frac{1}{2} & 0 & 0.178 \end{pmatrix} @ \begin{pmatrix} \frac{1}{2} & \frac{1}{4} & 0.089 \end{pmatrix}$	[7,13]
	b <sub>24</sub>	Si <sub>1</sub>	Co <sub>2</sub>	1	1	$\begin{pmatrix} \frac{1}{2} & 0 & 0.178 \end{pmatrix} @ \begin{pmatrix} 0 & \frac{1}{4} & 0.089 \end{pmatrix}$	[8,14]

- SAMB:

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

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

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

$$\boxed{\text{No. 2}} \quad \hat{Q}_2^{(A_{1g})} [M_1, S_1]$$

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

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

$$\boxed{\text{No. 3}} \quad \hat{Q}_0^{(A_{1g})}(1, 1) [M_1, S_1]$$

$$\hat{Z}_3 = \mathbb{X}_3[\mathbb{Q}_0^{(a, A_{1g})}(1, 1)] \otimes \mathbb{Y}_1[\mathbb{Q}_0^{(s, A_{1g})}]$$

$$\hat{Z}_3(\mathbf{k}) = \mathbb{X}_3[\mathbb{Q}_0^{(a, A_{1g})}(1, 1)] \otimes \mathbb{U}_1[\mathbb{Q}_0^{(s, A_{1g})}]$$

$$\boxed{\text{No. 4}} \quad \hat{Q}_2^{(A_{1g})}(1, -1) [M_1, S_1]$$

$$\hat{Z}_4 = \mathbb{X}_4[\mathbb{Q}_2^{(a, A_{1g})}(1, -1)] \otimes \mathbb{Y}_1[\mathbb{Q}_0^{(s, A_{1g})}]$$

$$\hat{Z}_4(\mathbf{k}) = \mathbb{X}_4[\mathbb{Q}_2^{(a, A_{1g})}(1, -1)] \otimes \mathbb{U}_1[\mathbb{Q}_0^{(s, A_{1g})}]$$

$$\boxed{\text{No. 5}} \quad \hat{Q}_0^{(A_{1g})} [M_1, S_2]$$

$$\hat{Z}_5 = \mathbb{X}_1[\mathbb{Q}_0^{(a, A_{1g})}] \otimes \mathbb{Y}_2[\mathbb{Q}_0^{(s, A_{1g})}]$$

$$\hat{Z}_5(\mathbf{k}) = \mathbb{X}_1[\mathbb{Q}_0^{(a, A_{1g})}] \otimes \mathbb{U}_2[\mathbb{Q}_0^{(s, A_{1g})}]$$

$$\boxed{\text{No. 6}} \quad \hat{Q}_2^{(A_{1g})} [M_1, S_2]$$

$$\hat{Z}_6 = \mathbb{X}_2[\mathbb{Q}_2^{(a, A_{1g})}] \otimes \mathbb{Y}_2[\mathbb{Q}_0^{(s, A_{1g})}]$$

$$\hat{Z}_6(\mathbf{k}) = \mathbb{X}_2[\mathbb{Q}_2^{(a, A_{1g})}] \otimes \mathbb{U}_2[\mathbb{Q}_0^{(s, A_{1g})}]$$

$$\boxed{\text{No. 7}} \quad \hat{\mathbb{Q}}_0^{(A_{1g})}(1, 1) \text{ [M}_1, \text{S}_2]$$

$$\hat{\mathbb{Z}}_7 = \mathbb{X}_3[\mathbb{Q}_0^{(a, A_{1g})}(1, 1)] \otimes \mathbb{Y}_2[\mathbb{Q}_0^{(s, A_{1g})}]$$

$$\hat{\mathbb{Z}}_7(\mathbf{k}) = \mathbb{X}_3[\mathbb{Q}_0^{(a, A_{1g})}(1, 1)] \otimes \mathbb{U}_2[\mathbb{Q}_0^{(s, A_{1g})}]$$

$$\boxed{\text{No. 8}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})}(1, -1) \text{ [M}_1, \text{S}_2]$$

$$\hat{\mathbb{Z}}_8 = \mathbb{X}_4[\mathbb{Q}_2^{(a, A_{1g})}(1, -1)] \otimes \mathbb{Y}_2[\mathbb{Q}_0^{(s, A_{1g})}]$$

$$\hat{\mathbb{Z}}_8(\mathbf{k}) = \mathbb{X}_4[\mathbb{Q}_2^{(a, A_{1g})}(1, -1)] \otimes \mathbb{U}_2[\mathbb{Q}_0^{(s, A_{1g})}]$$

$$\boxed{\text{No. 9}} \quad \hat{\mathbb{Q}}_0^{(A_{1g})} \text{ [M}_1, \text{S}_3]$$

$$\hat{\mathbb{Z}}_9 = \mathbb{X}_1[\mathbb{Q}_0^{(a, A_{1g})}] \otimes \mathbb{Y}_3[\mathbb{Q}_0^{(s, A_{1g})}]$$

$$\hat{\mathbb{Z}}_9(\mathbf{k}) = \mathbb{X}_1[\mathbb{Q}_0^{(a, A_{1g})}] \otimes \mathbb{U}_3[\mathbb{Q}_0^{(s, A_{1g})}]$$

$$\boxed{\text{No. 10}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})} \text{ [M}_1, \text{S}_3]$$

$$\hat{\mathbb{Z}}_{10} = \mathbb{X}_2[\mathbb{Q}_2^{(a, A_{1g})}] \otimes \mathbb{Y}_3[\mathbb{Q}_0^{(s, A_{1g})}]$$

$$\hat{\mathbb{Z}}_{10}(\mathbf{k}) = \mathbb{X}_2[\mathbb{Q}_2^{(a, A_{1g})}] \otimes \mathbb{U}_3[\mathbb{Q}_0^{(s, A_{1g})}]$$

$$\boxed{\text{No. 11}} \quad \hat{\mathbb{Q}}_0^{(A_{1g})}(1, 1) \text{ [M}_1, \text{S}_3]$$

$$\hat{\mathbb{Z}}_{11} = \mathbb{X}_3[\mathbb{Q}_0^{(a, A_{1g})}(1, 1)] \otimes \mathbb{Y}_3[\mathbb{Q}_0^{(s, A_{1g})}]$$

$$\hat{\mathbb{Z}}_{11}(\mathbf{k}) = \mathbb{X}_3[\mathbb{Q}_0^{(a, A_{1g})}(1, 1)] \otimes \mathbb{U}_3[\mathbb{Q}_0^{(s, A_{1g})}]$$

$$\boxed{\text{No. 12}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})}(1, -1) \text{ [M}_1, \text{S}_3]$$

$$\hat{\mathbb{Z}}_{12} = \mathbb{X}_4[\mathbb{Q}_2^{(a, A_{1g})}(1, -1)] \otimes \mathbb{Y}_3[\mathbb{Q}_0^{(s, A_{1g})}]$$

$$\hat{\mathbb{Z}}_{12}(\mathbf{k}) = \mathbb{X}_4[\mathbb{Q}_2^{(a, A_{1g})}(1, -1)] \otimes \mathbb{U}_3[\mathbb{Q}_0^{(s, A_{1g})}]$$

$$\boxed{\text{No. 13}} \quad \hat{\mathbb{Q}}_0^{(A_{1g})} [\mathbf{M}_1, \mathbf{B}_1]$$

$$\hat{\mathbf{Z}}_{13} = \mathbb{X}_1[\mathbb{Q}_0^{(a, A_{1g})}] \otimes \mathbb{Y}_4[\mathbb{Q}_0^{(b, A_{1g})}]$$

$$\begin{aligned} \hat{\mathbf{Z}}_{13}(\mathbf{k}) = & -\frac{\mathbb{X}_1[\mathbb{Q}_0^{(a, A_{1g})}] \otimes \mathbb{U}_{11}[\mathbb{T}_3^{(u, B_{2u})}] \otimes \mathbb{F}_8[\mathbb{T}_3^{(k, B_{2u})}]}{2} + \frac{\mathbb{X}_1[\mathbb{Q}_0^{(a, A_{1g})}] \otimes \mathbb{U}_4[\mathbb{Q}_0^{(u, A_{1g})}] \otimes \mathbb{F}_1[\mathbb{Q}_0^{(k, A_{1g})}]}{2} \\ & + \frac{\mathbb{X}_1[\mathbb{Q}_0^{(a, A_{1g})}] \otimes \mathbb{U}_6[\mathbb{Q}_2^{(u, B_{1g})}] \otimes \mathbb{F}_2[\mathbb{Q}_2^{(k, B_{1g})}]}{2} - \frac{\mathbb{X}_1[\mathbb{Q}_0^{(a, A_{1g})}] \otimes \mathbb{U}_9[\mathbb{T}_1^{(u, A_{2u})}] \otimes \mathbb{F}_5[\mathbb{T}_1^{(k, A_{2u})}]}{2} \end{aligned}$$

$$\boxed{\text{No. 14}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})} [\mathbf{M}_1, \mathbf{B}_1]$$

$$\hat{\mathbf{Z}}_{14} = \mathbb{X}_2[\mathbb{Q}_2^{(a, A_{1g})}] \otimes \mathbb{Y}_4[\mathbb{Q}_0^{(b, A_{1g})}]$$

$$\begin{aligned} \hat{\mathbf{Z}}_{14}(\mathbf{k}) = & -\frac{\mathbb{X}_2[\mathbb{Q}_2^{(a, A_{1g})}] \otimes \mathbb{U}_{11}[\mathbb{T}_3^{(u, B_{2u})}] \otimes \mathbb{F}_8[\mathbb{T}_3^{(k, B_{2u})}]}{2} + \frac{\mathbb{X}_2[\mathbb{Q}_2^{(a, A_{1g})}] \otimes \mathbb{U}_4[\mathbb{Q}_0^{(u, A_{1g})}] \otimes \mathbb{F}_1[\mathbb{Q}_0^{(k, A_{1g})}]}{2} \\ & + \frac{\mathbb{X}_2[\mathbb{Q}_2^{(a, A_{1g})}] \otimes \mathbb{U}_6[\mathbb{Q}_2^{(u, B_{1g})}] \otimes \mathbb{F}_2[\mathbb{Q}_2^{(k, B_{1g})}]}{2} - \frac{\mathbb{X}_2[\mathbb{Q}_2^{(a, A_{1g})}] \otimes \mathbb{U}_9[\mathbb{T}_1^{(u, A_{2u})}] \otimes \mathbb{F}_5[\mathbb{T}_1^{(k, A_{2u})}]}{2} \end{aligned}$$

$$\boxed{\text{No. 15}} \quad \hat{\mathbb{Q}}_0^{(A_{1g})} [\mathbf{M}_1, \mathbf{B}_1]$$

$$\hat{\mathbf{Z}}_{15} = \frac{\sqrt{3}\mathbb{X}_5[\mathbb{Q}_2^{(a, B_{1g})}] \otimes \mathbb{Y}_5[\mathbb{Q}_2^{(b, B_{1g})}]}{3} + \frac{\sqrt{3}\mathbb{X}_7[\mathbb{Q}_{2,0}^{(a, E_g)}] \otimes \mathbb{Y}_6[\mathbb{Q}_{2,0}^{(b, E_g)}]}{3} + \frac{\sqrt{3}\mathbb{X}_8[\mathbb{Q}_{2,1}^{(a, E_g)}] \otimes \mathbb{Y}_7[\mathbb{Q}_{2,1}^{(b, E_g)}]}{3}$$

$$\begin{aligned} \hat{\mathbf{Z}}_{15}(\mathbf{k}) = & -\frac{\sqrt{3}\mathbb{X}_5[\mathbb{Q}_2^{(a, B_{1g})}] \otimes \mathbb{U}_{11}[\mathbb{T}_3^{(u, B_{2u})}] \otimes \mathbb{F}_5[\mathbb{T}_1^{(k, A_{2u})}]}{6} + \frac{\sqrt{3}\mathbb{X}_5[\mathbb{Q}_2^{(a, B_{1g})}] \otimes \mathbb{U}_4[\mathbb{Q}_0^{(u, A_{1g})}] \otimes \mathbb{F}_2[\mathbb{Q}_2^{(k, B_{1g})}]}{6} + \frac{\sqrt{3}\mathbb{X}_5[\mathbb{Q}_2^{(a, B_{1g})}] \otimes \mathbb{U}_6[\mathbb{Q}_2^{(u, B_{1g})}] \otimes \mathbb{F}_1[\mathbb{Q}_0^{(k, A_{1g})}]}{6} \\ & - \frac{\sqrt{3}\mathbb{X}_5[\mathbb{Q}_2^{(a, B_{1g})}] \otimes \mathbb{U}_9[\mathbb{T}_1^{(u, A_{2u})}] \otimes \mathbb{F}_8[\mathbb{T}_3^{(k, B_{2u})}]}{6} - \frac{\sqrt{3}\mathbb{X}_7[\mathbb{Q}_{2,0}^{(a, E_g)}] \otimes \mathbb{U}_{11}[\mathbb{T}_3^{(u, B_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k, E_u)}]}{6} + \frac{\sqrt{3}\mathbb{X}_7[\mathbb{Q}_{2,0}^{(a, E_g)}] \otimes \mathbb{U}_4[\mathbb{Q}_0^{(u, A_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k, E_g)}]}{6} \\ & + \frac{\sqrt{3}\mathbb{X}_7[\mathbb{Q}_{2,0}^{(a, E_g)}] \otimes \mathbb{U}_6[\mathbb{Q}_2^{(u, B_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k, E_g)}]}{6} - \frac{\sqrt{3}\mathbb{X}_7[\mathbb{Q}_{2,0}^{(a, E_g)}] \otimes \mathbb{U}_9[\mathbb{T}_1^{(u, A_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k, E_u)}]}{6} + \frac{\sqrt{3}\mathbb{X}_8[\mathbb{Q}_{2,1}^{(a, E_g)}] \otimes \mathbb{U}_{11}[\mathbb{T}_3^{(u, B_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k, E_u)}]}{6} \\ & + \frac{\sqrt{3}\mathbb{X}_8[\mathbb{Q}_{2,1}^{(a, E_g)}] \otimes \mathbb{U}_4[\mathbb{Q}_0^{(u, A_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k, E_g)}]}{6} - \frac{\sqrt{3}\mathbb{X}_8[\mathbb{Q}_{2,1}^{(a, E_g)}] \otimes \mathbb{U}_6[\mathbb{Q}_2^{(u, B_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k, E_g)}]}{6} - \frac{\sqrt{3}\mathbb{X}_8[\mathbb{Q}_{2,1}^{(a, E_g)}] \otimes \mathbb{U}_9[\mathbb{T}_1^{(u, A_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k, E_u)}]}{6} \end{aligned}$$

$$\boxed{\text{No. 16}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})} [\mathbf{M}_1, \mathbf{B}_1]$$

$$\hat{\mathbf{Z}}_{16} = -\frac{\sqrt{6}\mathbb{X}_5[\mathbb{Q}_2^{(a, B_{1g})}] \otimes \mathbb{Y}_5[\mathbb{Q}_2^{(b, B_{1g})}]}{3} + \frac{\sqrt{6}\mathbb{X}_7[\mathbb{Q}_{2,0}^{(a, E_g)}] \otimes \mathbb{Y}_6[\mathbb{Q}_{2,0}^{(b, E_g)}]}{6} + \frac{\sqrt{6}\mathbb{X}_8[\mathbb{Q}_{2,1}^{(a, E_g)}] \otimes \mathbb{Y}_7[\mathbb{Q}_{2,1}^{(b, E_g)}]}{6}$$

$$\begin{aligned}
\hat{Z}_{16}(\mathbf{k}) = & \frac{\sqrt{6}\mathbb{X}_5[\mathbb{Q}_2^{(a,B_{1g})}] \otimes \mathbb{U}_{11}[\mathbb{T}_3^{(u,B_{2u})}] \otimes \mathbb{F}_5[\mathbb{T}_1^{(k,A_{2u})}]}{6} - \frac{\sqrt{6}\mathbb{X}_5[\mathbb{Q}_2^{(a,B_{1g})}] \otimes \mathbb{U}_4[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_2[\mathbb{Q}_2^{(k,B_{1g})}]}{6} - \frac{\sqrt{6}\mathbb{X}_5[\mathbb{Q}_2^{(a,B_{1g})}] \otimes \mathbb{U}_6[\mathbb{Q}_2^{(u,B_{1g})}] \otimes \mathbb{F}_1[\mathbb{Q}_0^{(k,A_{1g})}]}{6} \\
& + \frac{\sqrt{6}\mathbb{X}_5[\mathbb{Q}_2^{(a,B_{1g})}] \otimes \mathbb{U}_9[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_8[\mathbb{T}_3^{(k,B_{2u})}]}{6} - \frac{\sqrt{6}\mathbb{X}_7[\mathbb{Q}_{2,0}^{(a,E_g)}] \otimes \mathbb{U}_{11}[\mathbb{T}_3^{(u,B_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k,E_u)}]}{12} + \frac{\sqrt{6}\mathbb{X}_7[\mathbb{Q}_{2,0}^{(a,E_g)}] \otimes \mathbb{U}_4[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k,E_g)}]}{12} \\
& + \frac{\sqrt{6}\mathbb{X}_7[\mathbb{Q}_{2,0}^{(a,E_g)}] \otimes \mathbb{U}_6[\mathbb{Q}_2^{(u,B_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k,E_g)}]}{12} - \frac{\sqrt{6}\mathbb{X}_7[\mathbb{Q}_{2,0}^{(a,E_g)}] \otimes \mathbb{U}_9[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k,E_u)}]}{12} + \frac{\sqrt{6}\mathbb{X}_8[\mathbb{Q}_{2,1}^{(a,E_g)}] \otimes \mathbb{U}_{11}[\mathbb{T}_3^{(u,B_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k,E_u)}]}{12} \\
& + \frac{\sqrt{6}\mathbb{X}_8[\mathbb{Q}_{2,1}^{(a,E_g)}] \otimes \mathbb{U}_4[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k,E_g)}]}{12} - \frac{\sqrt{6}\mathbb{X}_8[\mathbb{Q}_{2,1}^{(a,E_g)}] \otimes \mathbb{U}_6[\mathbb{Q}_2^{(u,B_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k,E_g)}]}{12} - \frac{\sqrt{6}\mathbb{X}_8[\mathbb{Q}_{2,1}^{(a,E_g)}] \otimes \mathbb{U}_9[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k,E_u)}]}{12}
\end{aligned}$$

$$\boxed{\text{No. 17}} \quad \hat{\mathbb{Q}}_0^{(A_{1g})}(1, 1) \text{ } [\mathbb{M}_1, \mathbb{B}_1]$$

$$\hat{Z}_{17} = \mathbb{X}_3[\mathbb{Q}_0^{(a,A_{1g})}(1, 1)] \otimes \mathbb{Y}_4[\mathbb{Q}_0^{(b,A_{1g})}]$$

$$\begin{aligned}
\hat{Z}_{17}(\mathbf{k}) = & -\frac{\mathbb{X}_3[\mathbb{Q}_0^{(a,A_{1g})}(1, 1)] \otimes \mathbb{U}_{11}[\mathbb{T}_3^{(u,B_{2u})}] \otimes \mathbb{F}_8[\mathbb{T}_3^{(k,B_{2u})}]}{2} + \frac{\mathbb{X}_3[\mathbb{Q}_0^{(a,A_{1g})}(1, 1)] \otimes \mathbb{U}_4[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_1[\mathbb{Q}_0^{(k,A_{1g})}]}{2} \\
& + \frac{\mathbb{X}_3[\mathbb{Q}_0^{(a,A_{1g})}(1, 1)] \otimes \mathbb{U}_6[\mathbb{Q}_2^{(u,B_{1g})}] \otimes \mathbb{F}_2[\mathbb{Q}_2^{(k,B_{1g})}]}{2} - \frac{\mathbb{X}_3[\mathbb{Q}_0^{(a,A_{1g})}(1, 1)] \otimes \mathbb{U}_9[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_5[\mathbb{T}_1^{(k,A_{2u})}]}{2}
\end{aligned}$$

$$\boxed{\text{No. 18}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})}(1, -1) \text{ } [\mathbb{M}_1, \mathbb{B}_1]$$

$$\hat{Z}_{18} = \mathbb{X}_4[\mathbb{Q}_2^{(a,A_{1g})}(1, -1)] \otimes \mathbb{Y}_4[\mathbb{Q}_0^{(b,A_{1g})}]$$

$$\begin{aligned}
\hat{Z}_{18}(\mathbf{k}) = & -\frac{\mathbb{X}_4[\mathbb{Q}_2^{(a,A_{1g})}(1, -1)] \otimes \mathbb{U}_{11}[\mathbb{T}_3^{(u,B_{2u})}] \otimes \mathbb{F}_8[\mathbb{T}_3^{(k,B_{2u})}]}{2} + \frac{\mathbb{X}_4[\mathbb{Q}_2^{(a,A_{1g})}(1, -1)] \otimes \mathbb{U}_4[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_1[\mathbb{Q}_0^{(k,A_{1g})}]}{2} \\
& + \frac{\mathbb{X}_4[\mathbb{Q}_2^{(a,A_{1g})}(1, -1)] \otimes \mathbb{U}_6[\mathbb{Q}_2^{(u,B_{1g})}] \otimes \mathbb{F}_2[\mathbb{Q}_2^{(k,B_{1g})}]}{2} - \frac{\mathbb{X}_4[\mathbb{Q}_2^{(a,A_{1g})}(1, -1)] \otimes \mathbb{U}_9[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_5[\mathbb{T}_1^{(k,A_{2u})}]}{2}
\end{aligned}$$

$$\boxed{\text{No. 19}} \quad \hat{\mathbb{Q}}_0^{(A_{1g})}(1, -1) \text{ } [\mathbb{M}_1, \mathbb{B}_1]$$

$$\hat{Z}_{19} = \frac{\sqrt{3}\mathbb{X}_{11}[\mathbb{Q}_{2,0}^{(a,E_g)}(1, -1)] \otimes \mathbb{Y}_6[\mathbb{Q}_{2,0}^{(b,E_g)}]}{3} + \frac{\sqrt{3}\mathbb{X}_{12}[\mathbb{Q}_{2,1}^{(a,E_g)}(1, -1)] \otimes \mathbb{Y}_7[\mathbb{Q}_{2,1}^{(b,E_g)}]}{3} + \frac{\sqrt{3}\mathbb{X}_9[\mathbb{Q}_2^{(a,B_{1g})}(1, -1)] \otimes \mathbb{Y}_5[\mathbb{Q}_2^{(b,B_{1g})}]}{3}$$

$$\begin{aligned}
\hat{Z}_{19}(\mathbf{k}) = & -\frac{\sqrt{3}\mathbb{X}_{11}[\mathbb{Q}_{2,0}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_{11}[\mathbb{T}_3^{(u,B_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k,E_u)}]}{6} + \frac{\sqrt{3}\mathbb{X}_{11}[\mathbb{Q}_{2,0}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_4[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k,E_g)}]}{6} \\
& + \frac{\sqrt{3}\mathbb{X}_{11}[\mathbb{Q}_{2,0}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_6[\mathbb{Q}_2^{(u,B_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k,E_g)}]}{6} - \frac{\sqrt{3}\mathbb{X}_{11}[\mathbb{Q}_{2,0}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_9[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k,E_u)}]}{6} \\
& + \frac{\sqrt{3}\mathbb{X}_{12}[\mathbb{Q}_{2,1}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_{11}[\mathbb{T}_3^{(u,B_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k,E_u)}]}{6} + \frac{\sqrt{3}\mathbb{X}_{12}[\mathbb{Q}_{2,1}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_4[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k,E_g)}]}{6} \\
& - \frac{\sqrt{3}\mathbb{X}_{12}[\mathbb{Q}_{2,1}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_6[\mathbb{Q}_2^{(u,B_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k,E_g)}]}{6} - \frac{\sqrt{3}\mathbb{X}_{12}[\mathbb{Q}_{2,1}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_9[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k,E_u)}]}{6} \\
& - \frac{\sqrt{3}\mathbb{X}_9[\mathbb{Q}_2^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_{11}[\mathbb{T}_3^{(u,B_{2u})}] \otimes \mathbb{F}_5[\mathbb{T}_1^{(k,A_{2u})}]}{6} + \frac{\sqrt{3}\mathbb{X}_9[\mathbb{Q}_2^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_4[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_2[\mathbb{Q}_2^{(k,B_{1g})}]}{6} \\
& + \frac{\sqrt{3}\mathbb{X}_9[\mathbb{Q}_2^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_6[\mathbb{Q}_2^{(u,B_{1g})}] \otimes \mathbb{F}_1[\mathbb{Q}_0^{(k,A_{1g})}]}{6} - \frac{\sqrt{3}\mathbb{X}_9[\mathbb{Q}_2^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_9[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_8[\mathbb{T}_3^{(k,B_{2u})}]}{6}
\end{aligned}$$

$$\boxed{\text{No. 20}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})}(1,-1) [\mathbb{M}_1, \mathbb{B}_1]$$

$$\hat{Z}_{20} = \frac{\sqrt{6}\mathbb{X}_{11}[\mathbb{Q}_{2,0}^{(a,E_g)}(1,-1)] \otimes \mathbb{Y}_6[\mathbb{Q}_{2,0}^{(b,E_g)}]}{6} + \frac{\sqrt{6}\mathbb{X}_{12}[\mathbb{Q}_{2,1}^{(a,E_g)}(1,-1)] \otimes \mathbb{Y}_7[\mathbb{Q}_{2,1}^{(b,E_g)}]}{6} - \frac{\sqrt{6}\mathbb{X}_9[\mathbb{Q}_2^{(a,B_{1g})}(1,-1)] \otimes \mathbb{Y}_5[\mathbb{Q}_2^{(b,B_{1g})}]}{3}$$

$$\begin{aligned}
\hat{Z}_{20}(\mathbf{k}) = & -\frac{\sqrt{6}\mathbb{X}_{11}[\mathbb{Q}_{2,0}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_{11}[\mathbb{T}_3^{(u,B_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k,E_u)}]}{12} + \frac{\sqrt{6}\mathbb{X}_{11}[\mathbb{Q}_{2,0}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_4[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k,E_g)}]}{12} \\
& + \frac{\sqrt{6}\mathbb{X}_{11}[\mathbb{Q}_{2,0}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_6[\mathbb{Q}_2^{(u,B_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k,E_g)}]}{12} - \frac{\sqrt{6}\mathbb{X}_{11}[\mathbb{Q}_{2,0}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_9[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k,E_u)}]}{12} \\
& + \frac{\sqrt{6}\mathbb{X}_{12}[\mathbb{Q}_{2,1}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_{11}[\mathbb{T}_3^{(u,B_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k,E_u)}]}{12} + \frac{\sqrt{6}\mathbb{X}_{12}[\mathbb{Q}_{2,1}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_4[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k,E_g)}]}{12} \\
& - \frac{\sqrt{6}\mathbb{X}_{12}[\mathbb{Q}_{2,1}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_6[\mathbb{Q}_2^{(u,B_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k,E_g)}]}{12} - \frac{\sqrt{6}\mathbb{X}_{12}[\mathbb{Q}_{2,1}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_9[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k,E_u)}]}{12} \\
& + \frac{\sqrt{6}\mathbb{X}_9[\mathbb{Q}_2^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_{11}[\mathbb{T}_3^{(u,B_{2u})}] \otimes \mathbb{F}_5[\mathbb{T}_1^{(k,A_{2u})}]}{6} - \frac{\sqrt{6}\mathbb{X}_9[\mathbb{Q}_2^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_4[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_2[\mathbb{Q}_2^{(k,B_{1g})}]}{6} \\
& - \frac{\sqrt{6}\mathbb{X}_9[\mathbb{Q}_2^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_6[\mathbb{Q}_2^{(u,B_{1g})}] \otimes \mathbb{F}_1[\mathbb{Q}_0^{(k,A_{1g})}]}{6} + \frac{\sqrt{6}\mathbb{X}_9[\mathbb{Q}_2^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_9[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_8[\mathbb{T}_3^{(k,B_{2u})}]}{6}
\end{aligned}$$

$$\boxed{\text{No. 21}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})}(1,0) [\mathbb{M}_1, \mathbb{B}_1]$$

$$\hat{Z}_{21} = \frac{\sqrt{2}\mathbb{X}_{13}[\mathbb{G}_{1,0}^{(a,E_g)}(1,0)] \otimes \mathbb{Y}_6[\mathbb{Q}_{2,0}^{(b,E_g)}]}{2} - \frac{\sqrt{2}\mathbb{X}_{14}[\mathbb{G}_{1,1}^{(a,E_g)}(1,0)] \otimes \mathbb{Y}_7[\mathbb{Q}_{2,1}^{(b,E_g)}]}{2}$$



$$\begin{aligned}
\hat{\mathbb{Z}}_{21}(\mathbf{k}) = & -\frac{\sqrt{2}\mathbb{X}_{13}[\mathbb{G}_{1,0}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{11}[\mathbb{T}_3^{(u,B_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k,E_u)}]}{4} + \frac{\sqrt{2}\mathbb{X}_{13}[\mathbb{G}_{1,0}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_4[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k,E_g)}]}{4} \\
& + \frac{\sqrt{2}\mathbb{X}_{13}[\mathbb{G}_{1,0}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_6[\mathbb{Q}_2^{(u,B_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k,E_g)}]}{4} - \frac{\sqrt{2}\mathbb{X}_{13}[\mathbb{G}_{1,0}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_9[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k,E_u)}]}{4} \\
& - \frac{\sqrt{2}\mathbb{X}_{14}[\mathbb{G}_{1,1}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{11}[\mathbb{T}_3^{(u,B_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k,E_u)}]}{4} - \frac{\sqrt{2}\mathbb{X}_{14}[\mathbb{G}_{1,1}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_4[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k,E_g)}]}{4} \\
& + \frac{\sqrt{2}\mathbb{X}_{14}[\mathbb{G}_{1,1}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_6[\mathbb{Q}_2^{(u,B_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k,E_g)}]}{4} + \frac{\sqrt{2}\mathbb{X}_{14}[\mathbb{G}_{1,1}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_9[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k,E_u)}]}{4}
\end{aligned}$$

$$\boxed{\text{No. 22}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})} [\mathbb{M}_1, \mathbb{B}_1]$$

$$\hat{\mathbb{Z}}_{22} = \frac{\sqrt{2}\mathbb{X}_{15}[\mathbb{M}_{1,0}^{(a,E_g)}] \otimes \mathbb{Y}_{10}[\mathbb{T}_{2,0}^{(b,E_g)}]}{2} - \frac{\sqrt{2}\mathbb{X}_{16}[\mathbb{M}_{1,1}^{(a,E_g)}] \otimes \mathbb{Y}_{11}[\mathbb{T}_{2,1}^{(b,E_g)}]}{2}$$

$$\begin{aligned}
\hat{\mathbb{Z}}_{22}(\mathbf{k}) = & \frac{\sqrt{2}\mathbb{X}_{15}[\mathbb{M}_{1,0}^{(a,E_g)}] \otimes \mathbb{U}_{10}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k,E_g)}]}{4} + \frac{\sqrt{2}\mathbb{X}_{15}[\mathbb{M}_{1,0}^{(a,E_g)}] \otimes \mathbb{U}_5[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k,E_u)}]}{4} + \frac{\sqrt{2}\mathbb{X}_{15}[\mathbb{M}_{1,0}^{(a,E_g)}] \otimes \mathbb{U}_7[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k,E_u)}]}{4} \\
& + \frac{\sqrt{2}\mathbb{X}_{15}[\mathbb{M}_{1,0}^{(a,E_g)}] \otimes \mathbb{U}_8[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k,E_g)}]}{4} + \frac{\sqrt{2}\mathbb{X}_{16}[\mathbb{M}_{1,1}^{(a,E_g)}] \otimes \mathbb{U}_{10}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k,E_g)}]}{4} \\
& - \frac{\sqrt{2}\mathbb{X}_{16}[\mathbb{M}_{1,1}^{(a,E_g)}] \otimes \mathbb{U}_5[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k,E_u)}]}{4} + \frac{\sqrt{2}\mathbb{X}_{16}[\mathbb{M}_{1,1}^{(a,E_g)}] \otimes \mathbb{U}_7[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k,E_u)}]}{4} - \frac{\sqrt{2}\mathbb{X}_{16}[\mathbb{M}_{1,1}^{(a,E_g)}] \otimes \mathbb{U}_8[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k,E_g)}]}{4}
\end{aligned}$$

$$\boxed{\text{No. 23}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})}(1,1) [\mathbb{M}_1, \mathbb{B}_1]$$

$$\hat{\mathbb{Z}}_{23} = \frac{\sqrt{2}\mathbb{X}_{17}[\mathbb{M}_{1,0}^{(a,E_g)}(1,1)] \otimes \mathbb{Y}_{10}[\mathbb{T}_{2,0}^{(b,E_g)}]}{2} - \frac{\sqrt{2}\mathbb{X}_{18}[\mathbb{M}_{1,1}^{(a,E_g)}(1,1)] \otimes \mathbb{Y}_{11}[\mathbb{T}_{2,1}^{(b,E_g)}]}{2}$$

$$\begin{aligned}
\hat{\mathbb{Z}}_{23}(\mathbf{k}) = & \frac{\sqrt{2}\mathbb{X}_{17}[\mathbb{M}_{1,0}^{(a,E_g)}(1,1)] \otimes \mathbb{U}_{10}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k,E_g)}]}{4} + \frac{\sqrt{2}\mathbb{X}_{17}[\mathbb{M}_{1,0}^{(a,E_g)}(1,1)] \otimes \mathbb{U}_5[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k,E_u)}]}{4} \\
& + \frac{\sqrt{2}\mathbb{X}_{17}[\mathbb{M}_{1,0}^{(a,E_g)}(1,1)] \otimes \mathbb{U}_7[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k,E_u)}]}{4} + \frac{\sqrt{2}\mathbb{X}_{17}[\mathbb{M}_{1,0}^{(a,E_g)}(1,1)] \otimes \mathbb{U}_8[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k,E_g)}]}{4} \\
& + \frac{\sqrt{2}\mathbb{X}_{18}[\mathbb{M}_{1,1}^{(a,E_g)}(1,1)] \otimes \mathbb{U}_{10}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k,E_g)}]}{4} - \frac{\sqrt{2}\mathbb{X}_{18}[\mathbb{M}_{1,1}^{(a,E_g)}(1,1)] \otimes \mathbb{U}_5[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k,E_u)}]}{4} \\
& + \frac{\sqrt{2}\mathbb{X}_{18}[\mathbb{M}_{1,1}^{(a,E_g)}(1,1)] \otimes \mathbb{U}_7[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k,E_u)}]}{4} - \frac{\sqrt{2}\mathbb{X}_{18}[\mathbb{M}_{1,1}^{(a,E_g)}(1,1)] \otimes \mathbb{U}_8[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k,E_g)}]}{4}
\end{aligned}$$

$$\boxed{\text{No. 24}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})}(1, -1) [\mathbf{M}_1, \mathbf{B}_1]$$

$$\hat{\mathbb{Z}}_{24} = \frac{\sqrt{2}\mathbb{X}_{19}[\mathbf{M}_{1,0}^{(a,E_g)}(1, -1)] \otimes \mathbb{Y}_{10}[\mathbb{T}_{2,0}^{(b,E_g)}]}{2} - \frac{\sqrt{2}\mathbb{X}_{20}[\mathbf{M}_{1,1}^{(a,E_g)}(1, -1)] \otimes \mathbb{Y}_{11}[\mathbb{T}_{2,1}^{(b,E_g)}]}{2}$$

$$\begin{aligned} \hat{\mathbb{Z}}_{24}(\mathbf{k}) = & \frac{\sqrt{2}\mathbb{X}_{19}[\mathbf{M}_{1,0}^{(a,E_g)}(1, -1)] \otimes \mathbb{U}_{10}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k,E_g)}]}{4} + \frac{\sqrt{2}\mathbb{X}_{19}[\mathbf{M}_{1,0}^{(a,E_g)}(1, -1)] \otimes \mathbb{U}_5[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k,E_u)}]}{4} \\ & + \frac{\sqrt{2}\mathbb{X}_{19}[\mathbf{M}_{1,0}^{(a,E_g)}(1, -1)] \otimes \mathbb{U}_7[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k,E_u)}]}{4} + \frac{\sqrt{2}\mathbb{X}_{19}[\mathbf{M}_{1,0}^{(a,E_g)}(1, -1)] \otimes \mathbb{U}_8[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k,E_g)}]}{4} \\ & + \frac{\sqrt{2}\mathbb{X}_{20}[\mathbf{M}_{1,1}^{(a,E_g)}(1, -1)] \otimes \mathbb{U}_{10}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k,E_g)}]}{4} - \frac{\sqrt{2}\mathbb{X}_{20}[\mathbf{M}_{1,1}^{(a,E_g)}(1, -1)] \otimes \mathbb{U}_5[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k,E_u)}]}{4} \\ & + \frac{\sqrt{2}\mathbb{X}_{20}[\mathbf{M}_{1,1}^{(a,E_g)}(1, -1)] \otimes \mathbb{U}_7[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k,E_u)}]}{4} - \frac{\sqrt{2}\mathbb{X}_{20}[\mathbf{M}_{1,1}^{(a,E_g)}(1, -1)] \otimes \mathbb{U}_8[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k,E_g)}]}{4} \end{aligned}$$

$$\boxed{\text{No. 25}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})}(1, -1) [\mathbf{M}_1, \mathbf{B}_1]$$

$$\begin{aligned} \hat{\mathbb{Z}}_{25} = & -\frac{\sqrt{3}\mathbb{X}_{21}[\mathbf{M}_{3,0}^{(a,E_g,1)}(1, -1)] \otimes \mathbb{Y}_{10}[\mathbb{T}_{2,0}^{(b,E_g)}]}{6} + \frac{\sqrt{3}\mathbb{X}_{22}[\mathbf{M}_{3,1}^{(a,E_g,1)}(1, -1)] \otimes \mathbb{Y}_{11}[\mathbb{T}_{2,1}^{(b,E_g)}]}{6} - \frac{\sqrt{5}\mathbb{X}_{23}[\mathbf{M}_{3,0}^{(a,E_g,2)}(1, -1)] \otimes \mathbb{Y}_{10}[\mathbb{T}_{2,0}^{(b,E_g)}]}{6} \\ & + \frac{\sqrt{5}\mathbb{X}_{24}[\mathbf{M}_{3,1}^{(a,E_g,2)}(1, -1)] \otimes \mathbb{Y}_{11}[\mathbb{T}_{2,1}^{(b,E_g)}]}{6} - \frac{\sqrt{5}\mathbb{X}_{27}[\mathbf{M}_3^{(a,B_{1g})}(1, -1)] \otimes \mathbb{Y}_9[\mathbb{T}_2^{(b,B_{1g})}]}{3} \end{aligned}$$

$$\begin{aligned}
\hat{Z}_{25}(\mathbf{k}) = & -\frac{\sqrt{3}\mathbb{X}_{21}[\mathbb{M}_{3,0}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_{10}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k,E_g)}]}{12} - \frac{\sqrt{3}\mathbb{X}_{21}[\mathbb{M}_{3,0}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_5[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k,E_u)}]}{12} \\
& - \frac{\sqrt{3}\mathbb{X}_{21}[\mathbb{M}_{3,0}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_7[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k,E_u)}]}{12} - \frac{\sqrt{3}\mathbb{X}_{21}[\mathbb{M}_{3,0}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_8[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k,E_g)}]}{12} \\
& - \frac{\sqrt{3}\mathbb{X}_{22}[\mathbb{M}_{3,1}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_{10}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k,E_g)}]}{12} + \frac{\sqrt{3}\mathbb{X}_{22}[\mathbb{M}_{3,1}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_5[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k,E_u)}]}{12} \\
& - \frac{\sqrt{3}\mathbb{X}_{22}[\mathbb{M}_{3,1}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_7[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k,E_u)}]}{12} + \frac{\sqrt{3}\mathbb{X}_{22}[\mathbb{M}_{3,1}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_8[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k,E_g)}]}{12} \\
& - \frac{\sqrt{5}\mathbb{X}_{23}[\mathbb{M}_{3,0}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{U}_{10}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k,E_g)}]}{12} - \frac{\sqrt{5}\mathbb{X}_{23}[\mathbb{M}_{3,0}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{U}_5[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k,E_u)}]}{12} \\
& - \frac{\sqrt{5}\mathbb{X}_{23}[\mathbb{M}_{3,0}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{U}_7[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k,E_u)}]}{12} - \frac{\sqrt{5}\mathbb{X}_{23}[\mathbb{M}_{3,0}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{U}_8[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k,E_g)}]}{12} \\
& - \frac{\sqrt{5}\mathbb{X}_{24}[\mathbb{M}_{3,1}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{U}_{10}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k,E_g)}]}{12} + \frac{\sqrt{5}\mathbb{X}_{24}[\mathbb{M}_{3,1}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{U}_5[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k,E_u)}]}{12} \\
& - \frac{\sqrt{5}\mathbb{X}_{24}[\mathbb{M}_{3,1}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{U}_7[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k,E_u)}]}{12} + \frac{\sqrt{5}\mathbb{X}_{24}[\mathbb{M}_{3,1}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{U}_8[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k,E_g)}]}{12} \\
& - \frac{\sqrt{5}\mathbb{X}_{27}[\mathbb{M}_3^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_{10}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_1[\mathbb{Q}_0^{(k,A_{1g})}]}{6} - \frac{\sqrt{5}\mathbb{X}_{27}[\mathbb{M}_3^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_5[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_8[\mathbb{T}_3^{(k,B_{2u})}]}{6} \\
& - \frac{\sqrt{5}\mathbb{X}_{27}[\mathbb{M}_3^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_7[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_5[\mathbb{T}_1^{(k,A_{2u})}]}{6} - \frac{\sqrt{5}\mathbb{X}_{27}[\mathbb{M}_3^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_8[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_2[\mathbb{Q}_2^{(k,B_{1g})}]}{6}
\end{aligned}$$

$$\begin{aligned}
\boxed{\text{No. 26}} \quad & \hat{\mathbb{Q}}_4^{(A_{1g},1)}(1,-1) [\mathbb{M}_1, \mathbb{B}_1] \\
\hat{Z}_{26} = & \frac{\sqrt{195}\mathbb{X}_{21}[\mathbb{M}_{3,0}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{Y}_{10}[\mathbb{T}_{2,0}^{(b,E_g)}]}{78} - \frac{\sqrt{195}\mathbb{X}_{22}[\mathbb{M}_{3,1}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{Y}_{11}[\mathbb{T}_{2,1}^{(b,E_g)}]}{78} - \frac{\sqrt{13}\mathbb{X}_{23}[\mathbb{M}_{3,0}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{Y}_{10}[\mathbb{T}_{2,0}^{(b,E_g)}]}{6} \\
& + \frac{\sqrt{13}\mathbb{X}_{24}[\mathbb{M}_{3,1}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{Y}_{11}[\mathbb{T}_{2,1}^{(b,E_g)}]}{6} + \frac{5\sqrt{13}\mathbb{X}_{27}[\mathbb{M}_3^{(a,B_{1g})}(1,-1)] \otimes \mathbb{Y}_9[\mathbb{T}_2^{(b,B_{1g})}]}{39}
\end{aligned}$$

$$\begin{aligned}
\hat{\mathbb{Z}}_{26}(\mathbf{k}) = & \frac{\sqrt{195}\mathbb{X}_{21}[\mathbb{M}_{3,0}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_{10}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k,E_g)}]}{156} + \frac{\sqrt{195}\mathbb{X}_{21}[\mathbb{M}_{3,0}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_5[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k,E_u)}]}{156} \\
& + \frac{\sqrt{195}\mathbb{X}_{21}[\mathbb{M}_{3,0}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_7[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k,E_u)}]}{156} + \frac{\sqrt{195}\mathbb{X}_{21}[\mathbb{M}_{3,0}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_8[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k,E_g)}]}{156} \\
& + \frac{\sqrt{195}\mathbb{X}_{22}[\mathbb{M}_{3,1}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_{10}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k,E_g)}]}{156} - \frac{\sqrt{195}\mathbb{X}_{22}[\mathbb{M}_{3,1}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_5[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k,E_u)}]}{156} \\
& + \frac{\sqrt{195}\mathbb{X}_{22}[\mathbb{M}_{3,1}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_7[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k,E_u)}]}{156} - \frac{\sqrt{195}\mathbb{X}_{22}[\mathbb{M}_{3,1}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_8[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k,E_g)}]}{156} \\
& - \frac{\sqrt{13}\mathbb{X}_{23}[\mathbb{M}_{3,0}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{U}_{10}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k,E_g)}]}{12} - \frac{\sqrt{13}\mathbb{X}_{23}[\mathbb{M}_{3,0}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{U}_5[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k,E_u)}]}{12} \\
& - \frac{\sqrt{13}\mathbb{X}_{23}[\mathbb{M}_{3,0}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{U}_7[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k,E_u)}]}{12} - \frac{\sqrt{13}\mathbb{X}_{23}[\mathbb{M}_{3,0}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{U}_8[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k,E_g)}]}{12} \\
& - \frac{\sqrt{13}\mathbb{X}_{24}[\mathbb{M}_{3,1}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{U}_{10}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k,E_g)}]}{12} + \frac{\sqrt{13}\mathbb{X}_{24}[\mathbb{M}_{3,1}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{U}_5[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k,E_u)}]}{12} \\
& - \frac{\sqrt{13}\mathbb{X}_{24}[\mathbb{M}_{3,1}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{U}_7[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k,E_u)}]}{12} + \frac{\sqrt{13}\mathbb{X}_{24}[\mathbb{M}_{3,1}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{U}_8[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k,E_g)}]}{12} \\
& + \frac{5\sqrt{13}\mathbb{X}_{27}[\mathbb{M}_3^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_{10}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_1[\mathbb{Q}_0^{(k,A_{1g})}]}{78} + \frac{5\sqrt{13}\mathbb{X}_{27}[\mathbb{M}_3^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_5[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_8[\mathbb{T}_3^{(k,B_{2u})}]}{78} \\
& + \frac{5\sqrt{13}\mathbb{X}_{27}[\mathbb{M}_3^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_7[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_5[\mathbb{T}_1^{(k,A_{2u})}]}{78} + \frac{5\sqrt{13}\mathbb{X}_{27}[\mathbb{M}_3^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_8[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_2[\mathbb{Q}_2^{(k,B_{1g})}]}{78}
\end{aligned}$$

$$\begin{aligned}
\boxed{\text{No. 27}} \quad & \hat{\mathbb{Q}}_4^{(A_{1g},2)}(1,-1) [\mathbb{M}_1, \mathbb{B}_1] \\
\hat{\mathbb{Z}}_{27} = & -\frac{\sqrt{65}\mathbb{X}_{21}[\mathbb{M}_{3,0}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{Y}_{10}[\mathbb{T}_{2,0}^{(b,E_g)}]}{13} + \frac{\sqrt{65}\mathbb{X}_{22}[\mathbb{M}_{3,1}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{Y}_{11}[\mathbb{T}_{2,1}^{(b,E_g)}]}{13} + \frac{\sqrt{39}\mathbb{X}_{27}[\mathbb{M}_3^{(a,B_{1g})}(1,-1)] \otimes \mathbb{Y}_9[\mathbb{T}_2^{(b,B_{1g})}]}{13} \\
\hat{\mathbb{Z}}_{27}(\mathbf{k}) = & -\frac{\sqrt{65}\mathbb{X}_{21}[\mathbb{M}_{3,0}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_{10}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k,E_g)}]}{26} - \frac{\sqrt{65}\mathbb{X}_{21}[\mathbb{M}_{3,0}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_5[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k,E_u)}]}{26} \\
& - \frac{\sqrt{65}\mathbb{X}_{21}[\mathbb{M}_{3,0}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_7[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k,E_u)}]}{26} - \frac{\sqrt{65}\mathbb{X}_{21}[\mathbb{M}_{3,0}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_8[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k,E_g)}]}{26} \\
& - \frac{\sqrt{65}\mathbb{X}_{22}[\mathbb{M}_{3,1}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_{10}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k,E_g)}]}{26} + \frac{\sqrt{65}\mathbb{X}_{22}[\mathbb{M}_{3,1}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_5[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k,E_u)}]}{26} \\
& - \frac{\sqrt{65}\mathbb{X}_{22}[\mathbb{M}_{3,1}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_7[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k,E_u)}]}{26} + \frac{\sqrt{65}\mathbb{X}_{22}[\mathbb{M}_{3,1}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_8[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k,E_g)}]}{26} \\
& + \frac{\sqrt{39}\mathbb{X}_{27}[\mathbb{M}_3^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_{10}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_1[\mathbb{Q}_0^{(k,A_{1g})}]}{26} + \frac{\sqrt{39}\mathbb{X}_{27}[\mathbb{M}_3^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_5[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_8[\mathbb{T}_3^{(k,B_{2u})}]}{26} \\
& + \frac{\sqrt{39}\mathbb{X}_{27}[\mathbb{M}_3^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_7[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_5[\mathbb{T}_1^{(k,A_{2u})}]}{26} + \frac{\sqrt{39}\mathbb{X}_{27}[\mathbb{M}_3^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_8[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_2[\mathbb{Q}_2^{(k,B_{1g})}]}{26}
\end{aligned}$$

$$\boxed{\text{No. 28}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})}(1, 0) \text{ [M}_1, \text{B}_1]$$

$$\hat{\mathbb{Z}}_{28} = \mathbb{X}_{31}[\mathbb{T}_2^{(a, A_{1g})}(1, 0)] \otimes \mathbb{Y}_8[\mathbb{T}_0^{(b, A_{1g})}]$$

$$\begin{aligned} \hat{\mathbb{Z}}_{28}(\mathbf{k}) = & \frac{\mathbb{X}_{31}[\mathbb{T}_2^{(a, A_{1g})}(1, 0)] \otimes \mathbb{U}_{10}[\mathbb{T}_2^{(u, B_{1g})}] \otimes \mathbb{F}_2[\mathbb{Q}_2^{(k, B_{1g})}]}{2} + \frac{\mathbb{X}_{31}[\mathbb{T}_2^{(a, A_{1g})}(1, 0)] \otimes \mathbb{U}_5[\mathbb{Q}_1^{(u, A_{2u})}] \otimes \mathbb{F}_5[\mathbb{T}_1^{(k, A_{2u})}]}{2} \\ & + \frac{\mathbb{X}_{31}[\mathbb{T}_2^{(a, A_{1g})}(1, 0)] \otimes \mathbb{U}_7[\mathbb{Q}_3^{(u, B_{2u})}] \otimes \mathbb{F}_8[\mathbb{T}_3^{(k, B_{2u})}]}{2} + \frac{\mathbb{X}_{31}[\mathbb{T}_2^{(a, A_{1g})}(1, 0)] \otimes \mathbb{U}_8[\mathbb{T}_0^{(u, A_{1g})}] \otimes \mathbb{F}_1[\mathbb{Q}_0^{(k, A_{1g})}]}{2} \end{aligned}$$

$$\boxed{\text{No. 29}} \quad \hat{\mathbb{Q}}_0^{(A_{1g})}(1, 0) \text{ [M}_1, \text{B}_1]$$

$$\hat{\mathbb{Z}}_{29} = \frac{\sqrt{3}\mathbb{X}_{25}[\mathbb{T}_{2,0}^{(a, E_g)}(1, 0)] \otimes \mathbb{Y}_{10}[\mathbb{T}_{2,0}^{(b, E_g)}]}{3} + \frac{\sqrt{3}\mathbb{X}_{26}[\mathbb{T}_{2,1}^{(a, E_g)}(1, 0)] \otimes \mathbb{Y}_{11}[\mathbb{T}_{2,1}^{(b, E_g)}]}{3} + \frac{\sqrt{3}\mathbb{X}_{28}[\mathbb{T}_2^{(a, B_{1g})}(1, 0)] \otimes \mathbb{Y}_9[\mathbb{T}_2^{(b, B_{1g})}]}{3}$$

$$\begin{aligned} \hat{\mathbb{Z}}_{29}(\mathbf{k}) = & \frac{\sqrt{3}\mathbb{X}_{25}[\mathbb{T}_{2,0}^{(a, E_g)}(1, 0)] \otimes \mathbb{U}_{10}[\mathbb{T}_2^{(u, B_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k, E_g)}]}{6} + \frac{\sqrt{3}\mathbb{X}_{25}[\mathbb{T}_{2,0}^{(a, E_g)}(1, 0)] \otimes \mathbb{U}_5[\mathbb{Q}_1^{(u, A_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k, E_u)}]}{6} + \frac{\sqrt{3}\mathbb{X}_{25}[\mathbb{T}_{2,0}^{(a, E_g)}(1, 0)] \otimes \mathbb{U}_7[\mathbb{Q}_3^{(u, B_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k, E_u)}]}{6} \\ & + \frac{\sqrt{3}\mathbb{X}_{25}[\mathbb{T}_{2,0}^{(a, E_g)}(1, 0)] \otimes \mathbb{U}_8[\mathbb{T}_0^{(u, A_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k, E_g)}]}{6} - \frac{\sqrt{3}\mathbb{X}_{26}[\mathbb{T}_{2,1}^{(a, E_g)}(1, 0)] \otimes \mathbb{U}_{10}[\mathbb{T}_2^{(u, B_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k, E_g)}]}{6} \\ & + \frac{\sqrt{3}\mathbb{X}_{26}[\mathbb{T}_{2,1}^{(a, E_g)}(1, 0)] \otimes \mathbb{U}_5[\mathbb{Q}_1^{(u, A_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k, E_u)}]}{6} - \frac{\sqrt{3}\mathbb{X}_{26}[\mathbb{T}_{2,1}^{(a, E_g)}(1, 0)] \otimes \mathbb{U}_7[\mathbb{Q}_3^{(u, B_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k, E_u)}]}{6} + \frac{\sqrt{3}\mathbb{X}_{26}[\mathbb{T}_{2,1}^{(a, E_g)}(1, 0)] \otimes \mathbb{U}_8[\mathbb{T}_0^{(u, A_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k, E_g)}]}{6} \\ & + \frac{\sqrt{3}\mathbb{X}_{28}[\mathbb{T}_2^{(a, B_{1g})}(1, 0)] \otimes \mathbb{U}_{10}[\mathbb{T}_2^{(u, B_{1g})}] \otimes \mathbb{F}_1[\mathbb{Q}_0^{(k, A_{1g})}]}{6} + \frac{\sqrt{3}\mathbb{X}_{28}[\mathbb{T}_2^{(a, B_{1g})}(1, 0)] \otimes \mathbb{U}_5[\mathbb{Q}_1^{(u, A_{2u})}] \otimes \mathbb{F}_8[\mathbb{T}_3^{(k, B_{2u})}]}{6} \\ & + \frac{\sqrt{3}\mathbb{X}_{28}[\mathbb{T}_2^{(a, B_{1g})}(1, 0)] \otimes \mathbb{U}_7[\mathbb{Q}_3^{(u, B_{2u})}] \otimes \mathbb{F}_5[\mathbb{T}_1^{(k, A_{2u})}]}{6} + \frac{\sqrt{3}\mathbb{X}_{28}[\mathbb{T}_2^{(a, B_{1g})}(1, 0)] \otimes \mathbb{U}_8[\mathbb{T}_0^{(u, A_{1g})}] \otimes \mathbb{F}_2[\mathbb{Q}_2^{(k, B_{1g})}]}{6} \end{aligned}$$

$$\boxed{\text{No. 30}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})}(1, 0) \text{ [M}_1, \text{B}_1]$$

$$\hat{\mathbb{Z}}_{30} = \frac{\sqrt{6}\mathbb{X}_{25}[\mathbb{T}_{2,0}^{(a, E_g)}(1, 0)] \otimes \mathbb{Y}_{10}[\mathbb{T}_{2,0}^{(b, E_g)}]}{6} + \frac{\sqrt{6}\mathbb{X}_{26}[\mathbb{T}_{2,1}^{(a, E_g)}(1, 0)] \otimes \mathbb{Y}_{11}[\mathbb{T}_{2,1}^{(b, E_g)}]}{6} - \frac{\sqrt{6}\mathbb{X}_{28}[\mathbb{T}_2^{(a, B_{1g})}(1, 0)] \otimes \mathbb{Y}_9[\mathbb{T}_2^{(b, B_{1g})}]}{3}$$

$$\begin{aligned} \hat{\mathbb{Z}}_{30}(\mathbf{k}) = & \frac{\sqrt{6}\mathbb{X}_{25}[\mathbb{T}_{2,0}^{(a, E_g)}(1, 0)] \otimes \mathbb{U}_{10}[\mathbb{T}_2^{(u, B_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k, E_g)}]}{12} + \frac{\sqrt{6}\mathbb{X}_{25}[\mathbb{T}_{2,0}^{(a, E_g)}(1, 0)] \otimes \mathbb{U}_5[\mathbb{Q}_1^{(u, A_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k, E_u)}]}{12} + \frac{\sqrt{6}\mathbb{X}_{25}[\mathbb{T}_{2,0}^{(a, E_g)}(1, 0)] \otimes \mathbb{U}_7[\mathbb{Q}_3^{(u, B_{2u})}] \otimes \mathbb{F}_7[\mathbb{T}_{1,1}^{(k, E_u)}]}{12} \\ & + \frac{\sqrt{6}\mathbb{X}_{25}[\mathbb{T}_{2,0}^{(a, E_g)}(1, 0)] \otimes \mathbb{U}_8[\mathbb{T}_0^{(u, A_{1g})}] \otimes \mathbb{F}_3[\mathbb{Q}_{2,0}^{(k, E_g)}]}{12} - \frac{\sqrt{6}\mathbb{X}_{26}[\mathbb{T}_{2,1}^{(a, E_g)}(1, 0)] \otimes \mathbb{U}_{10}[\mathbb{T}_2^{(u, B_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k, E_g)}]}{12} \\ & + \frac{\sqrt{6}\mathbb{X}_{26}[\mathbb{T}_{2,1}^{(a, E_g)}(1, 0)] \otimes \mathbb{U}_5[\mathbb{Q}_1^{(u, A_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k, E_u)}]}{12} - \frac{\sqrt{6}\mathbb{X}_{26}[\mathbb{T}_{2,1}^{(a, E_g)}(1, 0)] \otimes \mathbb{U}_7[\mathbb{Q}_3^{(u, B_{2u})}] \otimes \mathbb{F}_6[\mathbb{T}_{1,0}^{(k, E_u)}]}{12} + \frac{\sqrt{6}\mathbb{X}_{26}[\mathbb{T}_{2,1}^{(a, E_g)}(1, 0)] \otimes \mathbb{U}_8[\mathbb{T}_0^{(u, A_{1g})}] \otimes \mathbb{F}_4[\mathbb{Q}_{2,1}^{(k, E_g)}]}{12} \\ & - \frac{\sqrt{6}\mathbb{X}_{28}[\mathbb{T}_2^{(a, B_{1g})}(1, 0)] \otimes \mathbb{U}_{10}[\mathbb{T}_2^{(u, B_{1g})}] \otimes \mathbb{F}_1[\mathbb{Q}_0^{(k, A_{1g})}]}{6} - \frac{\sqrt{6}\mathbb{X}_{28}[\mathbb{T}_2^{(a, B_{1g})}(1, 0)] \otimes \mathbb{U}_5[\mathbb{Q}_1^{(u, A_{2u})}] \otimes \mathbb{F}_8[\mathbb{T}_3^{(k, B_{2u})}]}{6} \\ & - \frac{\sqrt{6}\mathbb{X}_{28}[\mathbb{T}_2^{(a, B_{1g})}(1, 0)] \otimes \mathbb{U}_7[\mathbb{Q}_3^{(u, B_{2u})}] \otimes \mathbb{F}_5[\mathbb{T}_1^{(k, A_{2u})}]}{6} - \frac{\sqrt{6}\mathbb{X}_{28}[\mathbb{T}_2^{(a, B_{1g})}(1, 0)] \otimes \mathbb{U}_8[\mathbb{T}_0^{(u, A_{1g})}] \otimes \mathbb{F}_2[\mathbb{Q}_2^{(k, B_{1g})}]}{6} \end{aligned}$$

$$\boxed{\text{No. 31}} \quad \hat{\mathbb{Q}}_0^{(A_{1g})} [M_1, B_2]$$

$$\hat{\mathbb{Z}}_{31} = \mathbb{X}_1[\mathbb{Q}_0^{(a, A_{1g})}] \otimes \mathbb{Y}_{12}[\mathbb{Q}_0^{(b, A_{1g})}]$$

$$\hat{\mathbb{Z}}_{31}(\mathbf{k}) = \frac{\sqrt{2}\mathbb{X}_1[\mathbb{Q}_0^{(a, A_{1g})}] \otimes \mathbb{U}_{12}[\mathbb{Q}_0^{(u, A_{1g})}] \otimes \mathbb{F}_9[\mathbb{Q}_0^{(k, A_{1g})}]}{2} - \frac{\sqrt{2}\mathbb{X}_1[\mathbb{Q}_0^{(a, A_{1g})}] \otimes \mathbb{U}_{15}[\mathbb{T}_1^{(u, A_{2u})}] \otimes \mathbb{F}_{13}[\mathbb{T}_1^{(k, A_{2u})}]}{2}$$

$$\boxed{\text{No. 32}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})} [M_1, B_2]$$

$$\hat{\mathbb{Z}}_{32} = \mathbb{X}_2[\mathbb{Q}_2^{(a, A_{1g})}] \otimes \mathbb{Y}_{12}[\mathbb{Q}_0^{(b, A_{1g})}]$$

$$\hat{\mathbb{Z}}_{32}(\mathbf{k}) = \frac{\sqrt{2}\mathbb{X}_2[\mathbb{Q}_2^{(a, A_{1g})}] \otimes \mathbb{U}_{12}[\mathbb{Q}_0^{(u, A_{1g})}] \otimes \mathbb{F}_9[\mathbb{Q}_0^{(k, A_{1g})}]}{2} - \frac{\sqrt{2}\mathbb{X}_2[\mathbb{Q}_2^{(a, A_{1g})}] \otimes \mathbb{U}_{15}[\mathbb{T}_1^{(u, A_{2u})}] \otimes \mathbb{F}_{13}[\mathbb{T}_1^{(k, A_{2u})}]}{2}$$

$$\boxed{\text{No. 33}} \quad \hat{\mathbb{Q}}_0^{(A_{1g})} [M_1, B_2]$$

$$\hat{\mathbb{Z}}_{33} = \frac{\sqrt{3}\mathbb{X}_6[\mathbb{Q}_2^{(a, B_{2g})}] \otimes \mathbb{Y}_{13}[\mathbb{Q}_2^{(b, B_{2g})}]}{3} + \frac{\sqrt{3}\mathbb{X}_7[\mathbb{Q}_{2,0}^{(a, E_g)}] \otimes \mathbb{Y}_{14}[\mathbb{Q}_{2,0}^{(b, E_g)}]}{3} + \frac{\sqrt{3}\mathbb{X}_8[\mathbb{Q}_{2,1}^{(a, E_g)}] \otimes \mathbb{Y}_{15}[\mathbb{Q}_{2,1}^{(b, E_g)}]}{3}$$

$$\begin{aligned} \hat{\mathbb{Z}}_{33}(\mathbf{k}) = & \frac{\sqrt{6}\mathbb{X}_6[\mathbb{Q}_2^{(a, B_{2g})}] \otimes \mathbb{U}_{12}[\mathbb{Q}_0^{(u, A_{1g})}] \otimes \mathbb{F}_{10}[\mathbb{Q}_2^{(k, B_{2g})}]}{6} - \frac{\sqrt{6}\mathbb{X}_6[\mathbb{Q}_2^{(a, B_{2g})}] \otimes \mathbb{U}_{15}[\mathbb{T}_1^{(u, A_{2u})}] \otimes \mathbb{F}_{16}[\mathbb{T}_3^{(k, B_{1u})}]}{6} + \frac{\sqrt{6}\mathbb{X}_7[\mathbb{Q}_{2,0}^{(a, E_g)}] \otimes \mathbb{U}_{12}[\mathbb{Q}_0^{(u, A_{1g})}] \otimes \mathbb{F}_{11}[\mathbb{Q}_{2,0}^{(k, E_g)}]}{6} \\ & - \frac{\sqrt{6}\mathbb{X}_7[\mathbb{Q}_{2,0}^{(a, E_g)}] \otimes \mathbb{U}_{15}[\mathbb{T}_1^{(u, A_{2u})}] \otimes \mathbb{F}_{15}[\mathbb{T}_{1,1}^{(k, E_u)}]}{6} + \frac{\sqrt{6}\mathbb{X}_8[\mathbb{Q}_{2,1}^{(a, E_g)}] \otimes \mathbb{U}_{12}[\mathbb{Q}_0^{(u, A_{1g})}] \otimes \mathbb{F}_{12}[\mathbb{Q}_{2,1}^{(k, E_g)}]}{6} - \frac{\sqrt{6}\mathbb{X}_8[\mathbb{Q}_{2,1}^{(a, E_g)}] \otimes \mathbb{U}_{15}[\mathbb{T}_1^{(u, A_{2u})}] \otimes \mathbb{F}_{14}[\mathbb{T}_{1,0}^{(k, E_u)}]}{6} \end{aligned}$$

$$\boxed{\text{No. 34}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})} [M_1, B_2]$$

$$\hat{\mathbb{Z}}_{34} = -\frac{\sqrt{6}\mathbb{X}_6[\mathbb{Q}_2^{(a, B_{2g})}] \otimes \mathbb{Y}_{13}[\mathbb{Q}_2^{(b, B_{2g})}]}{3} + \frac{\sqrt{6}\mathbb{X}_7[\mathbb{Q}_{2,0}^{(a, E_g)}] \otimes \mathbb{Y}_{14}[\mathbb{Q}_{2,0}^{(b, E_g)}]}{6} + \frac{\sqrt{6}\mathbb{X}_8[\mathbb{Q}_{2,1}^{(a, E_g)}] \otimes \mathbb{Y}_{15}[\mathbb{Q}_{2,1}^{(b, E_g)}]}{6}$$

$$\begin{aligned} \hat{\mathbb{Z}}_{34}(\mathbf{k}) = & -\frac{\sqrt{3}\mathbb{X}_6[\mathbb{Q}_2^{(a, B_{2g})}] \otimes \mathbb{U}_{12}[\mathbb{Q}_0^{(u, A_{1g})}] \otimes \mathbb{F}_{10}[\mathbb{Q}_2^{(k, B_{2g})}]}{3} + \frac{\sqrt{3}\mathbb{X}_6[\mathbb{Q}_2^{(a, B_{2g})}] \otimes \mathbb{U}_{15}[\mathbb{T}_1^{(u, A_{2u})}] \otimes \mathbb{F}_{16}[\mathbb{T}_3^{(k, B_{1u})}]}{3} + \frac{\sqrt{3}\mathbb{X}_7[\mathbb{Q}_{2,0}^{(a, E_g)}] \otimes \mathbb{U}_{12}[\mathbb{Q}_0^{(u, A_{1g})}] \otimes \mathbb{F}_{11}[\mathbb{Q}_{2,0}^{(k, E_g)}]}{6} \\ & - \frac{\sqrt{3}\mathbb{X}_7[\mathbb{Q}_{2,0}^{(a, E_g)}] \otimes \mathbb{U}_{15}[\mathbb{T}_1^{(u, A_{2u})}] \otimes \mathbb{F}_{15}[\mathbb{T}_{1,1}^{(k, E_u)}]}{6} + \frac{\sqrt{3}\mathbb{X}_8[\mathbb{Q}_{2,1}^{(a, E_g)}] \otimes \mathbb{U}_{12}[\mathbb{Q}_0^{(u, A_{1g})}] \otimes \mathbb{F}_{12}[\mathbb{Q}_{2,1}^{(k, E_g)}]}{6} - \frac{\sqrt{3}\mathbb{X}_8[\mathbb{Q}_{2,1}^{(a, E_g)}] \otimes \mathbb{U}_{15}[\mathbb{T}_1^{(u, A_{2u})}] \otimes \mathbb{F}_{14}[\mathbb{T}_{1,0}^{(k, E_u)}]}{6} \end{aligned}$$

$$\boxed{\text{No. 35}} \quad \hat{\mathbb{Q}}_0^{(A_{1g})} (1, 1) [M_1, B_2]$$

$$\hat{\mathbb{Z}}_{35} = \mathbb{X}_3[\mathbb{Q}_0^{(a, A_{1g})} (1, 1)] \otimes \mathbb{Y}_{12}[\mathbb{Q}_0^{(b, A_{1g})}]$$

$$\hat{Z}_{35}(\mathbf{k}) = \frac{\sqrt{2}\mathbb{X}_3[\mathbb{Q}_0^{(a,A_{1g})}(1,1)] \otimes \mathbb{U}_{12}[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_9[\mathbb{Q}_0^{(k,A_{1g})}]}{2} - \frac{\sqrt{2}\mathbb{X}_3[\mathbb{Q}_0^{(a,A_{1g})}(1,1)] \otimes \mathbb{U}_{15}[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{13}[\mathbb{T}_1^{(k,A_{2u})}]}{2}$$

$$\boxed{\text{No. 36}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})}(1, -1) [\mathbb{M}_1, \mathbb{B}_2]$$

$$\hat{Z}_{36} = \mathbb{X}_4[\mathbb{Q}_2^{(a,A_{1g})}(1, -1)] \otimes \mathbb{Y}_{12}[\mathbb{Q}_0^{(b,A_{1g})}]$$

$$\hat{Z}_{36}(\mathbf{k}) = \frac{\sqrt{2}\mathbb{X}_4[\mathbb{Q}_2^{(a,A_{1g})}(1, -1)] \otimes \mathbb{U}_{12}[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_9[\mathbb{Q}_0^{(k,A_{1g})}]}{2} - \frac{\sqrt{2}\mathbb{X}_4[\mathbb{Q}_2^{(a,A_{1g})}(1, -1)] \otimes \mathbb{U}_{15}[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{13}[\mathbb{T}_1^{(k,A_{2u})}]}{2}$$

$$\boxed{\text{No. 37}} \quad \hat{\mathbb{Q}}_0^{(A_{1g})}(1, -1) [\mathbb{M}_1, \mathbb{B}_2]$$

$$\hat{Z}_{37} = \frac{\sqrt{3}\mathbb{X}_{10}[\mathbb{Q}_2^{(a,B_{2g})}(1, -1)] \otimes \mathbb{Y}_{13}[\mathbb{Q}_2^{(b,B_{2g})}]}{3} + \frac{\sqrt{3}\mathbb{X}_{11}[\mathbb{Q}_{2,0}^{(a,E_g)}(1, -1)] \otimes \mathbb{Y}_{14}[\mathbb{Q}_{2,0}^{(b,E_g)}]}{3} + \frac{\sqrt{3}\mathbb{X}_{12}[\mathbb{Q}_{2,1}^{(a,E_g)}(1, -1)] \otimes \mathbb{Y}_{15}[\mathbb{Q}_{2,1}^{(b,E_g)}]}{3}$$

$$\begin{aligned} \hat{Z}_{37}(\mathbf{k}) = & \frac{\sqrt{6}\mathbb{X}_{10}[\mathbb{Q}_2^{(a,B_{2g})}(1, -1)] \otimes \mathbb{U}_{12}[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{10}[\mathbb{Q}_2^{(k,B_{2g})}]}{6} - \frac{\sqrt{6}\mathbb{X}_{10}[\mathbb{Q}_2^{(a,B_{2g})}(1, -1)] \otimes \mathbb{U}_{15}[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{16}[\mathbb{T}_3^{(k,B_{1u})}]}{6} \\ & + \frac{\sqrt{6}\mathbb{X}_{11}[\mathbb{Q}_{2,0}^{(a,E_g)}(1, -1)] \otimes \mathbb{U}_{12}[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{11}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{6} - \frac{\sqrt{6}\mathbb{X}_{11}[\mathbb{Q}_{2,0}^{(a,E_g)}(1, -1)] \otimes \mathbb{U}_{15}[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{15}[\mathbb{T}_{1,1}^{(k,E_u)}]}{6} \\ & + \frac{\sqrt{6}\mathbb{X}_{12}[\mathbb{Q}_{2,1}^{(a,E_g)}(1, -1)] \otimes \mathbb{U}_{12}[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{12}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{6} - \frac{\sqrt{6}\mathbb{X}_{12}[\mathbb{Q}_{2,1}^{(a,E_g)}(1, -1)] \otimes \mathbb{U}_{15}[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{14}[\mathbb{T}_{1,0}^{(k,E_u)}]}{6} \end{aligned}$$

$$\boxed{\text{No. 38}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})}(1, -1) [\mathbb{M}_1, \mathbb{B}_2]$$

$$\hat{Z}_{38} = -\frac{\sqrt{6}\mathbb{X}_{10}[\mathbb{Q}_2^{(a,B_{2g})}(1, -1)] \otimes \mathbb{Y}_{13}[\mathbb{Q}_2^{(b,B_{2g})}]}{3} + \frac{\sqrt{6}\mathbb{X}_{11}[\mathbb{Q}_{2,0}^{(a,E_g)}(1, -1)] \otimes \mathbb{Y}_{14}[\mathbb{Q}_{2,0}^{(b,E_g)}]}{6} + \frac{\sqrt{6}\mathbb{X}_{12}[\mathbb{Q}_{2,1}^{(a,E_g)}(1, -1)] \otimes \mathbb{Y}_{15}[\mathbb{Q}_{2,1}^{(b,E_g)}]}{6}$$

$$\begin{aligned} \hat{Z}_{38}(\mathbf{k}) = & -\frac{\sqrt{3}\mathbb{X}_{10}[\mathbb{Q}_2^{(a,B_{2g})}(1, -1)] \otimes \mathbb{U}_{12}[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{10}[\mathbb{Q}_2^{(k,B_{2g})}]}{3} + \frac{\sqrt{3}\mathbb{X}_{10}[\mathbb{Q}_2^{(a,B_{2g})}(1, -1)] \otimes \mathbb{U}_{15}[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{16}[\mathbb{T}_3^{(k,B_{1u})}]}{3} \\ & + \frac{\sqrt{3}\mathbb{X}_{11}[\mathbb{Q}_{2,0}^{(a,E_g)}(1, -1)] \otimes \mathbb{U}_{12}[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{11}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{6} - \frac{\sqrt{3}\mathbb{X}_{11}[\mathbb{Q}_{2,0}^{(a,E_g)}(1, -1)] \otimes \mathbb{U}_{15}[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{15}[\mathbb{T}_{1,1}^{(k,E_u)}]}{6} \\ & + \frac{\sqrt{3}\mathbb{X}_{12}[\mathbb{Q}_{2,1}^{(a,E_g)}(1, -1)] \otimes \mathbb{U}_{12}[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{12}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{6} - \frac{\sqrt{3}\mathbb{X}_{12}[\mathbb{Q}_{2,1}^{(a,E_g)}(1, -1)] \otimes \mathbb{U}_{15}[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{14}[\mathbb{T}_{1,0}^{(k,E_u)}]}{6} \end{aligned}$$

$$\boxed{\text{No. 39}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})}(1, 0) [\mathbb{M}_1, \mathbb{B}_2]$$

$$\hat{Z}_{39} = \frac{\sqrt{2}\mathbb{X}_{13}[\mathbb{G}_{1,0}^{(a,E_g)}(1, 0)] \otimes \mathbb{Y}_{14}[\mathbb{Q}_{2,0}^{(b,E_g)}]}{2} - \frac{\sqrt{2}\mathbb{X}_{14}[\mathbb{G}_{1,1}^{(a,E_g)}(1, 0)] \otimes \mathbb{Y}_{15}[\mathbb{Q}_{2,1}^{(b,E_g)}]}{2}$$

$$\hat{Z}_{39}(\mathbf{k}) = \frac{\mathbb{X}_{13}[\mathbb{G}_{1,0}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{12}[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{11}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{2} - \frac{\mathbb{X}_{13}[\mathbb{G}_{1,0}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{15}[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{15}[\mathbb{T}_{1,1}^{(k,E_u)}]}{2} \\ - \frac{\mathbb{X}_{14}[\mathbb{G}_{1,1}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{12}[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{12}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{2} + \frac{\mathbb{X}_{14}[\mathbb{G}_{1,1}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{15}[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{14}[\mathbb{T}_{1,0}^{(k,E_u)}]}{2}$$

$$\boxed{\text{No. 40}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})} [\mathbb{M}_1, \mathbb{B}_2]$$

$$\hat{Z}_{40} = \frac{\sqrt{2}\mathbb{X}_{15}[\mathbb{M}_{1,0}^{(a,E_g)}] \otimes \mathbb{Y}_{18}[\mathbb{T}_{2,0}^{(b,E_g)}]}{2} - \frac{\sqrt{2}\mathbb{X}_{16}[\mathbb{M}_{1,1}^{(a,E_g)}] \otimes \mathbb{Y}_{19}[\mathbb{T}_{2,1}^{(b,E_g)}]}{2}$$

$$\hat{Z}_{40}(\mathbf{k}) = \frac{\mathbb{X}_{15}[\mathbb{M}_{1,0}^{(a,E_g)}] \otimes \mathbb{U}_{13}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{15}[\mathbb{T}_{1,1}^{(k,E_u)}]}{2} + \frac{\mathbb{X}_{15}[\mathbb{M}_{1,0}^{(a,E_g)}] \otimes \mathbb{U}_{14}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{11}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{2} \\ - \frac{\mathbb{X}_{16}[\mathbb{M}_{1,1}^{(a,E_g)}] \otimes \mathbb{U}_{13}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{14}[\mathbb{T}_{1,0}^{(k,E_u)}]}{2} - \frac{\mathbb{X}_{16}[\mathbb{M}_{1,1}^{(a,E_g)}] \otimes \mathbb{U}_{14}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{12}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{2}$$

$$\boxed{\text{No. 41}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})}(1,1) [\mathbb{M}_1, \mathbb{B}_2]$$

$$\hat{Z}_{41} = \frac{\sqrt{2}\mathbb{X}_{17}[\mathbb{M}_{1,0}^{(a,E_g)}(1,1)] \otimes \mathbb{Y}_{18}[\mathbb{T}_{2,0}^{(b,E_g)}]}{2} - \frac{\sqrt{2}\mathbb{X}_{18}[\mathbb{M}_{1,1}^{(a,E_g)}(1,1)] \otimes \mathbb{Y}_{19}[\mathbb{T}_{2,1}^{(b,E_g)}]}{2}$$

$$\hat{Z}_{41}(\mathbf{k}) = \frac{\mathbb{X}_{17}[\mathbb{M}_{1,0}^{(a,E_g)}(1,1)] \otimes \mathbb{U}_{13}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{15}[\mathbb{T}_{1,1}^{(k,E_u)}]}{2} + \frac{\mathbb{X}_{17}[\mathbb{M}_{1,0}^{(a,E_g)}(1,1)] \otimes \mathbb{U}_{14}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{11}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{2} \\ - \frac{\mathbb{X}_{18}[\mathbb{M}_{1,1}^{(a,E_g)}(1,1)] \otimes \mathbb{U}_{13}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{14}[\mathbb{T}_{1,0}^{(k,E_u)}]}{2} - \frac{\mathbb{X}_{18}[\mathbb{M}_{1,1}^{(a,E_g)}(1,1)] \otimes \mathbb{U}_{14}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{12}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{2}$$

$$\boxed{\text{No. 42}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})}(1,-1) [\mathbb{M}_1, \mathbb{B}_2]$$

$$\hat{Z}_{42} = \frac{\sqrt{2}\mathbb{X}_{19}[\mathbb{M}_{1,0}^{(a,E_g)}(1,-1)] \otimes \mathbb{Y}_{18}[\mathbb{T}_{2,0}^{(b,E_g)}]}{2} - \frac{\sqrt{2}\mathbb{X}_{20}[\mathbb{M}_{1,1}^{(a,E_g)}(1,-1)] \otimes \mathbb{Y}_{19}[\mathbb{T}_{2,1}^{(b,E_g)}]}{2}$$

$$\hat{Z}_{42}(\mathbf{k}) = \frac{\mathbb{X}_{19}[\mathbb{M}_{1,0}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_{13}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{15}[\mathbb{T}_{1,1}^{(k,E_u)}]}{2} + \frac{\mathbb{X}_{19}[\mathbb{M}_{1,0}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_{14}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{11}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{2} \\ - \frac{\mathbb{X}_{20}[\mathbb{M}_{1,1}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_{13}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{14}[\mathbb{T}_{1,0}^{(k,E_u)}]}{2} - \frac{\mathbb{X}_{20}[\mathbb{M}_{1,1}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_{14}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{12}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{2}$$



$$\boxed{\text{No. 43}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})}(1, -1) [M_1, B_2]$$

$$\hat{Z}_{43} = -\frac{\sqrt{3}\mathbb{X}_{21}[\mathbb{M}_{3,0}^{(a,E_g,1)}(1, -1)] \otimes \mathbb{Y}_{18}[\mathbb{T}_{2,0}^{(b,E_g)}]}{6} + \frac{\sqrt{3}\mathbb{X}_{22}[\mathbb{M}_{3,1}^{(a,E_g,1)}(1, -1)] \otimes \mathbb{Y}_{19}[\mathbb{T}_{2,1}^{(b,E_g)}]}{6} - \frac{\sqrt{5}\mathbb{X}_{23}[\mathbb{M}_{3,0}^{(a,E_g,2)}(1, -1)] \otimes \mathbb{Y}_{18}[\mathbb{T}_{2,0}^{(b,E_g)}]}{6} \\ + \frac{\sqrt{5}\mathbb{X}_{24}[\mathbb{M}_{3,1}^{(a,E_g,2)}(1, -1)] \otimes \mathbb{Y}_{19}[\mathbb{T}_{2,1}^{(b,E_g)}]}{6} + \frac{\sqrt{5}\mathbb{X}_{29}[\mathbb{M}_3^{(a,B_{2g})}(1, -1)] \otimes \mathbb{Y}_{17}[\mathbb{T}_2^{(b,B_{2g})}]}{3}$$

$$\hat{Z}_{43}(\mathbf{k}) = -\frac{\sqrt{6}\mathbb{X}_{21}[\mathbb{M}_{3,0}^{(a,E_g,1)}(1, -1)] \otimes \mathbb{U}_{13}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{15}[\mathbb{T}_{1,1}^{(k,E_u)}]}{12} - \frac{\sqrt{6}\mathbb{X}_{21}[\mathbb{M}_{3,0}^{(a,E_g,1)}(1, -1)] \otimes \mathbb{U}_{14}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{11}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{12} \\ + \frac{\sqrt{6}\mathbb{X}_{22}[\mathbb{M}_{3,1}^{(a,E_g,1)}(1, -1)] \otimes \mathbb{U}_{13}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{14}[\mathbb{T}_{1,0}^{(k,E_u)}]}{12} + \frac{\sqrt{6}\mathbb{X}_{22}[\mathbb{M}_{3,1}^{(a,E_g,1)}(1, -1)] \otimes \mathbb{U}_{14}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{12}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{12} \\ - \frac{\sqrt{10}\mathbb{X}_{23}[\mathbb{M}_{3,0}^{(a,E_g,2)}(1, -1)] \otimes \mathbb{U}_{13}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{15}[\mathbb{T}_{1,1}^{(k,E_u)}]}{12} - \frac{\sqrt{10}\mathbb{X}_{23}[\mathbb{M}_{3,0}^{(a,E_g,2)}(1, -1)] \otimes \mathbb{U}_{14}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{11}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{12} \\ + \frac{\sqrt{10}\mathbb{X}_{24}[\mathbb{M}_{3,1}^{(a,E_g,2)}(1, -1)] \otimes \mathbb{U}_{13}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{14}[\mathbb{T}_{1,0}^{(k,E_u)}]}{12} + \frac{\sqrt{10}\mathbb{X}_{24}[\mathbb{M}_{3,1}^{(a,E_g,2)}(1, -1)] \otimes \mathbb{U}_{14}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{12}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{12} \\ + \frac{\sqrt{10}\mathbb{X}_{29}[\mathbb{M}_3^{(a,B_{2g})}(1, -1)] \otimes \mathbb{U}_{13}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{16}[\mathbb{T}_3^{(k,B_{1u})}]}{6} + \frac{\sqrt{10}\mathbb{X}_{29}[\mathbb{M}_3^{(a,B_{2g})}(1, -1)] \otimes \mathbb{U}_{14}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{10}[\mathbb{Q}_2^{(k,B_{2g})}]}{6}$$

$$\boxed{\text{No. 44}} \quad \hat{\mathbb{Q}}_4^{(A_{1g,1})}(1, -1) [M_1, B_2]$$

$$\hat{Z}_{44} = -\frac{\sqrt{3}\mathbb{X}_{23}[\mathbb{M}_{3,0}^{(a,E_g,2)}(1, -1)] \otimes \mathbb{Y}_{18}[\mathbb{T}_{2,0}^{(b,E_g)}]}{3} + \frac{\sqrt{3}\mathbb{X}_{24}[\mathbb{M}_{3,1}^{(a,E_g,2)}(1, -1)] \otimes \mathbb{Y}_{19}[\mathbb{T}_{2,1}^{(b,E_g)}]}{3} - \frac{\sqrt{3}\mathbb{X}_{29}[\mathbb{M}_3^{(a,B_{2g})}(1, -1)] \otimes \mathbb{Y}_{17}[\mathbb{T}_2^{(b,B_{2g})}]}{3}$$

$$\hat{Z}_{44}(\mathbf{k}) = -\frac{\sqrt{6}\mathbb{X}_{23}[\mathbb{M}_{3,0}^{(a,E_g,2)}(1, -1)] \otimes \mathbb{U}_{13}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{15}[\mathbb{T}_{1,1}^{(k,E_u)}]}{6} - \frac{\sqrt{6}\mathbb{X}_{23}[\mathbb{M}_{3,0}^{(a,E_g,2)}(1, -1)] \otimes \mathbb{U}_{14}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{11}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{6} \\ + \frac{\sqrt{6}\mathbb{X}_{24}[\mathbb{M}_{3,1}^{(a,E_g,2)}(1, -1)] \otimes \mathbb{U}_{13}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{14}[\mathbb{T}_{1,0}^{(k,E_u)}]}{6} + \frac{\sqrt{6}\mathbb{X}_{24}[\mathbb{M}_{3,1}^{(a,E_g,2)}(1, -1)] \otimes \mathbb{U}_{14}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{12}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{6} \\ - \frac{\sqrt{6}\mathbb{X}_{29}[\mathbb{M}_3^{(a,B_{2g})}(1, -1)] \otimes \mathbb{U}_{13}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{16}[\mathbb{T}_3^{(k,B_{1u})}]}{6} - \frac{\sqrt{6}\mathbb{X}_{29}[\mathbb{M}_3^{(a,B_{2g})}(1, -1)] \otimes \mathbb{U}_{14}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{10}[\mathbb{Q}_2^{(k,B_{2g})}]}{6}$$

$$\boxed{\text{No. 45}} \quad \hat{\mathbb{Q}}_4^{(A_{1g,2})}(1, -1) [M_1, B_2]$$

$$\hat{Z}_{45} = -\frac{\sqrt{15}\mathbb{X}_{21}[\mathbb{M}_{3,0}^{(a,E_g,1)}(1, -1)] \otimes \mathbb{Y}_{18}[\mathbb{T}_{2,0}^{(b,E_g)}]}{6} + \frac{\sqrt{15}\mathbb{X}_{22}[\mathbb{M}_{3,1}^{(a,E_g,1)}(1, -1)] \otimes \mathbb{Y}_{19}[\mathbb{T}_{2,1}^{(b,E_g)}]}{6} \\ + \frac{\mathbb{X}_{23}[\mathbb{M}_{3,0}^{(a,E_g,2)}(1, -1)] \otimes \mathbb{Y}_{18}[\mathbb{T}_{2,0}^{(b,E_g)}]}{6} - \frac{\mathbb{X}_{24}[\mathbb{M}_{3,1}^{(a,E_g,2)}(1, -1)] \otimes \mathbb{Y}_{19}[\mathbb{T}_{2,1}^{(b,E_g)}]}{6} - \frac{\mathbb{X}_{29}[\mathbb{M}_3^{(a,B_{2g})}(1, -1)] \otimes \mathbb{Y}_{17}[\mathbb{T}_2^{(b,B_{2g})}]}{3}$$

$$\begin{aligned}
\hat{Z}_{45}(\mathbf{k}) = & -\frac{\sqrt{30}\mathbb{X}_{21}[\mathbb{M}_{3,0}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_{13}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{15}[\mathbb{T}_{1,1}^{(k,E_u)}]}{12} - \frac{\sqrt{30}\mathbb{X}_{21}[\mathbb{M}_{3,0}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_{14}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{11}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{12} \\
& + \frac{\sqrt{30}\mathbb{X}_{22}[\mathbb{M}_{3,1}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_{13}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{14}[\mathbb{T}_{1,0}^{(k,E_u)}]}{12} + \frac{\sqrt{30}\mathbb{X}_{22}[\mathbb{M}_{3,1}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_{14}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{12}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{12} \\
& + \frac{\sqrt{2}\mathbb{X}_{23}[\mathbb{M}_{3,0}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{U}_{13}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{15}[\mathbb{T}_{1,1}^{(k,E_u)}]}{12} + \frac{\sqrt{2}\mathbb{X}_{23}[\mathbb{M}_{3,0}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{U}_{14}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{11}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{12} \\
& - \frac{\sqrt{2}\mathbb{X}_{24}[\mathbb{M}_{3,1}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{U}_{13}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{14}[\mathbb{T}_{1,0}^{(k,E_u)}]}{12} - \frac{\sqrt{2}\mathbb{X}_{24}[\mathbb{M}_{3,1}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{U}_{14}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{12}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{12} \\
& - \frac{\sqrt{2}\mathbb{X}_{29}[\mathbb{M}_3^{(a,B_{2g})}(1,-1)] \otimes \mathbb{U}_{13}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{16}[\mathbb{T}_3^{(k,B_{1u})}]}{6} - \frac{\sqrt{2}\mathbb{X}_{29}[\mathbb{M}_3^{(a,B_{2g})}(1,-1)] \otimes \mathbb{U}_{14}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{10}[\mathbb{Q}_2^{(k,B_{2g})}]}{6}
\end{aligned}$$

$$\boxed{\text{No. 46}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})}(1,0) [\mathbb{M}_1, \mathbb{B}_2]$$

$$\hat{Z}_{46} = \mathbb{X}_{31}[\mathbb{T}_2^{(a,A_{1g})}(1,0)] \otimes \mathbb{Y}_{16}[\mathbb{T}_0^{(b,A_{1g})}]$$

$$\hat{Z}_{46}(\mathbf{k}) = \frac{\sqrt{2}\mathbb{X}_{31}[\mathbb{T}_2^{(a,A_{1g})}(1,0)] \otimes \mathbb{U}_{13}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{13}[\mathbb{T}_1^{(k,A_{2u})}]}{2} + \frac{\sqrt{2}\mathbb{X}_{31}[\mathbb{T}_2^{(a,A_{1g})}(1,0)] \otimes \mathbb{U}_{14}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_9[\mathbb{Q}_0^{(k,A_{1g})}]}{2}$$

$$\boxed{\text{No. 47}} \quad \hat{\mathbb{Q}}_0^{(A_{1g})}(1,0) [\mathbb{M}_1, \mathbb{B}_2]$$

$$\hat{Z}_{47} = \frac{\sqrt{3}\mathbb{X}_{25}[\mathbb{T}_{2,0}^{(a,E_g)}(1,0)] \otimes \mathbb{Y}_{18}[\mathbb{T}_{2,0}^{(b,E_g)}]}{3} + \frac{\sqrt{3}\mathbb{X}_{26}[\mathbb{T}_{2,1}^{(a,E_g)}(1,0)] \otimes \mathbb{Y}_{19}[\mathbb{T}_{2,1}^{(b,E_g)}]}{3} + \frac{\sqrt{3}\mathbb{X}_{30}[\mathbb{T}_2^{(a,B_{2g})}(1,0)] \otimes \mathbb{Y}_{17}[\mathbb{T}_2^{(b,B_{2g})}]}{3}$$

$$\begin{aligned}
\hat{Z}_{47}(\mathbf{k}) = & \frac{\sqrt{6}\mathbb{X}_{25}[\mathbb{T}_{2,0}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{13}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{15}[\mathbb{T}_{1,1}^{(k,E_u)}]}{6} + \frac{\sqrt{6}\mathbb{X}_{25}[\mathbb{T}_{2,0}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{14}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{11}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{6} \\
& + \frac{\sqrt{6}\mathbb{X}_{26}[\mathbb{T}_{2,1}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{13}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{14}[\mathbb{T}_{1,0}^{(k,E_u)}]}{6} + \frac{\sqrt{6}\mathbb{X}_{26}[\mathbb{T}_{2,1}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{14}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{12}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{6} \\
& + \frac{\sqrt{6}\mathbb{X}_{30}[\mathbb{T}_2^{(a,B_{2g})}(1,0)] \otimes \mathbb{U}_{13}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{16}[\mathbb{T}_3^{(k,B_{1u})}]}{6} + \frac{\sqrt{6}\mathbb{X}_{30}[\mathbb{T}_2^{(a,B_{2g})}(1,0)] \otimes \mathbb{U}_{14}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{10}[\mathbb{Q}_2^{(k,B_{2g})}]}{6}
\end{aligned}$$

$$\boxed{\text{No. 48}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})}(1,0) [\mathbb{M}_1, \mathbb{B}_2]$$

$$\hat{Z}_{48} = \frac{\sqrt{6}\mathbb{X}_{25}[\mathbb{T}_{2,0}^{(a,E_g)}(1,0)] \otimes \mathbb{Y}_{18}[\mathbb{T}_{2,0}^{(b,E_g)}]}{6} + \frac{\sqrt{6}\mathbb{X}_{26}[\mathbb{T}_{2,1}^{(a,E_g)}(1,0)] \otimes \mathbb{Y}_{19}[\mathbb{T}_{2,1}^{(b,E_g)}]}{6} - \frac{\sqrt{6}\mathbb{X}_{30}[\mathbb{T}_2^{(a,B_{2g})}(1,0)] \otimes \mathbb{Y}_{17}[\mathbb{T}_2^{(b,B_{2g})}]}{3}$$

$$\begin{aligned}\hat{\mathbb{Z}}_{48}(\mathbf{k}) = & \frac{\sqrt{3}\mathbb{X}_{25}[\mathbb{T}_{2,0}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{13}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{15}[\mathbb{T}_{1,1}^{(k,E_u)}]}{6} + \frac{\sqrt{3}\mathbb{X}_{25}[\mathbb{T}_{2,0}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{14}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{11}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{6} \\ & + \frac{\sqrt{3}\mathbb{X}_{26}[\mathbb{T}_{2,1}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{13}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{14}[\mathbb{T}_{1,0}^{(k,E_u)}]}{6} + \frac{\sqrt{3}\mathbb{X}_{26}[\mathbb{T}_{2,1}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{14}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{12}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{6} \\ & - \frac{\sqrt{3}\mathbb{X}_{30}[\mathbb{T}_2^{(a,B_{2g})}(1,0)] \otimes \mathbb{U}_{13}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{16}[\mathbb{T}_3^{(k,B_{1u})}]}{3} - \frac{\sqrt{3}\mathbb{X}_{30}[\mathbb{T}_2^{(a,B_{2g})}(1,0)] \otimes \mathbb{U}_{14}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{10}[\mathbb{Q}_2^{(k,B_{2g})}]}{3}\end{aligned}$$

$$\boxed{\text{No. 49}} \quad \hat{\mathbb{Q}}_0^{(A_{1g})} [\mathbb{M}_1, \mathbb{B}_3]$$

$$\hat{\mathbb{Z}}_{49} = \mathbb{X}_1[\mathbb{Q}_0^{(a,A_{1g})}] \otimes \mathbb{Y}_{20}[\mathbb{Q}_0^{(b,A_{1g})}]$$

$$\begin{aligned}\hat{\mathbb{Z}}_{49}(\mathbf{k}) = & \frac{\mathbb{X}_1[\mathbb{Q}_0^{(a,A_{1g})}] \otimes \mathbb{U}_{16}[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{17}[\mathbb{Q}_0^{(k,A_{1g})}]}{2} + \frac{\mathbb{X}_1[\mathbb{Q}_0^{(a,A_{1g})}] \otimes \mathbb{U}_{18}[\mathbb{Q}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{18}[\mathbb{Q}_2^{(k,B_{1g})}]}{2} \\ & - \frac{\mathbb{X}_1[\mathbb{Q}_0^{(a,A_{1g})}] \otimes \mathbb{U}_{21}[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{21}[\mathbb{T}_1^{(k,A_{2u})}]}{2} - \frac{\mathbb{X}_1[\mathbb{Q}_0^{(a,A_{1g})}] \otimes \mathbb{U}_{23}[\mathbb{T}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{24}[\mathbb{T}_3^{(k,B_{2u})}]}{2}\end{aligned}$$

$$\boxed{\text{No. 50}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})} [\mathbb{M}_1, \mathbb{B}_3]$$

$$\hat{\mathbb{Z}}_{50} = \mathbb{X}_2[\mathbb{Q}_2^{(a,A_{1g})}] \otimes \mathbb{Y}_{20}[\mathbb{Q}_0^{(b,A_{1g})}]$$

$$\begin{aligned}\hat{\mathbb{Z}}_{50}(\mathbf{k}) = & \frac{\mathbb{X}_2[\mathbb{Q}_2^{(a,A_{1g})}] \otimes \mathbb{U}_{16}[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{17}[\mathbb{Q}_0^{(k,A_{1g})}]}{2} + \frac{\mathbb{X}_2[\mathbb{Q}_2^{(a,A_{1g})}] \otimes \mathbb{U}_{18}[\mathbb{Q}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{18}[\mathbb{Q}_2^{(k,B_{1g})}]}{2} \\ & - \frac{\mathbb{X}_2[\mathbb{Q}_2^{(a,A_{1g})}] \otimes \mathbb{U}_{21}[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{21}[\mathbb{T}_1^{(k,A_{2u})}]}{2} - \frac{\mathbb{X}_2[\mathbb{Q}_2^{(a,A_{1g})}] \otimes \mathbb{U}_{23}[\mathbb{T}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{24}[\mathbb{T}_3^{(k,B_{2u})}]}{2}\end{aligned}$$

$$\boxed{\text{No. 51}} \quad \hat{\mathbb{Q}}_0^{(A_{1g})} [\mathbb{M}_1, \mathbb{B}_3]$$

$$\hat{\mathbb{Z}}_{51} = \frac{\sqrt{3}\mathbb{X}_5[\mathbb{Q}_2^{(a,B_{1g})}] \otimes \mathbb{Y}_{21}[\mathbb{Q}_2^{(b,B_{1g})}]}{3} + \frac{\sqrt{3}\mathbb{X}_7[\mathbb{Q}_{2,0}^{(a,E_g)}] \otimes \mathbb{Y}_{22}[\mathbb{Q}_{2,0}^{(b,E_g)}]}{3} + \frac{\sqrt{3}\mathbb{X}_8[\mathbb{Q}_{2,1}^{(a,E_g)}] \otimes \mathbb{Y}_{23}[\mathbb{Q}_{2,1}^{(b,E_g)}]}{3}$$

$$\begin{aligned}\hat{\mathbb{Z}}_{51}(\mathbf{k}) = & \frac{\sqrt{3}\mathbb{X}_5[\mathbb{Q}_2^{(a,B_{1g})}] \otimes \mathbb{U}_{16}[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{18}[\mathbb{Q}_2^{(k,B_{1g})}]}{6} + \frac{\sqrt{3}\mathbb{X}_5[\mathbb{Q}_2^{(a,B_{1g})}] \otimes \mathbb{U}_{18}[\mathbb{Q}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{17}[\mathbb{Q}_0^{(k,A_{1g})}]}{6} - \frac{\sqrt{3}\mathbb{X}_5[\mathbb{Q}_2^{(a,B_{1g})}] \otimes \mathbb{U}_{21}[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{24}[\mathbb{T}_3^{(k,B_{2u})}]}{6} \\ & - \frac{\sqrt{3}\mathbb{X}_5[\mathbb{Q}_2^{(a,B_{1g})}] \otimes \mathbb{U}_{23}[\mathbb{T}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{21}[\mathbb{T}_1^{(k,A_{2u})}]}{6} + \frac{\sqrt{3}\mathbb{X}_7[\mathbb{Q}_{2,0}^{(a,E_g)}] \otimes \mathbb{U}_{16}[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{19}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{6} + \frac{\sqrt{3}\mathbb{X}_7[\mathbb{Q}_{2,0}^{(a,E_g)}] \otimes \mathbb{U}_{18}[\mathbb{Q}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{19}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{6} \\ & - \frac{\sqrt{3}\mathbb{X}_7[\mathbb{Q}_{2,0}^{(a,E_g)}] \otimes \mathbb{U}_{21}[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{23}[\mathbb{T}_{1,1}^{(k,E_u)}]}{6} - \frac{\sqrt{3}\mathbb{X}_7[\mathbb{Q}_{2,0}^{(a,E_g)}] \otimes \mathbb{U}_{23}[\mathbb{T}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{23}[\mathbb{T}_{1,1}^{(k,E_u)}]}{6} + \frac{\sqrt{3}\mathbb{X}_8[\mathbb{Q}_{2,1}^{(a,E_g)}] \otimes \mathbb{U}_{16}[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{20}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{6} \\ & - \frac{\sqrt{3}\mathbb{X}_8[\mathbb{Q}_{2,1}^{(a,E_g)}] \otimes \mathbb{U}_{18}[\mathbb{Q}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{20}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{6} - \frac{\sqrt{3}\mathbb{X}_8[\mathbb{Q}_{2,1}^{(a,E_g)}] \otimes \mathbb{U}_{21}[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{22}[\mathbb{T}_{1,0}^{(k,E_u)}]}{6} + \frac{\sqrt{3}\mathbb{X}_8[\mathbb{Q}_{2,1}^{(a,E_g)}] \otimes \mathbb{U}_{23}[\mathbb{T}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{22}[\mathbb{T}_{1,0}^{(k,E_u)}]}{6}\end{aligned}$$

$$\boxed{\text{No. 52}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})} [M_1, B_3]$$

$$\hat{\mathbb{Z}}_{52} = -\frac{\sqrt{6}\mathbb{X}_5[\mathbb{Q}_2^{(a, B_{1g})}] \otimes \mathbb{Y}_{21}[\mathbb{Q}_2^{(b, B_{1g})}]}{3} + \frac{\sqrt{6}\mathbb{X}_7[\mathbb{Q}_{2,0}^{(a, E_g)}] \otimes \mathbb{Y}_{22}[\mathbb{Q}_{2,0}^{(b, E_g)}]}{6} + \frac{\sqrt{6}\mathbb{X}_8[\mathbb{Q}_{2,1}^{(a, E_g)}] \otimes \mathbb{Y}_{23}[\mathbb{Q}_{2,1}^{(b, E_g)}]}{6}$$

$$\begin{aligned} \hat{\mathbb{Z}}_{52}(\mathbf{k}) = & -\frac{\sqrt{6}\mathbb{X}_5[\mathbb{Q}_2^{(a, B_{1g})}] \otimes \mathbb{U}_{16}[\mathbb{Q}_0^{(u, A_{1g})}] \otimes \mathbb{F}_{18}[\mathbb{Q}_2^{(k, B_{1g})}]}{6} - \frac{\sqrt{6}\mathbb{X}_5[\mathbb{Q}_2^{(a, B_{1g})}] \otimes \mathbb{U}_{18}[\mathbb{Q}_2^{(u, B_{1g})}] \otimes \mathbb{F}_{17}[\mathbb{Q}_0^{(k, A_{1g})}]}{6} + \frac{\sqrt{6}\mathbb{X}_5[\mathbb{Q}_2^{(a, B_{1g})}] \otimes \mathbb{U}_{21}[\mathbb{T}_1^{(u, A_{2u})}] \otimes \mathbb{F}_{24}[\mathbb{T}_3^{(k, B_{2u})}]}{6} \\ & + \frac{\sqrt{6}\mathbb{X}_5[\mathbb{Q}_2^{(a, B_{1g})}] \otimes \mathbb{U}_{23}[\mathbb{T}_3^{(u, B_{2u})}] \otimes \mathbb{F}_{21}[\mathbb{T}_1^{(k, A_{2u})}]}{6} + \frac{\sqrt{6}\mathbb{X}_7[\mathbb{Q}_{2,0}^{(a, E_g)}] \otimes \mathbb{U}_{16}[\mathbb{Q}_0^{(u, A_{1g})}] \otimes \mathbb{F}_{19}[\mathbb{Q}_{2,0}^{(k, E_g)}]}{12} + \frac{\sqrt{6}\mathbb{X}_7[\mathbb{Q}_{2,0}^{(a, E_g)}] \otimes \mathbb{U}_{18}[\mathbb{Q}_2^{(u, B_{1g})}] \otimes \mathbb{F}_{19}[\mathbb{Q}_{2,0}^{(k, E_g)}]}{12} \\ & - \frac{\sqrt{6}\mathbb{X}_7[\mathbb{Q}_{2,0}^{(a, E_g)}] \otimes \mathbb{U}_{21}[\mathbb{T}_1^{(u, A_{2u})}] \otimes \mathbb{F}_{23}[\mathbb{T}_{1,1}^{(k, E_u)}]}{12} - \frac{\sqrt{6}\mathbb{X}_7[\mathbb{Q}_{2,0}^{(a, E_g)}] \otimes \mathbb{U}_{23}[\mathbb{T}_3^{(u, B_{2u})}] \otimes \mathbb{F}_{23}[\mathbb{T}_{1,1}^{(k, E_u)}]}{12} + \frac{\sqrt{6}\mathbb{X}_8[\mathbb{Q}_{2,1}^{(a, E_g)}] \otimes \mathbb{U}_{16}[\mathbb{Q}_0^{(u, A_{1g})}] \otimes \mathbb{F}_{20}[\mathbb{Q}_{2,1}^{(k, E_g)}]}{12} \\ & - \frac{\sqrt{6}\mathbb{X}_8[\mathbb{Q}_{2,1}^{(a, E_g)}] \otimes \mathbb{U}_{18}[\mathbb{Q}_2^{(u, B_{1g})}] \otimes \mathbb{F}_{20}[\mathbb{Q}_{2,1}^{(k, E_g)}]}{12} - \frac{\sqrt{6}\mathbb{X}_8[\mathbb{Q}_{2,1}^{(a, E_g)}] \otimes \mathbb{U}_{21}[\mathbb{T}_1^{(u, A_{2u})}] \otimes \mathbb{F}_{22}[\mathbb{T}_{1,0}^{(k, E_u)}]}{12} + \frac{\sqrt{6}\mathbb{X}_8[\mathbb{Q}_{2,1}^{(a, E_g)}] \otimes \mathbb{U}_{23}[\mathbb{T}_3^{(u, B_{2u})}] \otimes \mathbb{F}_{22}[\mathbb{T}_{1,0}^{(k, E_u)}]}{12} \end{aligned}$$

$$\boxed{\text{No. 53}} \quad \hat{\mathbb{Q}}_0^{(A_{1g})}(1, 1) [M_1, B_3]$$

$$\hat{\mathbb{Z}}_{53} = \mathbb{X}_3[\mathbb{Q}_0^{(a, A_{1g})}(1, 1)] \otimes \mathbb{Y}_{20}[\mathbb{Q}_0^{(b, A_{1g})}]$$

$$\begin{aligned} \hat{\mathbb{Z}}_{53}(\mathbf{k}) = & \frac{\mathbb{X}_3[\mathbb{Q}_0^{(a, A_{1g})}(1, 1)] \otimes \mathbb{U}_{16}[\mathbb{Q}_0^{(u, A_{1g})}] \otimes \mathbb{F}_{17}[\mathbb{Q}_0^{(k, A_{1g})}]}{2} + \frac{\mathbb{X}_3[\mathbb{Q}_0^{(a, A_{1g})}(1, 1)] \otimes \mathbb{U}_{18}[\mathbb{Q}_2^{(u, B_{1g})}] \otimes \mathbb{F}_{18}[\mathbb{Q}_2^{(k, B_{1g})}]}{2} \\ & - \frac{\mathbb{X}_3[\mathbb{Q}_0^{(a, A_{1g})}(1, 1)] \otimes \mathbb{U}_{21}[\mathbb{T}_1^{(u, A_{2u})}] \otimes \mathbb{F}_{21}[\mathbb{T}_1^{(k, A_{2u})}]}{2} - \frac{\mathbb{X}_3[\mathbb{Q}_0^{(a, A_{1g})}(1, 1)] \otimes \mathbb{U}_{23}[\mathbb{T}_3^{(u, B_{2u})}] \otimes \mathbb{F}_{24}[\mathbb{T}_3^{(k, B_{2u})}]}{2} \end{aligned}$$

$$\boxed{\text{No. 54}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})}(1, -1) [M_1, B_3]$$

$$\hat{\mathbb{Z}}_{54} = \mathbb{X}_4[\mathbb{Q}_2^{(a, A_{1g})}(1, -1)] \otimes \mathbb{Y}_{20}[\mathbb{Q}_0^{(b, A_{1g})}]$$

$$\begin{aligned} \hat{\mathbb{Z}}_{54}(\mathbf{k}) = & \frac{\mathbb{X}_4[\mathbb{Q}_2^{(a, A_{1g})}(1, -1)] \otimes \mathbb{U}_{16}[\mathbb{Q}_0^{(u, A_{1g})}] \otimes \mathbb{F}_{17}[\mathbb{Q}_0^{(k, A_{1g})}]}{2} + \frac{\mathbb{X}_4[\mathbb{Q}_2^{(a, A_{1g})}(1, -1)] \otimes \mathbb{U}_{18}[\mathbb{Q}_2^{(u, B_{1g})}] \otimes \mathbb{F}_{18}[\mathbb{Q}_2^{(k, B_{1g})}]}{2} \\ & - \frac{\mathbb{X}_4[\mathbb{Q}_2^{(a, A_{1g})}(1, -1)] \otimes \mathbb{U}_{21}[\mathbb{T}_1^{(u, A_{2u})}] \otimes \mathbb{F}_{21}[\mathbb{T}_1^{(k, A_{2u})}]}{2} - \frac{\mathbb{X}_4[\mathbb{Q}_2^{(a, A_{1g})}(1, -1)] \otimes \mathbb{U}_{23}[\mathbb{T}_3^{(u, B_{2u})}] \otimes \mathbb{F}_{24}[\mathbb{T}_3^{(k, B_{2u})}]}{2} \end{aligned}$$

$$\boxed{\text{No. 55}} \quad \hat{\mathbb{Q}}_0^{(A_{1g})}(1, -1) [M_1, B_3]$$

$$\hat{\mathbb{Z}}_{55} = \frac{\sqrt{3}\mathbb{X}_{11}[\mathbb{Q}_{2,0}^{(a, E_g)}(1, -1)] \otimes \mathbb{Y}_{22}[\mathbb{Q}_{2,0}^{(b, E_g)}]}{3} + \frac{\sqrt{3}\mathbb{X}_{12}[\mathbb{Q}_{2,1}^{(a, E_g)}(1, -1)] \otimes \mathbb{Y}_{23}[\mathbb{Q}_{2,1}^{(b, E_g)}]}{3} + \frac{\sqrt{3}\mathbb{X}_9[\mathbb{Q}_2^{(a, B_{1g})}(1, -1)] \otimes \mathbb{Y}_{21}[\mathbb{Q}_2^{(b, B_{1g})}]}{3}$$

$$\begin{aligned}
\hat{Z}_{55}(\mathbf{k}) = & \frac{\sqrt{3}\mathbb{X}_{11}[\mathbb{Q}_{2,0}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_{16}[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{19}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{6} + \frac{\sqrt{3}\mathbb{X}_{11}[\mathbb{Q}_{2,0}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_{18}[\mathbb{Q}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{19}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{6} \\
& - \frac{\sqrt{3}\mathbb{X}_{11}[\mathbb{Q}_{2,0}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_{21}[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{23}[\mathbb{T}_{1,1}^{(k,E_u)}]}{6} - \frac{\sqrt{3}\mathbb{X}_{11}[\mathbb{Q}_{2,0}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_{23}[\mathbb{T}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{23}[\mathbb{T}_{1,1}^{(k,E_u)}]}{6} \\
& + \frac{\sqrt{3}\mathbb{X}_{12}[\mathbb{Q}_{2,1}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_{16}[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{20}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{6} - \frac{\sqrt{3}\mathbb{X}_{12}[\mathbb{Q}_{2,1}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_{18}[\mathbb{Q}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{20}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{6} \\
& - \frac{\sqrt{3}\mathbb{X}_{12}[\mathbb{Q}_{2,1}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_{21}[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{22}[\mathbb{T}_{1,0}^{(k,E_u)}]}{6} + \frac{\sqrt{3}\mathbb{X}_{12}[\mathbb{Q}_{2,1}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_{23}[\mathbb{T}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{22}[\mathbb{T}_{1,0}^{(k,E_u)}]}{6} \\
& + \frac{\sqrt{3}\mathbb{X}_9[\mathbb{Q}_2^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_{16}[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{18}[\mathbb{Q}_2^{(k,B_{1g})}]}{6} + \frac{\sqrt{3}\mathbb{X}_9[\mathbb{Q}_2^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_{18}[\mathbb{Q}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{17}[\mathbb{Q}_0^{(k,A_{1g})}]}{6} \\
& - \frac{\sqrt{3}\mathbb{X}_9[\mathbb{Q}_2^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_{21}[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{24}[\mathbb{T}_3^{(k,B_{2u})}]}{6} - \frac{\sqrt{3}\mathbb{X}_9[\mathbb{Q}_2^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_{23}[\mathbb{T}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{21}[\mathbb{T}_1^{(k,A_{2u})}]}{6}
\end{aligned}$$

$$\boxed{\text{No. 56}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})}(1,-1) [\text{M}_1, \text{B}_3]$$

$$\hat{Z}_{56} = \frac{\sqrt{6}\mathbb{X}_{11}[\mathbb{Q}_{2,0}^{(a,E_g)}(1,-1)] \otimes \mathbb{Y}_{22}[\mathbb{Q}_{2,0}^{(b,E_g)}]}{6} + \frac{\sqrt{6}\mathbb{X}_{12}[\mathbb{Q}_{2,1}^{(a,E_g)}(1,-1)] \otimes \mathbb{Y}_{23}[\mathbb{Q}_{2,1}^{(b,E_g)}]}{6} - \frac{\sqrt{6}\mathbb{X}_9[\mathbb{Q}_2^{(a,B_{1g})}(1,-1)] \otimes \mathbb{Y}_{21}[\mathbb{Q}_2^{(b,B_{1g})}]}{3}$$

$$\begin{aligned}
\hat{Z}_{56}(\mathbf{k}) = & \frac{\sqrt{6}\mathbb{X}_{11}[\mathbb{Q}_{2,0}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_{16}[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{19}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{12} + \frac{\sqrt{6}\mathbb{X}_{11}[\mathbb{Q}_{2,0}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_{18}[\mathbb{Q}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{19}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{12} \\
& - \frac{\sqrt{6}\mathbb{X}_{11}[\mathbb{Q}_{2,0}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_{21}[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{23}[\mathbb{T}_{1,1}^{(k,E_u)}]}{12} - \frac{\sqrt{6}\mathbb{X}_{11}[\mathbb{Q}_{2,0}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_{23}[\mathbb{T}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{23}[\mathbb{T}_{1,1}^{(k,E_u)}]}{12} \\
& + \frac{\sqrt{6}\mathbb{X}_{12}[\mathbb{Q}_{2,1}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_{16}[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{20}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{12} - \frac{\sqrt{6}\mathbb{X}_{12}[\mathbb{Q}_{2,1}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_{18}[\mathbb{Q}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{20}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{12} \\
& - \frac{\sqrt{6}\mathbb{X}_{12}[\mathbb{Q}_{2,1}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_{21}[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{22}[\mathbb{T}_{1,0}^{(k,E_u)}]}{12} + \frac{\sqrt{6}\mathbb{X}_{12}[\mathbb{Q}_{2,1}^{(a,E_g)}(1,-1)] \otimes \mathbb{U}_{23}[\mathbb{T}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{22}[\mathbb{T}_{1,0}^{(k,E_u)}]}{12} \\
& - \frac{\sqrt{6}\mathbb{X}_9[\mathbb{Q}_2^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_{16}[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{18}[\mathbb{Q}_2^{(k,B_{1g})}]}{6} - \frac{\sqrt{6}\mathbb{X}_9[\mathbb{Q}_2^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_{18}[\mathbb{Q}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{17}[\mathbb{Q}_0^{(k,A_{1g})}]}{6} \\
& + \frac{\sqrt{6}\mathbb{X}_9[\mathbb{Q}_2^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_{21}[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{24}[\mathbb{T}_3^{(k,B_{2u})}]}{6} + \frac{\sqrt{6}\mathbb{X}_9[\mathbb{Q}_2^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_{23}[\mathbb{T}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{21}[\mathbb{T}_1^{(k,A_{2u})}]}{6}
\end{aligned}$$

$$\boxed{\text{No. 57}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})}(1,0) [\text{M}_1, \text{B}_3]$$

$$\hat{Z}_{57} = \frac{\sqrt{2}\mathbb{X}_{13}[\mathbb{G}_{1,0}^{(a,E_g)}(1,0)] \otimes \mathbb{Y}_{22}[\mathbb{Q}_{2,0}^{(b,E_g)}]}{2} - \frac{\sqrt{2}\mathbb{X}_{14}[\mathbb{G}_{1,1}^{(a,E_g)}(1,0)] \otimes \mathbb{Y}_{23}[\mathbb{Q}_{2,1}^{(b,E_g)}]}{2}$$

$$\begin{aligned}\hat{\mathbb{Z}}_{57}(\mathbf{k}) = & \frac{\sqrt{2}\mathbb{X}_{13}[\mathbb{G}_{1,0}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{16}[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{19}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{4} + \frac{\sqrt{2}\mathbb{X}_{13}[\mathbb{G}_{1,0}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{18}[\mathbb{Q}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{19}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{4} \\ & - \frac{\sqrt{2}\mathbb{X}_{13}[\mathbb{G}_{1,0}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{21}[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{23}[\mathbb{T}_{1,1}^{(k,E_u)}]}{4} - \frac{\sqrt{2}\mathbb{X}_{13}[\mathbb{G}_{1,0}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{23}[\mathbb{T}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{23}[\mathbb{T}_{1,1}^{(k,E_u)}]}{4} \\ & - \frac{\sqrt{2}\mathbb{X}_{14}[\mathbb{G}_{1,1}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{16}[\mathbb{Q}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{20}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{4} + \frac{\sqrt{2}\mathbb{X}_{14}[\mathbb{G}_{1,1}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{18}[\mathbb{Q}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{20}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{4} \\ & + \frac{\sqrt{2}\mathbb{X}_{14}[\mathbb{G}_{1,1}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{21}[\mathbb{T}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{22}[\mathbb{T}_{1,0}^{(k,E_u)}]}{4} - \frac{\sqrt{2}\mathbb{X}_{14}[\mathbb{G}_{1,1}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{23}[\mathbb{T}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{22}[\mathbb{T}_{1,0}^{(k,E_u)}]}{4}\end{aligned}$$

$$\boxed{\text{No. 58}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})} [\mathbb{M}_1, \mathbb{B}_3]$$

$$\hat{\mathbb{Z}}_{58} = \frac{\sqrt{2}\mathbb{X}_{15}[\mathbb{M}_{1,0}^{(a,E_g)}] \otimes \mathbb{Y}_{26}[\mathbb{T}_{2,0}^{(b,E_g)}]}{2} - \frac{\sqrt{2}\mathbb{X}_{16}[\mathbb{M}_{1,1}^{(a,E_g)}] \otimes \mathbb{Y}_{27}[\mathbb{T}_{2,1}^{(b,E_g)}]}{2}$$

$$\begin{aligned}\hat{\mathbb{Z}}_{58}(\mathbf{k}) = & \frac{\sqrt{2}\mathbb{X}_{15}[\mathbb{M}_{1,0}^{(a,E_g)}] \otimes \mathbb{U}_{17}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{23}[\mathbb{T}_{1,1}^{(k,E_u)}]}{4} + \frac{\sqrt{2}\mathbb{X}_{15}[\mathbb{M}_{1,0}^{(a,E_g)}] \otimes \mathbb{U}_{19}[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{23}[\mathbb{T}_{1,1}^{(k,E_u)}]}{4} + \frac{\sqrt{2}\mathbb{X}_{15}[\mathbb{M}_{1,0}^{(a,E_g)}] \otimes \mathbb{U}_{20}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{19}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{4} \\ & + \frac{\sqrt{2}\mathbb{X}_{15}[\mathbb{M}_{1,0}^{(a,E_g)}] \otimes \mathbb{U}_{22}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{19}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{4} - \frac{\sqrt{2}\mathbb{X}_{16}[\mathbb{M}_{1,1}^{(a,E_g)}] \otimes \mathbb{U}_{17}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{22}[\mathbb{T}_{1,0}^{(k,E_u)}]}{4} \\ & + \frac{\sqrt{2}\mathbb{X}_{16}[\mathbb{M}_{1,1}^{(a,E_g)}] \otimes \mathbb{U}_{19}[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{22}[\mathbb{T}_{1,0}^{(k,E_u)}]}{4} - \frac{\sqrt{2}\mathbb{X}_{16}[\mathbb{M}_{1,1}^{(a,E_g)}] \otimes \mathbb{U}_{20}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{20}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{4} + \frac{\sqrt{2}\mathbb{X}_{16}[\mathbb{M}_{1,1}^{(a,E_g)}] \otimes \mathbb{U}_{22}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{20}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{4}\end{aligned}$$

$$\boxed{\text{No. 59}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})}(1,1) [\mathbb{M}_1, \mathbb{B}_3]$$

$$\hat{\mathbb{Z}}_{59} = \frac{\sqrt{2}\mathbb{X}_{17}[\mathbb{M}_{1,0}^{(a,E_g)}(1,1)] \otimes \mathbb{Y}_{26}[\mathbb{T}_{2,0}^{(b,E_g)}]}{2} - \frac{\sqrt{2}\mathbb{X}_{18}[\mathbb{M}_{1,1}^{(a,E_g)}(1,1)] \otimes \mathbb{Y}_{27}[\mathbb{T}_{2,1}^{(b,E_g)}]}{2}$$

$$\begin{aligned}\hat{\mathbb{Z}}_{59}(\mathbf{k}) = & \frac{\sqrt{2}\mathbb{X}_{17}[\mathbb{M}_{1,0}^{(a,E_g)}(1,1)] \otimes \mathbb{U}_{17}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{23}[\mathbb{T}_{1,1}^{(k,E_u)}]}{4} + \frac{\sqrt{2}\mathbb{X}_{17}[\mathbb{M}_{1,0}^{(a,E_g)}(1,1)] \otimes \mathbb{U}_{19}[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{23}[\mathbb{T}_{1,1}^{(k,E_u)}]}{4} \\ & + \frac{\sqrt{2}\mathbb{X}_{17}[\mathbb{M}_{1,0}^{(a,E_g)}(1,1)] \otimes \mathbb{U}_{20}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{19}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{4} + \frac{\sqrt{2}\mathbb{X}_{17}[\mathbb{M}_{1,0}^{(a,E_g)}(1,1)] \otimes \mathbb{U}_{22}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{19}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{4} \\ & - \frac{\sqrt{2}\mathbb{X}_{18}[\mathbb{M}_{1,1}^{(a,E_g)}(1,1)] \otimes \mathbb{U}_{17}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{22}[\mathbb{T}_{1,0}^{(k,E_u)}]}{4} + \frac{\sqrt{2}\mathbb{X}_{18}[\mathbb{M}_{1,1}^{(a,E_g)}(1,1)] \otimes \mathbb{U}_{19}[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{22}[\mathbb{T}_{1,0}^{(k,E_u)}]}{4} \\ & - \frac{\sqrt{2}\mathbb{X}_{18}[\mathbb{M}_{1,1}^{(a,E_g)}(1,1)] \otimes \mathbb{U}_{20}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{20}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{4} + \frac{\sqrt{2}\mathbb{X}_{18}[\mathbb{M}_{1,1}^{(a,E_g)}(1,1)] \otimes \mathbb{U}_{22}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{20}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{4}\end{aligned}$$

$$\boxed{\text{No. 60}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})}(1, -1) [\text{M}_1, \text{B}_3]$$

$$\hat{\mathbb{Z}}_{60} = \frac{\sqrt{2}\mathbb{X}_{19}[\mathbb{M}_{1,0}^{(a,E_g)}(1, -1)] \otimes \mathbb{Y}_{26}[\mathbb{T}_{2,0}^{(b,E_g)}]}{2} - \frac{\sqrt{2}\mathbb{X}_{20}[\mathbb{M}_{1,1}^{(a,E_g)}(1, -1)] \otimes \mathbb{Y}_{27}[\mathbb{T}_{2,1}^{(b,E_g)}]}{2}$$

$$\begin{aligned} \hat{\mathbb{Z}}_{60}(\mathbf{k}) = & \frac{\sqrt{2}\mathbb{X}_{19}[\mathbb{M}_{1,0}^{(a,E_g)}(1, -1)] \otimes \mathbb{U}_{17}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{23}[\mathbb{T}_{1,1}^{(k,E_u)}]}{4} + \frac{\sqrt{2}\mathbb{X}_{19}[\mathbb{M}_{1,0}^{(a,E_g)}(1, -1)] \otimes \mathbb{U}_{19}[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{23}[\mathbb{T}_{1,1}^{(k,E_u)}]}{4} \\ & + \frac{\sqrt{2}\mathbb{X}_{19}[\mathbb{M}_{1,0}^{(a,E_g)}(1, -1)] \otimes \mathbb{U}_{20}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{19}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{4} + \frac{\sqrt{2}\mathbb{X}_{19}[\mathbb{M}_{1,0}^{(a,E_g)}(1, -1)] \otimes \mathbb{U}_{22}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{19}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{4} \\ & - \frac{\sqrt{2}\mathbb{X}_{20}[\mathbb{M}_{1,1}^{(a,E_g)}(1, -1)] \otimes \mathbb{U}_{17}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{22}[\mathbb{T}_{1,0}^{(k,E_u)}]}{4} + \frac{\sqrt{2}\mathbb{X}_{20}[\mathbb{M}_{1,1}^{(a,E_g)}(1, -1)] \otimes \mathbb{U}_{19}[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{22}[\mathbb{T}_{1,0}^{(k,E_u)}]}{4} \\ & - \frac{\sqrt{2}\mathbb{X}_{20}[\mathbb{M}_{1,1}^{(a,E_g)}(1, -1)] \otimes \mathbb{U}_{20}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{20}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{4} + \frac{\sqrt{2}\mathbb{X}_{20}[\mathbb{M}_{1,1}^{(a,E_g)}(1, -1)] \otimes \mathbb{U}_{22}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{20}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{4} \end{aligned}$$

$$\boxed{\text{No. 61}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})}(1, -1) [\text{M}_1, \text{B}_3]$$

$$\begin{aligned} \hat{\mathbb{Z}}_{61} = & -\frac{\sqrt{3}\mathbb{X}_{21}[\mathbb{M}_{3,0}^{(a,E_g,1)}(1, -1)] \otimes \mathbb{Y}_{26}[\mathbb{T}_{2,0}^{(b,E_g)}]}{6} + \frac{\sqrt{3}\mathbb{X}_{22}[\mathbb{M}_{3,1}^{(a,E_g,1)}(1, -1)] \otimes \mathbb{Y}_{27}[\mathbb{T}_{2,1}^{(b,E_g)}]}{6} - \frac{\sqrt{5}\mathbb{X}_{23}[\mathbb{M}_{3,0}^{(a,E_g,2)}(1, -1)] \otimes \mathbb{Y}_{26}[\mathbb{T}_{2,0}^{(b,E_g)}]}{6} \\ & + \frac{\sqrt{5}\mathbb{X}_{24}[\mathbb{M}_{3,1}^{(a,E_g,2)}(1, -1)] \otimes \mathbb{Y}_{27}[\mathbb{T}_{2,1}^{(b,E_g)}]}{6} - \frac{\sqrt{5}\mathbb{X}_{27}[\mathbb{M}_3^{(a,B_{1g})}(1, -1)] \otimes \mathbb{Y}_{25}[\mathbb{T}_2^{(b,B_{1g})}]}{3} \end{aligned}$$

$$\begin{aligned}
\hat{Z}_{61}(\mathbf{k}) = & -\frac{\sqrt{3}\mathbb{X}_{21}[\mathbb{M}_{3,0}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_{17}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{23}[\mathbb{T}_{1,1}^{(k,E_u)}]}{12} - \frac{\sqrt{3}\mathbb{X}_{21}[\mathbb{M}_{3,0}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_{19}[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{23}[\mathbb{T}_{1,1}^{(k,E_u)}]}{12} \\
& - \frac{\sqrt{3}\mathbb{X}_{21}[\mathbb{M}_{3,0}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_{20}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{19}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{12} - \frac{\sqrt{3}\mathbb{X}_{21}[\mathbb{M}_{3,0}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_{22}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{19}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{12} \\
& + \frac{\sqrt{3}\mathbb{X}_{22}[\mathbb{M}_{3,1}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_{17}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{22}[\mathbb{T}_{1,0}^{(k,E_u)}]}{12} - \frac{\sqrt{3}\mathbb{X}_{22}[\mathbb{M}_{3,1}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_{19}[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{22}[\mathbb{T}_{1,0}^{(k,E_u)}]}{12} \\
& + \frac{\sqrt{3}\mathbb{X}_{22}[\mathbb{M}_{3,1}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_{20}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{20}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{12} - \frac{\sqrt{3}\mathbb{X}_{22}[\mathbb{M}_{3,1}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{U}_{22}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{20}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{12} \\
& - \frac{\sqrt{5}\mathbb{X}_{23}[\mathbb{M}_{3,0}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{U}_{17}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{23}[\mathbb{T}_{1,1}^{(k,E_u)}]}{12} - \frac{\sqrt{5}\mathbb{X}_{23}[\mathbb{M}_{3,0}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{U}_{19}[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{23}[\mathbb{T}_{1,1}^{(k,E_u)}]}{12} \\
& - \frac{\sqrt{5}\mathbb{X}_{23}[\mathbb{M}_{3,0}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{U}_{20}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{19}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{12} - \frac{\sqrt{5}\mathbb{X}_{23}[\mathbb{M}_{3,0}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{U}_{22}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{19}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{12} \\
& + \frac{\sqrt{5}\mathbb{X}_{24}[\mathbb{M}_{3,1}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{U}_{17}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{22}[\mathbb{T}_{1,0}^{(k,E_u)}]}{12} - \frac{\sqrt{5}\mathbb{X}_{24}[\mathbb{M}_{3,1}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{U}_{19}[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{22}[\mathbb{T}_{1,0}^{(k,E_u)}]}{12} \\
& + \frac{\sqrt{5}\mathbb{X}_{24}[\mathbb{M}_{3,1}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{U}_{20}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{20}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{12} - \frac{\sqrt{5}\mathbb{X}_{24}[\mathbb{M}_{3,1}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{U}_{22}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{20}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{12} \\
& - \frac{\sqrt{5}\mathbb{X}_{27}[\mathbb{M}_3^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_{17}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{24}[\mathbb{T}_3^{(k,B_{2u})}]}{6} - \frac{\sqrt{5}\mathbb{X}_{27}[\mathbb{M}_3^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_{19}[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{21}[\mathbb{T}_1^{(k,A_{2u})}]}{6} \\
& - \frac{\sqrt{5}\mathbb{X}_{27}[\mathbb{M}_3^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_{20}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{18}[\mathbb{Q}_2^{(k,B_{1g})}]}{6} - \frac{\sqrt{5}\mathbb{X}_{27}[\mathbb{M}_3^{(a,B_{1g})}(1,-1)] \otimes \mathbb{U}_{22}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{17}[\mathbb{Q}_0^{(k,A_{1g})}]}{6}
\end{aligned}$$

$$\begin{aligned}
& \boxed{\text{No. 62}} \quad \hat{\mathbb{Q}}_4^{(A_{1g},1)}(1,-1) [\mathbb{M}_1, \mathbb{B}_3] \\
\hat{Z}_{62} = & \frac{\sqrt{195}\mathbb{X}_{21}[\mathbb{M}_{3,0}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{Y}_{26}[\mathbb{T}_{2,0}^{(b,E_g)}]}{78} - \frac{\sqrt{195}\mathbb{X}_{22}[\mathbb{M}_{3,1}^{(a,E_g,1)}(1,-1)] \otimes \mathbb{Y}_{27}[\mathbb{T}_{2,1}^{(b,E_g)}]}{78} - \frac{\sqrt{13}\mathbb{X}_{23}[\mathbb{M}_{3,0}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{Y}_{26}[\mathbb{T}_{2,0}^{(b,E_g)}]}{6} \\
& + \frac{\sqrt{13}\mathbb{X}_{24}[\mathbb{M}_{3,1}^{(a,E_g,2)}(1,-1)] \otimes \mathbb{Y}_{27}[\mathbb{T}_{2,1}^{(b,E_g)}]}{6} + \frac{5\sqrt{13}\mathbb{X}_{27}[\mathbb{M}_3^{(a,B_{1g})}(1,-1)] \otimes \mathbb{Y}_{25}[\mathbb{T}_2^{(b,B_{1g})}]}{39}
\end{aligned}$$



$$\begin{aligned} \hat{Z}_{62}(\mathbf{k}) = & \frac{\sqrt{195}X_{21}[M_{3,0}^{(a,E_g,1)}(1,-1)] \otimes U_{17}[Q_1^{(u,A_{2u})}] \otimes F_{23}[T_{1,1}^{(k,E_u)}]}{156} + \frac{\sqrt{195}X_{21}[M_{3,0}^{(a,E_g,1)}(1,-1)] \otimes U_{19}[Q_3^{(u,B_{2u})}] \otimes F_{23}[T_{1,1}^{(k,E_u)}]}{156} \\ & + \frac{\sqrt{195}X_{21}[M_{3,0}^{(a,E_g,1)}(1,-1)] \otimes U_{20}[T_0^{(u,A_{1g})}] \otimes F_{19}[Q_{2,0}^{(k,E_g)}]}{156} + \frac{\sqrt{195}X_{21}[M_{3,0}^{(a,E_g,1)}(1,-1)] \otimes U_{22}[T_2^{(u,B_{1g})}] \otimes F_{19}[Q_{2,0}^{(k,E_g)}]}{156} \\ & - \frac{\sqrt{195}X_{22}[M_{3,1}^{(a,E_g,1)}(1,-1)] \otimes U_{17}[Q_1^{(u,A_{2u})}] \otimes F_{22}[T_{1,0}^{(k,E_u)}]}{156} + \frac{\sqrt{195}X_{22}[M_{3,1}^{(a,E_g,1)}(1,-1)] \otimes U_{19}[Q_3^{(u,B_{2u})}] \otimes F_{22}[T_{1,0}^{(k,E_u)}]}{156} \\ & - \frac{\sqrt{195}X_{22}[M_{3,1}^{(a,E_g,1)}(1,-1)] \otimes U_{20}[T_0^{(u,A_{1g})}] \otimes F_{20}[Q_{2,1}^{(k,E_g)}]}{156} + \frac{\sqrt{195}X_{22}[M_{3,1}^{(a,E_g,1)}(1,-1)] \otimes U_{22}[T_2^{(u,B_{1g})}] \otimes F_{20}[Q_{2,1}^{(k,E_g)}]}{156} \\ & - \frac{\sqrt{13}X_{23}[M_{3,0}^{(a,E_g,2)}(1,-1)] \otimes U_{17}[Q_1^{(u,A_{2u})}] \otimes F_{23}[T_{1,1}^{(k,E_u)}]}{12} - \frac{\sqrt{13}X_{23}[M_{3,0}^{(a,E_g,2)}(1,-1)] \otimes U_{19}[Q_3^{(u,B_{2u})}] \otimes F_{23}[T_{1,1}^{(k,E_u)}]}{12} \\ & - \frac{\sqrt{13}X_{23}[M_{3,0}^{(a,E_g,2)}(1,-1)] \otimes U_{20}[T_0^{(u,A_{1g})}] \otimes F_{19}[Q_{2,0}^{(k,E_g)}]}{12} - \frac{\sqrt{13}X_{23}[M_{3,0}^{(a,E_g,2)}(1,-1)] \otimes U_{22}[T_2^{(u,B_{1g})}] \otimes F_{19}[Q_{2,0}^{(k,E_g)}]}{12} \\ & + \frac{\sqrt{13}X_{24}[M_{3,1}^{(a,E_g,2)}(1,-1)] \otimes U_{17}[Q_1^{(u,A_{2u})}] \otimes F_{22}[T_{1,0}^{(k,E_u)}]}{12} - \frac{\sqrt{13}X_{24}[M_{3,1}^{(a,E_g,2)}(1,-1)] \otimes U_{19}[Q_3^{(u,B_{2u})}] \otimes F_{22}[T_{1,0}^{(k,E_u)}]}{12} \\ & + \frac{\sqrt{13}X_{24}[M_{3,1}^{(a,E_g,2)}(1,-1)] \otimes U_{20}[T_0^{(u,A_{1g})}] \otimes F_{20}[Q_{2,1}^{(k,E_g)}]}{12} - \frac{\sqrt{13}X_{24}[M_{3,1}^{(a,E_g,2)}(1,-1)] \otimes U_{22}[T_2^{(u,B_{1g})}] \otimes F_{20}[Q_{2,1}^{(k,E_g)}]}{12} \\ & + \frac{5\sqrt{13}X_{27}[M_3^{(a,B_{1g})}(1,-1)] \otimes U_{17}[Q_1^{(u,A_{2u})}] \otimes F_{24}[T_3^{(k,B_{2u})}]}{78} + \frac{5\sqrt{13}X_{27}[M_3^{(a,B_{1g})}(1,-1)] \otimes U_{19}[Q_3^{(u,B_{2u})}] \otimes F_{21}[T_1^{(k,A_{2u})}]}{78} \\ & + \frac{5\sqrt{13}X_{27}[M_3^{(a,B_{1g})}(1,-1)] \otimes U_{20}[T_0^{(u,A_{1g})}] \otimes F_{18}[Q_2^{(k,B_{1g})}]}{78} + \frac{5\sqrt{13}X_{27}[M_3^{(a,B_{1g})}(1,-1)] \otimes U_{22}[T_2^{(u,B_{1g})}] \otimes F_{17}[Q_0^{(k,A_{1g})}]}{78} \end{aligned}$$

$$\begin{aligned} \text{No. 63} \quad & \hat{\mathbb{Q}}_4^{(A_{1g},2)}(1, -1) [\mathbf{M}_1, \mathbf{B}_3] \\ \hat{\mathbb{Z}}_{63} = & -\frac{\sqrt{65}\mathbb{X}_{21}[\mathbf{M}_{3,0}^{(a,E_g,1)}(1, -1)] \otimes \mathbb{Y}_{26}[\mathbb{T}_{2,0}^{(b,E_g)}]}{13} + \frac{\sqrt{65}\mathbb{X}_{22}[\mathbf{M}_{3,1}^{(a,E_g,1)}(1, -1)] \otimes \mathbb{Y}_{27}[\mathbb{T}_{2,1}^{(b,E_g)}]}{13} + \frac{\sqrt{39}\mathbb{X}_{27}[\mathbf{M}_3^{(a,B_{1g})}(1, -1)] \otimes \mathbb{Y}_{25}[\mathbb{T}_2^{(b,B_{1g})}]}{13} \\ \hat{\mathbb{Z}}_{63}(\mathbf{k}) = & -\frac{\sqrt{65}\mathbb{X}_{21}[\mathbf{M}_{3,0}^{(a,E_g,1)}(1, -1)] \otimes \mathbb{U}_{17}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{23}[\mathbb{T}_{1,1}^{(k,E_u)}]}{26} - \frac{\sqrt{65}\mathbb{X}_{21}[\mathbf{M}_{3,0}^{(a,E_g,1)}(1, -1)] \otimes \mathbb{U}_{19}[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{23}[\mathbb{T}_{1,1}^{(k,E_u)}]}{26} \\ & - \frac{\sqrt{65}\mathbb{X}_{21}[\mathbf{M}_{3,0}^{(a,E_g,1)}(1, -1)] \otimes \mathbb{U}_{20}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{19}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{26} - \frac{\sqrt{65}\mathbb{X}_{21}[\mathbf{M}_{3,0}^{(a,E_g,1)}(1, -1)] \otimes \mathbb{U}_{22}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{19}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{26} \\ & + \frac{\sqrt{65}\mathbb{X}_{22}[\mathbf{M}_{3,1}^{(a,E_g,1)}(1, -1)] \otimes \mathbb{U}_{17}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{22}[\mathbb{T}_{1,0}^{(k,E_u)}]}{26} - \frac{\sqrt{65}\mathbb{X}_{22}[\mathbf{M}_{3,1}^{(a,E_g,1)}(1, -1)] \otimes \mathbb{U}_{19}[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{22}[\mathbb{T}_{1,0}^{(k,E_u)}]}{26} \\ & + \frac{\sqrt{65}\mathbb{X}_{22}[\mathbf{M}_{3,1}^{(a,E_g,1)}(1, -1)] \otimes \mathbb{U}_{20}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{20}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{26} - \frac{\sqrt{65}\mathbb{X}_{22}[\mathbf{M}_{3,1}^{(a,E_g,1)}(1, -1)] \otimes \mathbb{U}_{22}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{20}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{26} \\ & + \frac{\sqrt{39}\mathbb{X}_{27}[\mathbf{M}_3^{(a,B_{1g})}(1, -1)] \otimes \mathbb{U}_{17}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{24}[\mathbb{T}_3^{(k,B_{2u})}]}{26} + \frac{\sqrt{39}\mathbb{X}_{27}[\mathbf{M}_3^{(a,B_{1g})}(1, -1)] \otimes \mathbb{U}_{19}[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{21}[\mathbb{T}_1^{(k,A_{2u})}]}{26} \\ & + \frac{\sqrt{39}\mathbb{X}_{27}[\mathbf{M}_3^{(a,B_{1g})}(1, -1)] \otimes \mathbb{U}_{20}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{18}[\mathbb{Q}_2^{(k,B_{1g})}]}{26} + \frac{\sqrt{39}\mathbb{X}_{27}[\mathbf{M}_3^{(a,B_{1g})}(1, -1)] \otimes \mathbb{U}_{22}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{17}[\mathbb{Q}_0^{(k,A_{1g})}]}{26} \end{aligned}$$

$$\boxed{\text{No. 64}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})}(1, 0) \text{ [M}_1, \text{B}_3]$$

$$\hat{\mathbb{Z}}_{64} = \mathbb{X}_{31}[\mathbb{T}_2^{(a, A_{1g})}(1, 0)] \otimes \mathbb{Y}_{24}[\mathbb{T}_0^{(b, A_{1g})}]$$

$$\begin{aligned} \hat{\mathbb{Z}}_{64}(\mathbf{k}) = & \frac{\mathbb{X}_{31}[\mathbb{T}_2^{(a, A_{1g})}(1, 0)] \otimes \mathbb{U}_{17}[\mathbb{Q}_1^{(u, A_{2u})}] \otimes \mathbb{F}_{21}[\mathbb{T}_1^{(k, A_{2u})}]}{2} + \frac{\mathbb{X}_{31}[\mathbb{T}_2^{(a, A_{1g})}(1, 0)] \otimes \mathbb{U}_{19}[\mathbb{Q}_3^{(u, B_{2u})}] \otimes \mathbb{F}_{24}[\mathbb{T}_3^{(k, B_{2u})}]}{2} \\ & + \frac{\mathbb{X}_{31}[\mathbb{T}_2^{(a, A_{1g})}(1, 0)] \otimes \mathbb{U}_{20}[\mathbb{T}_0^{(u, A_{1g})}] \otimes \mathbb{F}_{17}[\mathbb{Q}_0^{(k, A_{1g})}]}{2} + \frac{\mathbb{X}_{31}[\mathbb{T}_2^{(a, A_{1g})}(1, 0)] \otimes \mathbb{U}_{22}[\mathbb{T}_2^{(u, B_{1g})}] \otimes \mathbb{F}_{18}[\mathbb{Q}_2^{(k, B_{1g})}]}{2} \end{aligned}$$

$$\boxed{\text{No. 65}} \quad \hat{\mathbb{Q}}_0^{(A_{1g})}(1, 0) \text{ [M}_1, \text{B}_3]$$

$$\hat{\mathbb{Z}}_{65} = \frac{\sqrt{3}\mathbb{X}_{25}[\mathbb{T}_{2,0}^{(a, E_g)}(1, 0)] \otimes \mathbb{Y}_{26}[\mathbb{T}_{2,0}^{(b, E_g)}]}{3} + \frac{\sqrt{3}\mathbb{X}_{26}[\mathbb{T}_{2,1}^{(a, E_g)}(1, 0)] \otimes \mathbb{Y}_{27}[\mathbb{T}_{2,1}^{(b, E_g)}]}{3} + \frac{\sqrt{3}\mathbb{X}_{28}[\mathbb{T}_2^{(a, B_{1g})}(1, 0)] \otimes \mathbb{Y}_{25}[\mathbb{T}_2^{(b, B_{1g})}]}{3}$$

$$\begin{aligned} \hat{\mathbb{Z}}_{65}(\mathbf{k}) = & \frac{\sqrt{3}\mathbb{X}_{25}[\mathbb{T}_{2,0}^{(a, E_g)}(1, 0)] \otimes \mathbb{U}_{17}[\mathbb{Q}_1^{(u, A_{2u})}] \otimes \mathbb{F}_{23}[\mathbb{T}_{1,1}^{(k, E_u)}]}{6} + \frac{\sqrt{3}\mathbb{X}_{25}[\mathbb{T}_{2,0}^{(a, E_g)}(1, 0)] \otimes \mathbb{U}_{19}[\mathbb{Q}_3^{(u, B_{2u})}] \otimes \mathbb{F}_{23}[\mathbb{T}_{1,1}^{(k, E_u)}]}{6} \\ & + \frac{\sqrt{3}\mathbb{X}_{25}[\mathbb{T}_{2,0}^{(a, E_g)}(1, 0)] \otimes \mathbb{U}_{20}[\mathbb{T}_0^{(u, A_{1g})}] \otimes \mathbb{F}_{19}[\mathbb{Q}_{2,0}^{(k, E_g)}]}{6} + \frac{\sqrt{3}\mathbb{X}_{25}[\mathbb{T}_{2,0}^{(a, E_g)}(1, 0)] \otimes \mathbb{U}_{22}[\mathbb{T}_2^{(u, B_{1g})}] \otimes \mathbb{F}_{19}[\mathbb{Q}_{2,0}^{(k, E_g)}]}{6} \\ & + \frac{\sqrt{3}\mathbb{X}_{26}[\mathbb{T}_{2,1}^{(a, E_g)}(1, 0)] \otimes \mathbb{U}_{17}[\mathbb{Q}_1^{(u, A_{2u})}] \otimes \mathbb{F}_{22}[\mathbb{T}_{1,0}^{(k, E_u)}]}{6} - \frac{\sqrt{3}\mathbb{X}_{26}[\mathbb{T}_{2,1}^{(a, E_g)}(1, 0)] \otimes \mathbb{U}_{19}[\mathbb{Q}_3^{(u, B_{2u})}] \otimes \mathbb{F}_{22}[\mathbb{T}_{1,0}^{(k, E_u)}]}{6} \\ & + \frac{\sqrt{3}\mathbb{X}_{26}[\mathbb{T}_{2,1}^{(a, E_g)}(1, 0)] \otimes \mathbb{U}_{20}[\mathbb{T}_0^{(u, A_{1g})}] \otimes \mathbb{F}_{20}[\mathbb{Q}_{2,1}^{(k, E_g)}]}{6} - \frac{\sqrt{3}\mathbb{X}_{26}[\mathbb{T}_{2,1}^{(a, E_g)}(1, 0)] \otimes \mathbb{U}_{22}[\mathbb{T}_2^{(u, B_{1g})}] \otimes \mathbb{F}_{20}[\mathbb{Q}_{2,1}^{(k, E_g)}]}{6} \\ & + \frac{\sqrt{3}\mathbb{X}_{28}[\mathbb{T}_2^{(a, B_{1g})}(1, 0)] \otimes \mathbb{U}_{17}[\mathbb{Q}_1^{(u, A_{2u})}] \otimes \mathbb{F}_{24}[\mathbb{T}_3^{(k, B_{2u})}]}{6} + \frac{\sqrt{3}\mathbb{X}_{28}[\mathbb{T}_2^{(a, B_{1g})}(1, 0)] \otimes \mathbb{U}_{19}[\mathbb{Q}_3^{(u, B_{2u})}] \otimes \mathbb{F}_{21}[\mathbb{T}_1^{(k, A_{2u})}]}{6} \\ & + \frac{\sqrt{3}\mathbb{X}_{28}[\mathbb{T}_2^{(a, B_{1g})}(1, 0)] \otimes \mathbb{U}_{20}[\mathbb{T}_0^{(u, A_{1g})}] \otimes \mathbb{F}_{18}[\mathbb{Q}_2^{(k, B_{1g})}]}{6} + \frac{\sqrt{3}\mathbb{X}_{28}[\mathbb{T}_2^{(a, B_{1g})}(1, 0)] \otimes \mathbb{U}_{22}[\mathbb{T}_2^{(u, B_{1g})}] \otimes \mathbb{F}_{17}[\mathbb{Q}_0^{(k, A_{1g})}]}{6} \end{aligned}$$

$$\boxed{\text{No. 66}} \quad \hat{\mathbb{Q}}_2^{(A_{1g})}(1, 0) \text{ [M}_1, \text{B}_3]$$

$$\hat{\mathbb{Z}}_{66} = \frac{\sqrt{6}\mathbb{X}_{25}[\mathbb{T}_{2,0}^{(a, E_g)}(1, 0)] \otimes \mathbb{Y}_{26}[\mathbb{T}_{2,0}^{(b, E_g)}]}{6} + \frac{\sqrt{6}\mathbb{X}_{26}[\mathbb{T}_{2,1}^{(a, E_g)}(1, 0)] \otimes \mathbb{Y}_{27}[\mathbb{T}_{2,1}^{(b, E_g)}]}{6} - \frac{\sqrt{6}\mathbb{X}_{28}[\mathbb{T}_2^{(a, B_{1g})}(1, 0)] \otimes \mathbb{Y}_{25}[\mathbb{T}_2^{(b, B_{1g})}]}{3}$$

$$\begin{aligned}
\hat{Z}_{66}(\mathbf{k}) = & \frac{\sqrt{6}\mathbb{X}_{25}[\mathbb{T}_{2,0}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{17}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{23}[\mathbb{T}_{1,1}^{(k,E_u)}]}{12} + \frac{\sqrt{6}\mathbb{X}_{25}[\mathbb{T}_{2,0}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{19}[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{23}[\mathbb{T}_{1,1}^{(k,E_u)}]}{12} \\
& + \frac{\sqrt{6}\mathbb{X}_{25}[\mathbb{T}_{2,0}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{20}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{19}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{12} + \frac{\sqrt{6}\mathbb{X}_{25}[\mathbb{T}_{2,0}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{22}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{19}[\mathbb{Q}_{2,0}^{(k,E_g)}]}{12} \\
& + \frac{\sqrt{6}\mathbb{X}_{26}[\mathbb{T}_{2,1}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{17}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{22}[\mathbb{T}_{1,0}^{(k,E_u)}]}{12} - \frac{\sqrt{6}\mathbb{X}_{26}[\mathbb{T}_{2,1}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{19}[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{22}[\mathbb{T}_{1,0}^{(k,E_u)}]}{12} \\
& + \frac{\sqrt{6}\mathbb{X}_{26}[\mathbb{T}_{2,1}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{20}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{20}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{12} - \frac{\sqrt{6}\mathbb{X}_{26}[\mathbb{T}_{2,1}^{(a,E_g)}(1,0)] \otimes \mathbb{U}_{22}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{20}[\mathbb{Q}_{2,1}^{(k,E_g)}]}{12} \\
& - \frac{\sqrt{6}\mathbb{X}_{28}[\mathbb{T}_2^{(a,B_{1g})}(1,0)] \otimes \mathbb{U}_{17}[\mathbb{Q}_1^{(u,A_{2u})}] \otimes \mathbb{F}_{24}[\mathbb{T}_3^{(k,B_{2u})}]}{6} - \frac{\sqrt{6}\mathbb{X}_{28}[\mathbb{T}_2^{(a,B_{1g})}(1,0)] \otimes \mathbb{U}_{19}[\mathbb{Q}_3^{(u,B_{2u})}] \otimes \mathbb{F}_{21}[\mathbb{T}_1^{(k,A_{2u})}]}{6} \\
& - \frac{\sqrt{6}\mathbb{X}_{28}[\mathbb{T}_2^{(a,B_{1g})}(1,0)] \otimes \mathbb{U}_{20}[\mathbb{T}_0^{(u,A_{1g})}] \otimes \mathbb{F}_{18}[\mathbb{Q}_2^{(k,B_{1g})}]}{6} - \frac{\sqrt{6}\mathbb{X}_{28}[\mathbb{T}_2^{(a,B_{1g})}(1,0)] \otimes \mathbb{U}_{22}[\mathbb{T}_2^{(u,B_{1g})}] \otimes \mathbb{F}_{17}[\mathbb{Q}_0^{(k,A_{1g})}]}{6}
\end{aligned}$$

Table 5: Atomic SAMB group.

group	bra	ket
M <sub>1</sub>	$(p_x, \uparrow), (p_x, \downarrow), (p_y, \uparrow), (p_y, \downarrow), (p_z, \uparrow), (p_z, \downarrow)$	$(p_x, \uparrow), (p_x, \downarrow), (p_y, \uparrow), (p_y, \downarrow), (p_z, \uparrow), (p_z, \downarrow)$

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{6}}{6} & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{6}}{6} & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{6}}{6} & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{6}}{6} & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{6} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{6} \end{pmatrix} $

*continued ...*

Table 6

symbol	type	group	form
$\mathbb{X}_2$	$\mathbb{Q}_2^{(a, A_{1g})}$	$M_1$	$\begin{pmatrix} -\frac{\sqrt{3}}{6} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{3}}{6} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{3}}{6} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{3}}{6} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{3} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{3} \end{pmatrix}$
$\mathbb{X}_3$	$\mathbb{Q}_0^{(a, A_{1g})}(1, 1)$	$M_1$	$\begin{pmatrix} 0 & 0 & -\frac{\sqrt{3}i}{6} & 0 & 0 & \frac{\sqrt{3}}{6} \\ 0 & 0 & 0 & \frac{\sqrt{3}i}{6} & -\frac{\sqrt{3}}{6} & 0 \\ \frac{\sqrt{3}i}{6} & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}i}{6} \\ 0 & -\frac{\sqrt{3}i}{6} & 0 & 0 & -\frac{\sqrt{3}i}{6} & 0 \\ 0 & -\frac{\sqrt{3}}{6} & 0 & \frac{\sqrt{3}i}{6} & 0 & 0 \\ \frac{\sqrt{3}}{6} & 0 & \frac{\sqrt{3}i}{6} & 0 & 0 & 0 \end{pmatrix}$
$\mathbb{X}_4$	$\mathbb{Q}_2^{(a, A_{1g})}(1, -1)$	$M_1$	$\begin{pmatrix} 0 & 0 & -\frac{\sqrt{6}i}{6} & 0 & 0 & -\frac{\sqrt{6}}{12} \\ 0 & 0 & 0 & \frac{\sqrt{6}i}{6} & \frac{\sqrt{6}}{12} & 0 \\ \frac{\sqrt{6}i}{6} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{12} \\ 0 & -\frac{\sqrt{6}i}{6} & 0 & 0 & \frac{\sqrt{6}i}{12} & 0 \\ 0 & \frac{\sqrt{6}}{12} & 0 & -\frac{\sqrt{6}i}{12} & 0 & 0 \\ -\frac{\sqrt{6}}{12} & 0 & -\frac{\sqrt{6}i}{12} & 0 & 0 & 0 \end{pmatrix}$
$\mathbb{X}_5$	$\mathbb{Q}_2^{(a, B_{1g})}$	$M_1$	$\begin{pmatrix} \frac{1}{2} & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{1}{2} & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{1}{2} & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{1}{2} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$
$\mathbb{X}_6$	$\mathbb{Q}_2^{(a, B_{2g})}$	$M_1$	$\begin{pmatrix} 0 & 0 & \frac{1}{2} & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{1}{2} & 0 & 0 \\ \frac{1}{2} & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{1}{2} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$

continued ...

Table 6

symbol	type	group	form
$\mathbb{X}_7$	$\mathbb{Q}_{2,0}^{(a,E_g)}$	$M_1$	$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{1}{2} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{1}{2} \\ 0 & 0 & \frac{1}{2} & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{1}{2} & 0 & 0 \end{pmatrix}$
$\mathbb{X}_8$	$\mathbb{Q}_{2,1}^{(a,E_g)}$	$M_1$	$\begin{pmatrix} 0 & 0 & 0 & 0 & \frac{1}{2} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{1}{2} \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ \frac{1}{2} & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{1}{2} & 0 & 0 & 0 & 0 \end{pmatrix}$
$\mathbb{X}_9$	$\mathbb{Q}_2^{(a,B_{1g})}(1,-1)$	$M_1$	$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{4} \\ 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{4} & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{4} \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{4} & 0 \\ 0 & \frac{\sqrt{2}}{4} & 0 & \frac{\sqrt{2}i}{4} & 0 & 0 \\ -\frac{\sqrt{2}}{4} & 0 & \frac{\sqrt{2}i}{4} & 0 & 0 & 0 \end{pmatrix}$
$\mathbb{X}_{10}$	$\mathbb{Q}_2^{(a,B_{2g})}(1,-1)$	$M_1$	$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{4} \\ 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{4} & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{4} \\ 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{4} & 0 \\ 0 & -\frac{\sqrt{2}i}{4} & 0 & \frac{\sqrt{2}}{4} & 0 & 0 \\ -\frac{\sqrt{2}i}{4} & 0 & -\frac{\sqrt{2}}{4} & 0 & 0 & 0 \end{pmatrix}$
$\mathbb{X}_{11}$	$\mathbb{Q}_{2,0}^{(a,E_g)}(1,-1)$	$M_1$	$\begin{pmatrix} 0 & 0 & 0 & -\frac{\sqrt{2}}{4} & \frac{\sqrt{2}i}{4} & 0 \\ 0 & 0 & \frac{\sqrt{2}}{4} & 0 & 0 & -\frac{\sqrt{2}i}{4} \\ 0 & \frac{\sqrt{2}}{4} & 0 & 0 & 0 & 0 \\ -\frac{\sqrt{2}}{4} & 0 & 0 & 0 & 0 & 0 \\ -\frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 \end{pmatrix}$

continued ...

Table 6

symbol	type	group	form
$\mathbb{X}_{12}$	$\mathbb{Q}_{2,1}^{(a,E_g)}(1,-1)$	$M_1$	$\begin{pmatrix} 0 & 0 & 0 & -\frac{\sqrt{2}i}{4} & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{2}i}{4} & 0 & 0 & 0 \\ 0 & \frac{\sqrt{2}i}{4} & 0 & 0 & -\frac{\sqrt{2}i}{4} & 0 \\ \frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{4} \\ 0 & 0 & \frac{\sqrt{2}i}{4} & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{2}i}{4} & 0 & 0 \end{pmatrix}$
$\mathbb{X}_{13}$	$\mathbb{G}_{1,0}^{(a,E_g)}(1,0)$	$M_1$	$\begin{pmatrix} 0 & 0 & 0 & -\frac{\sqrt{2}}{4} & -\frac{\sqrt{2}i}{4} & 0 \\ 0 & 0 & \frac{\sqrt{2}}{4} & 0 & 0 & \frac{\sqrt{2}i}{4} \\ 0 & \frac{\sqrt{2}}{4} & 0 & 0 & 0 & 0 \\ -\frac{\sqrt{2}}{4} & 0 & 0 & 0 & 0 & 0 \\ \frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 \end{pmatrix}$
$\mathbb{X}_{14}$	$\mathbb{G}_{1,1}^{(a,E_g)}(1,0)$	$M_1$	$\begin{pmatrix} 0 & 0 & 0 & \frac{\sqrt{2}i}{4} & 0 & 0 \\ 0 & 0 & \frac{\sqrt{2}i}{4} & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{2}i}{4} & 0 & 0 & -\frac{\sqrt{2}i}{4} & 0 \\ -\frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{4} \\ 0 & 0 & \frac{\sqrt{2}i}{4} & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{2}i}{4} & 0 & 0 \end{pmatrix}$
$\mathbb{X}_{15}$	$\mathbb{M}_{1,0}^{(a,E_g)}$	$M_1$	$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{i}{2} & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{i}{2} \\ 0 & 0 & \frac{i}{2} & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{i}{2} & 0 & 0 \end{pmatrix}$
$\mathbb{X}_{16}$	$\mathbb{M}_{1,1}^{(a,E_g)}$	$M_1$	$\begin{pmatrix} 0 & 0 & 0 & 0 & \frac{i}{2} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{i}{2} \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ -\frac{i}{2} & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{i}{2} & 0 & 0 & 0 & 0 \end{pmatrix}$

continued ...

Table 6

symbol	type	group	form
$\mathbb{X}_{17}$	$\mathbb{M}_{1,0}^{(a,E_g)}(1,1)$	$M_1$	$\begin{pmatrix} 0 & \frac{\sqrt{30}}{15} & 0 & -\frac{\sqrt{30}i}{20} & \frac{\sqrt{30}}{20} & 0 \\ \frac{\sqrt{30}}{15} & 0 & \frac{\sqrt{30}i}{20} & 0 & 0 & -\frac{\sqrt{30}}{20} \\ 0 & -\frac{\sqrt{30}i}{20} & 0 & -\frac{\sqrt{30}}{30} & 0 & 0 \\ \frac{\sqrt{30}i}{20} & 0 & -\frac{\sqrt{30}}{30} & 0 & 0 & 0 \\ \frac{\sqrt{30}}{20} & 0 & 0 & 0 & 0 & -\frac{\sqrt{30}}{30} \\ 0 & -\frac{\sqrt{30}}{20} & 0 & 0 & -\frac{\sqrt{30}}{30} & 0 \end{pmatrix}$
$\mathbb{X}_{18}$	$\mathbb{M}_{1,1}^{(a,E_g)}(1,1)$	$M_1$	$\begin{pmatrix} 0 & \frac{\sqrt{30}i}{30} & 0 & \frac{\sqrt{30}}{20} & 0 & 0 \\ -\frac{\sqrt{30}i}{30} & 0 & \frac{\sqrt{30}}{20} & 0 & 0 & 0 \\ 0 & \frac{\sqrt{30}}{20} & 0 & -\frac{\sqrt{30}i}{15} & \frac{\sqrt{30}}{20} & 0 \\ \frac{\sqrt{30}}{20} & 0 & \frac{\sqrt{30}i}{15} & 0 & 0 & -\frac{\sqrt{30}}{20} \\ 0 & 0 & \frac{\sqrt{30}}{20} & 0 & 0 & \frac{\sqrt{30}i}{30} \\ 0 & 0 & 0 & -\frac{\sqrt{30}}{20} & -\frac{\sqrt{30}i}{30} & 0 \end{pmatrix}$
$\mathbb{X}_{19}$	$\mathbb{M}_{1,0}^{(a,E_g)}(1,-1)$	$M_1$	$\begin{pmatrix} 0 & \frac{\sqrt{6}}{6} & 0 & 0 & 0 & 0 \\ \frac{\sqrt{6}}{6} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{6}}{6} & 0 & 0 \\ 0 & 0 & \frac{\sqrt{6}}{6} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{6} \\ 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{6} & 0 \end{pmatrix}$
$\mathbb{X}_{20}$	$\mathbb{M}_{1,1}^{(a,E_g)}(1,-1)$	$M_1$	$\begin{pmatrix} 0 & -\frac{\sqrt{6}i}{6} & 0 & 0 & 0 & 0 \\ \frac{\sqrt{6}i}{6} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{\sqrt{6}i}{6} & 0 & 0 \\ 0 & 0 & \frac{\sqrt{6}i}{6} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}i}{6} \\ 0 & 0 & 0 & 0 & \frac{\sqrt{6}i}{6} & 0 \end{pmatrix}$
$\mathbb{X}_{21}$	$\mathbb{M}_{3,0}^{(a,E_g,1)}(1,-1)$	$M_1$	$\begin{pmatrix} 0 & \frac{\sqrt{5}}{5} & 0 & \frac{\sqrt{5}i}{10} & -\frac{\sqrt{5}}{10} & 0 \\ \frac{\sqrt{5}}{5} & 0 & -\frac{\sqrt{5}i}{10} & 0 & 0 & \frac{\sqrt{5}}{10} \\ 0 & \frac{\sqrt{5}i}{10} & 0 & -\frac{\sqrt{5}}{10} & 0 & 0 \\ -\frac{\sqrt{5}i}{10} & 0 & -\frac{\sqrt{5}}{10} & 0 & 0 & 0 \\ -\frac{\sqrt{5}}{10} & 0 & 0 & 0 & 0 & -\frac{\sqrt{5}}{10} \\ 0 & \frac{\sqrt{5}}{10} & 0 & 0 & -\frac{\sqrt{5}}{10} & 0 \end{pmatrix}$

continued ...

Table 6

symbol	type	group	form
$\mathbb{X}_{22}$	$\mathbb{M}_{3,1}^{(a,E_g,1)}(1,-1)$	$M_1$	$\begin{pmatrix} 0 & \frac{\sqrt{5}i}{10} & 0 & -\frac{\sqrt{5}}{10} & 0 & 0 \\ -\frac{\sqrt{5}i}{10} & 0 & -\frac{\sqrt{5}}{10} & 0 & 0 & 0 \\ 0 & -\frac{\sqrt{5}}{10} & 0 & -\frac{\sqrt{5}i}{5} & -\frac{\sqrt{5}}{10} & 0 \\ -\frac{\sqrt{5}}{10} & 0 & \frac{\sqrt{5}i}{5} & 0 & 0 & \frac{\sqrt{5}}{10} \\ 0 & 0 & -\frac{\sqrt{5}}{10} & 0 & 0 & \frac{\sqrt{5}i}{10} \\ 0 & 0 & 0 & \frac{\sqrt{5}}{10} & -\frac{\sqrt{5}i}{10} & 0 \end{pmatrix}$
$\mathbb{X}_{23}$	$\mathbb{M}_{3,0}^{(a,E_g,2)}(1,-1)$	$M_1$	$\begin{pmatrix} 0 & 0 & 0 & -\frac{\sqrt{3}}{6} & -\frac{\sqrt{3}i}{6} & 0 \\ 0 & 0 & \frac{\sqrt{3}i}{6} & 0 & 0 & \frac{\sqrt{3}}{6} \\ 0 & -\frac{\sqrt{3}i}{6} & 0 & \frac{\sqrt{3}}{6} & 0 & 0 \\ \frac{\sqrt{3}i}{6} & 0 & \frac{\sqrt{3}}{6} & 0 & 0 & 0 \\ -\frac{\sqrt{3}}{6} & 0 & 0 & 0 & 0 & -\frac{\sqrt{3}}{6} \\ 0 & \frac{\sqrt{3}}{6} & 0 & 0 & -\frac{\sqrt{3}i}{6} & 0 \end{pmatrix}$
$\mathbb{X}_{24}$	$\mathbb{M}_{3,1}^{(a,E_g,2)}(1,-1)$	$M_1$	$\begin{pmatrix} 0 & -\frac{\sqrt{3}i}{6} & 0 & \frac{\sqrt{3}}{6} & 0 & 0 \\ \frac{\sqrt{3}i}{6} & 0 & \frac{\sqrt{3}}{6} & 0 & 0 & 0 \\ 0 & \frac{\sqrt{3}}{6} & 0 & 0 & -\frac{\sqrt{3}}{6} & 0 \\ \frac{\sqrt{3}}{6} & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{6} \\ 0 & 0 & -\frac{\sqrt{3}}{6} & 0 & 0 & \frac{\sqrt{3}i}{6} \\ 0 & 0 & 0 & \frac{\sqrt{3}}{6} & -\frac{\sqrt{3}i}{6} & 0 \end{pmatrix}$
$\mathbb{X}_{25}$	$\mathbb{T}_{2,0}^{(a,E_g)}(1,0)$	$M_1$	$\begin{pmatrix} 0 & 0 & 0 & \frac{\sqrt{6}i}{12} & \frac{\sqrt{6}}{12} & 0 \\ 0 & 0 & -\frac{\sqrt{6}i}{12} & 0 & 0 & -\frac{\sqrt{6}}{12} \\ 0 & \frac{\sqrt{6}i}{12} & 0 & \frac{\sqrt{6}}{6} & 0 & 0 \\ -\frac{\sqrt{6}i}{12} & 0 & \frac{\sqrt{6}}{6} & 0 & 0 & 0 \\ \frac{\sqrt{6}}{12} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{6} \\ 0 & -\frac{\sqrt{6}}{12} & 0 & 0 & -\frac{\sqrt{6}i}{6} & 0 \end{pmatrix}$
$\mathbb{X}_{26}$	$\mathbb{T}_{2,1}^{(a,E_g)}(1,0)$	$M_1$	$\begin{pmatrix} 0 & \frac{\sqrt{6}i}{6} & 0 & \frac{\sqrt{6}}{12} & 0 & 0 \\ -\frac{\sqrt{6}i}{6} & 0 & \frac{\sqrt{6}}{12} & 0 & 0 & 0 \\ 0 & \frac{\sqrt{6}}{12} & 0 & 0 & -\frac{\sqrt{6}}{12} & 0 \\ \frac{\sqrt{6}}{12} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{12} \\ 0 & 0 & -\frac{\sqrt{6}}{12} & 0 & 0 & -\frac{\sqrt{6}i}{6} \\ 0 & 0 & 0 & \frac{\sqrt{6}}{12} & \frac{\sqrt{6}i}{6} & 0 \end{pmatrix}$

continued ...



Table 6

symbol	type	group	form
$\mathbb{X}_{27}$	$\mathbb{M}_3^{(a, B_{1g})}(1, -1)$	$M_1$	$\begin{pmatrix} 0 & 0 & \frac{\sqrt{3}}{6} & 0 & 0 & -\frac{\sqrt{3}i}{6} \\ 0 & 0 & 0 & -\frac{\sqrt{3}}{6} & \frac{\sqrt{3}i}{6} & 0 \\ \frac{\sqrt{3}}{6} & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{6} \\ 0 & -\frac{\sqrt{3}}{6} & 0 & 0 & \frac{\sqrt{3}}{6} & 0 \\ 0 & -\frac{\sqrt{3}i}{6} & 0 & \frac{\sqrt{3}}{6} & 0 & 0 \\ \frac{\sqrt{3}i}{6} & 0 & \frac{\sqrt{3}}{6} & 0 & 0 & 0 \end{pmatrix}$
$\mathbb{X}_{28}$	$\mathbb{T}_2^{(a, B_{1g})}(1, 0)$	$M_1$	$\begin{pmatrix} 0 & 0 & -\frac{\sqrt{6}}{6} & 0 & 0 & -\frac{\sqrt{6}i}{12} \\ 0 & 0 & 0 & \frac{\sqrt{6}}{6} & \frac{\sqrt{6}i}{12} & 0 \\ -\frac{\sqrt{6}}{6} & 0 & 0 & 0 & 0 & \frac{\sqrt{6}}{12} \\ 0 & \frac{\sqrt{6}}{6} & 0 & 0 & \frac{\sqrt{6}}{12} & 0 \\ 0 & -\frac{\sqrt{6}i}{12} & 0 & \frac{\sqrt{6}}{12} & 0 & 0 \\ \frac{\sqrt{6}i}{12} & 0 & \frac{\sqrt{6}}{12} & 0 & 0 & 0 \end{pmatrix}$
$\mathbb{X}_{29}$	$\mathbb{M}_3^{(a, B_{2g})}(1, -1)$	$M_1$	$\begin{pmatrix} \frac{\sqrt{3}}{6} & 0 & 0 & 0 & 0 & \frac{\sqrt{3}}{6} \\ 0 & -\frac{\sqrt{3}}{6} & 0 & 0 & \frac{\sqrt{3}}{6} & 0 \\ 0 & 0 & -\frac{\sqrt{3}}{6} & 0 & 0 & \frac{\sqrt{3}i}{6} \\ 0 & 0 & 0 & \frac{\sqrt{3}}{6} & -\frac{\sqrt{3}i}{6} & 0 \\ 0 & \frac{\sqrt{3}}{6} & 0 & \frac{\sqrt{3}i}{6} & 0 & 0 \\ \frac{\sqrt{3}}{6} & 0 & -\frac{\sqrt{3}i}{6} & 0 & 0 & 0 \end{pmatrix}$
$\mathbb{X}_{30}$	$\mathbb{T}_2^{(a, B_{2g})}(1, 0)$	$M_1$	$\begin{pmatrix} \frac{\sqrt{6}}{6} & 0 & 0 & 0 & 0 & -\frac{\sqrt{6}}{12} \\ 0 & -\frac{\sqrt{6}}{6} & 0 & 0 & -\frac{\sqrt{6}}{12} & 0 \\ 0 & 0 & -\frac{\sqrt{6}}{6} & 0 & 0 & -\frac{\sqrt{6}i}{12} \\ 0 & 0 & 0 & \frac{\sqrt{6}}{6} & \frac{\sqrt{6}i}{12} & 0 \\ 0 & -\frac{\sqrt{6}}{12} & 0 & -\frac{\sqrt{6}i}{12} & 0 & 0 \\ -\frac{\sqrt{6}}{12} & 0 & \frac{\sqrt{6}i}{12} & 0 & 0 & 0 \end{pmatrix}$
$\mathbb{X}_{31}$	$\mathbb{T}_2^{(a, A_{1g})}(1, 0)$	$M_1$	$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{4} \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{4} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{4} \\ 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{4} & 0 \\ 0 & \frac{\sqrt{2}i}{4} & 0 & \frac{\sqrt{2}}{4} & 0 & 0 \\ -\frac{\sqrt{2}i}{4} & 0 & \frac{\sqrt{2}}{4} & 0 & 0 & 0 \end{pmatrix}$

Table 7: Cluster SAMB.

[illegible]

Table 8: Uniform SAMB.

symbol	type	cluster	form
$\mathbb{U}_1$	$\mathbb{Q}_0^{(s, A_{1g})}$	$S_1$	$\begin{pmatrix} \frac{\sqrt{2}}{2} & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{\sqrt{2}}{2} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$
$\mathbb{U}_2$	$\mathbb{Q}_0^{(s, A_{1g})}$	$S_2$	$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{\sqrt{2}}{2} & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\sqrt{2}}{2} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$
$\mathbb{U}_3$	$\mathbb{Q}_0^{(s, A_{1g})}$	$S_3$	$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{2} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{2} \end{pmatrix}$
$\mathbb{U}_4$	$\mathbb{Q}_0^{(u, A_{1g})}$	$B_1$	$\begin{pmatrix} 0 & 0 & \frac{\sqrt{2}}{4} & \frac{\sqrt{2}}{4} & 0 & 0 \\ 0 & 0 & \frac{\sqrt{2}}{4} & \frac{\sqrt{2}}{4} & 0 & 0 \\ \frac{\sqrt{2}}{4} & \frac{\sqrt{2}}{4} & 0 & 0 & 0 & 0 \\ \frac{\sqrt{2}}{4} & \frac{\sqrt{2}}{4} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$
$\mathbb{U}_5$	$\mathbb{Q}_1^{(u, A_{2u})}$	$B_1$	$\begin{pmatrix} 0 & 0 & \frac{\sqrt{2}}{4} & -\frac{\sqrt{2}}{4} & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{2}}{4} & -\frac{\sqrt{2}}{4} & 0 & 0 \\ \frac{\sqrt{2}}{4} & -\frac{\sqrt{2}}{4} & 0 & 0 & 0 & 0 \\ \frac{\sqrt{2}}{4} & -\frac{\sqrt{2}}{4} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$

*continued ...*

Table 8

symbol	type	cluster	form
$\mathbb{U}_6$	$\mathbb{Q}_2^{(u, B_{1g})}$	$B_1$	$\begin{pmatrix} 0 & 0 & \frac{\sqrt{2}}{4} & -\frac{\sqrt{2}}{4} & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{2}}{4} & \frac{\sqrt{2}}{4} & 0 & 0 \\ \frac{\sqrt{2}}{4} & -\frac{\sqrt{2}}{4} & 0 & 0 & 0 & 0 \\ -\frac{\sqrt{2}}{4} & \frac{\sqrt{2}}{4} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$
$\mathbb{U}_7$	$\mathbb{Q}_3^{(u, B_{2u})}$	$B_1$	$\begin{pmatrix} 0 & 0 & \frac{\sqrt{2}}{4} & -\frac{\sqrt{2}}{4} & 0 & 0 \\ 0 & 0 & \frac{\sqrt{2}}{4} & -\frac{\sqrt{2}}{4} & 0 & 0 \\ \frac{\sqrt{2}}{4} & \frac{\sqrt{2}}{4} & 0 & 0 & 0 & 0 \\ -\frac{\sqrt{2}}{4} & -\frac{\sqrt{2}}{4} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$
$\mathbb{U}_8$	$\mathbb{T}_0^{(u, A_{1g})}$	$B_1$	$\begin{pmatrix} 0 & 0 & -\frac{\sqrt{2}i}{4} & -\frac{\sqrt{2}i}{4} & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{2}i}{4} & -\frac{\sqrt{2}i}{4} & 0 & 0 \\ \frac{\sqrt{2}i}{4} & \frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 \\ \frac{\sqrt{2}i}{4} & \frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$
$\mathbb{U}_9$	$\mathbb{T}_1^{(u, A_{2u})}$	$B_1$	$\begin{pmatrix} 0 & 0 & -\frac{\sqrt{2}i}{4} & -\frac{\sqrt{2}i}{4} & 0 & 0 \\ 0 & 0 & \frac{\sqrt{2}i}{4} & \frac{\sqrt{2}i}{4} & 0 & 0 \\ \frac{\sqrt{2}i}{4} & -\frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 \\ \frac{\sqrt{2}i}{4} & -\frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$
$\mathbb{U}_{10}$	$\mathbb{T}_2^{(u, B_{1g})}$	$B_1$	$\begin{pmatrix} 0 & 0 & -\frac{\sqrt{2}i}{4} & \frac{\sqrt{2}i}{4} & 0 & 0 \\ 0 & 0 & \frac{\sqrt{2}i}{4} & -\frac{\sqrt{2}i}{4} & 0 & 0 \\ \frac{\sqrt{2}i}{4} & -\frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 \\ -\frac{\sqrt{2}i}{4} & \frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$

continued ...

Table 8

symbol	type	cluster	form
$\mathbb{U}_{11}$	$\mathbb{T}_3^{(u, B_{2u})}$	$B_1$	$\begin{pmatrix} 0 & 0 & -\frac{\sqrt{2}i}{4} & \frac{\sqrt{2}i}{4} & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{2}i}{4} & \frac{\sqrt{2}i}{4} & 0 & 0 \\ \frac{\sqrt{2}i}{4} & \frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 \\ -\frac{\sqrt{2}i}{4} & -\frac{\sqrt{2}i}{4} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$
$\mathbb{U}_{12}$	$\mathbb{Q}_0^{(u, A_{1g})}$	$B_2$	$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & \frac{1}{2} \\ 0 & 0 & 0 & 0 & \frac{1}{2} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{1}{2} & 0 & 0 & 0 & 0 \\ \frac{1}{2} & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$
$\mathbb{U}_{13}$	$\mathbb{Q}_1^{(u, A_{2u})}$	$B_2$	$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & \frac{1}{2} \\ 0 & 0 & 0 & 0 & -\frac{1}{2} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{1}{2} & 0 & 0 & 0 & 0 \\ \frac{1}{2} & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$
$\mathbb{U}_{14}$	$\mathbb{T}_0^{(u, A_{1g})}$	$B_2$	$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & -\frac{i}{2} \\ 0 & 0 & 0 & 0 & -\frac{i}{2} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{i}{2} & 0 & 0 & 0 & 0 \\ \frac{i}{2} & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$
$\mathbb{U}_{15}$	$\mathbb{T}_1^{(u, A_{2u})}$	$B_2$	$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & -\frac{i}{2} \\ 0 & 0 & 0 & 0 & \frac{i}{2} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{i}{2} & 0 & 0 & 0 & 0 \\ \frac{i}{2} & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$

continued ...

Table 8

symbol	type	cluster	form
$\mathbb{U}_{16}$	$\mathbb{Q}_0^{(u, A_{1g})}$	$B_3$	$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{4} & \frac{\sqrt{2}}{4} \\ 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{4} & \frac{\sqrt{2}}{4} \\ 0 & 0 & \frac{\sqrt{2}}{4} & \frac{\sqrt{2}}{4} & 0 & 0 \\ 0 & 0 & \frac{\sqrt{2}}{4} & \frac{\sqrt{2}}{4} & 0 & 0 \end{pmatrix}$
$\mathbb{U}_{17}$	$\mathbb{Q}_1^{(u, A_{2u})}$	$B_3$	$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{4} & -\frac{\sqrt{2}}{4} \\ 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{4} & -\frac{\sqrt{2}}{4} \\ 0 & 0 & \frac{\sqrt{2}}{4} & \frac{\sqrt{2}}{4} & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{2}}{4} & -\frac{\sqrt{2}}{4} & 0 & 0 \end{pmatrix}$
$\mathbb{U}_{18}$	$\mathbb{Q}_2^{(u, B_{1g})}$	$B_3$	$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{4} & -\frac{\sqrt{2}}{4} \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{4} & \frac{\sqrt{2}}{4} \\ 0 & 0 & \frac{\sqrt{2}}{4} & -\frac{\sqrt{2}}{4} & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{2}}{4} & \frac{\sqrt{2}}{4} & 0 & 0 \end{pmatrix}$
$\mathbb{U}_{19}$	$\mathbb{Q}_3^{(u, B_{2u})}$	$B_3$	$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\sqrt{2}}{4} & \frac{\sqrt{2}}{4} \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{2}}{4} & -\frac{\sqrt{2}}{4} \\ 0 & 0 & \frac{\sqrt{2}}{4} & -\frac{\sqrt{2}}{4} & 0 & 0 \\ 0 & 0 & \frac{\sqrt{2}}{4} & -\frac{\sqrt{2}}{4} & 0 & 0 \end{pmatrix}$
$\mathbb{U}_{20}$	$\mathbb{T}_0^{(u, A_{1g})}$	$B_3$	$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{4} & -\frac{\sqrt{2}i}{4} \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{4} & -\frac{\sqrt{2}i}{4} \\ 0 & 0 & \frac{\sqrt{2}i}{4} & \frac{\sqrt{2}i}{4} & 0 & 0 \\ 0 & 0 & \frac{\sqrt{2}i}{4} & \frac{\sqrt{2}i}{4} & 0 & 0 \end{pmatrix}$

continued ...

Table 8

symbol	type	cluster	form
$\mathbb{U}_{21}$	$\mathbb{T}_1^{(u, A_{2u})}$	$B_3$	$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{4} & \frac{\sqrt{2}i}{4} \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{4} & \frac{\sqrt{2}i}{4} \\ 0 & 0 & \frac{\sqrt{2}i}{4} & \frac{\sqrt{2}i}{4} & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{2}i}{4} & -\frac{\sqrt{2}i}{4} & 0 & 0 \end{pmatrix}$
$\mathbb{U}_{22}$	$\mathbb{T}_2^{(u, B_{1g})}$	$B_3$	$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{4} & \frac{\sqrt{2}i}{4} \\ 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{4} & -\frac{\sqrt{2}i}{4} \\ 0 & 0 & \frac{\sqrt{2}i}{4} & -\frac{\sqrt{2}i}{4} & 0 & 0 \\ 0 & 0 & -\frac{\sqrt{2}i}{4} & \frac{\sqrt{2}i}{4} & 0 & 0 \end{pmatrix}$
$\mathbb{U}_{23}$	$\mathbb{T}_3^{(u, B_{2u})}$	$B_3$	$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{\sqrt{2}i}{4} & -\frac{\sqrt{2}i}{4} \\ 0 & 0 & 0 & 0 & \frac{\sqrt{2}i}{4} & \frac{\sqrt{2}i}{4} \\ 0 & 0 & \frac{\sqrt{2}i}{4} & -\frac{\sqrt{2}i}{4} & 0 & 0 \\ 0 & 0 & \frac{\sqrt{2}i}{4} & -\frac{\sqrt{2}i}{4} & 0 & 0 \end{pmatrix}$

Table 9: Structure SAMB.

symbol	type	cluster	form
$\mathbb{F}_1$	$\mathbb{Q}_0^{(k, A_{1g})}$	$B_1$	$\frac{\sqrt{2}c_{001}}{2} + \frac{\sqrt{2}c_{002}}{2} + \frac{\sqrt{2}c_{005}}{2} + \frac{\sqrt{2}c_{006}}{2}$
$\mathbb{F}_2$	$\mathbb{Q}_2^{(k, B_{1g})}$	$B_1$	$\frac{\sqrt{2}c_{001}}{2} + \frac{\sqrt{2}c_{002}}{2} - \frac{\sqrt{2}c_{005}}{2} - \frac{\sqrt{2}c_{006}}{2}$
$\mathbb{F}_3$	$\mathbb{Q}_{2,0}^{(k, E_g)}$	$B_1$	$c_{001} - c_{002}$
$\mathbb{F}_4$	$\mathbb{Q}_{2,1}^{(k, E_g)}$	$B_1$	$-c_{005} + c_{006}$
$\mathbb{F}_5$	$\mathbb{T}_1^{(k, A_{2u})}$	$B_1$	$\frac{\sqrt{2}s_{001}}{2} + \frac{\sqrt{2}s_{002}}{2} - \frac{\sqrt{2}s_{005}}{2} - \frac{\sqrt{2}s_{006}}{2}$
$\mathbb{F}_6$	$\mathbb{T}_{1,0}^{(k, E_u)}$	$B_1$	$s_{005} - s_{006}$
$\mathbb{F}_7$	$\mathbb{T}_{1,1}^{(k, E_u)}$	$B_1$	$s_{001} - s_{002}$

continued ...

Table 9

symbol	type	cluster	form
F <sub>8</sub>	$\mathbb{T}_3^{(k, B_{2u})}$	B <sub>1</sub>	$\frac{\sqrt{2}s_{001}}{2} + \frac{\sqrt{2}s_{002}}{2} + \frac{\sqrt{2}s_{005}}{2} + \frac{\sqrt{2}s_{006}}{2}$
F <sub>9</sub>	$\mathbb{Q}_0^{(k, A_{1g})}$	B <sub>2</sub>	$\frac{\sqrt{2}c_{009}}{2} + \frac{\sqrt{2}c_{010}}{2} + \frac{\sqrt{2}c_{011}}{2} + \frac{\sqrt{2}c_{012}}{2}$
F <sub>10</sub>	$\mathbb{Q}_2^{(k, B_{2g})}$	B <sub>2</sub>	$\frac{\sqrt{2}c_{009}}{2} + \frac{\sqrt{2}c_{010}}{2} - \frac{\sqrt{2}c_{011}}{2} - \frac{\sqrt{2}c_{012}}{2}$
F <sub>11</sub>	$\mathbb{Q}_{2,0}^{(k, E_g)}$	B <sub>2</sub>	$\frac{\sqrt{2}c_{009}}{2} - \frac{\sqrt{2}c_{010}}{2} + \frac{\sqrt{2}c_{011}}{2} - \frac{\sqrt{2}c_{012}}{2}$
F <sub>12</sub>	$\mathbb{Q}_{2,1}^{(k, E_g)}$	B <sub>2</sub>	$\frac{\sqrt{2}c_{009}}{2} - \frac{\sqrt{2}c_{010}}{2} - \frac{\sqrt{2}c_{011}}{2} + \frac{\sqrt{2}c_{012}}{2}$
F <sub>13</sub>	$\mathbb{T}_1^{(k, A_{2u})}$	B <sub>2</sub>	$\frac{\sqrt{2}s_{009}}{2} + \frac{\sqrt{2}s_{010}}{2} - \frac{\sqrt{2}s_{011}}{2} - \frac{\sqrt{2}s_{012}}{2}$
F <sub>14</sub>	$\mathbb{T}_{1,0}^{(k, E_u)}$	B <sub>2</sub>	$\frac{\sqrt{2}s_{009}}{2} - \frac{\sqrt{2}s_{010}}{2} + \frac{\sqrt{2}s_{011}}{2} - \frac{\sqrt{2}s_{012}}{2}$
F <sub>15</sub>	$\mathbb{T}_{1,1}^{(k, E_u)}$	B <sub>2</sub>	$\frac{\sqrt{2}s_{009}}{2} - \frac{\sqrt{2}s_{010}}{2} - \frac{\sqrt{2}s_{011}}{2} + \frac{\sqrt{2}s_{012}}{2}$
F <sub>16</sub>	$\mathbb{T}_3^{(k, B_{1u})}$	B <sub>2</sub>	$\frac{\sqrt{2}s_{009}}{2} + \frac{\sqrt{2}s_{010}}{2} + \frac{\sqrt{2}s_{011}}{2} + \frac{\sqrt{2}s_{012}}{2}$
F <sub>17</sub>	$\mathbb{Q}_0^{(k, A_{1g})}$	B <sub>3</sub>	$\frac{\sqrt{2}c_{017}}{2} + \frac{\sqrt{2}c_{018}}{2} + \frac{\sqrt{2}c_{021}}{2} + \frac{\sqrt{2}c_{022}}{2}$
F <sub>18</sub>	$\mathbb{Q}_2^{(k, B_{1g})}$	B <sub>3</sub>	$\frac{\sqrt{2}c_{017}}{2} + \frac{\sqrt{2}c_{018}}{2} - \frac{\sqrt{2}c_{021}}{2} - \frac{\sqrt{2}c_{022}}{2}$
F <sub>19</sub>	$\mathbb{Q}_{2,0}^{(k, E_g)}$	B <sub>3</sub>	$c_{017} - c_{018}$
F <sub>20</sub>	$\mathbb{Q}_{2,1}^{(k, E_g)}$	B <sub>3</sub>	$-c_{021} + c_{022}$
F <sub>21</sub>	$\mathbb{T}_1^{(k, A_{2u})}$	B <sub>3</sub>	$\frac{\sqrt{2}s_{017}}{2} + \frac{\sqrt{2}s_{018}}{2} - \frac{\sqrt{2}s_{021}}{2} - \frac{\sqrt{2}s_{022}}{2}$
F <sub>22</sub>	$\mathbb{T}_{1,0}^{(k, E_u)}$	B <sub>3</sub>	$s_{021} - s_{022}$
F <sub>23</sub>	$\mathbb{T}_{1,1}^{(k, E_u)}$	B <sub>3</sub>	$s_{017} - s_{018}$
F <sub>24</sub>	$\mathbb{T}_3^{(k, B_{2u})}$	B <sub>3</sub>	$\frac{\sqrt{2}s_{017}}{2} + \frac{\sqrt{2}s_{018}}{2} + \frac{\sqrt{2}s_{021}}{2} + \frac{\sqrt{2}s_{022}}{2}$

Table 10: Polar harmonics.

No.	symbol	rank	irrep.	mul.	comp.	form
1	$\mathbb{Q}_0^{(A_{1g})}$	0	$A_{1g}$	—	—	1
2	$\mathbb{Q}_1^{(A_{2u})}$	1	$A_{2u}$	—	—	$z$
3	$\mathbb{Q}_{1,0}^{(E_u)}$	1	$E_u$	—	0	$x$
4	$\mathbb{Q}_{1,1}^{(E_u)}$	1	$E_u$	—	1	$y$
5	$\mathbb{Q}_2^{(A_{1g})}$	2	$A_{1g}$	—	—	$-\frac{x^2}{2} - \frac{y^2}{2} + z^2$
6	$\mathbb{Q}_2^{(B_{1g})}$	2	$B_{1g}$	—	—	$\frac{\sqrt{3}(x-y)(x+y)}{2}$

continued ...



Table 10

No.	symbol	rank	irrep.	mul.	comp.	form
7	$\mathbb{Q}_2^{(B_{2g})}$	2	$B_{2g}$	—	—	$\sqrt{3}xy$
8	$\mathbb{Q}_{2,0}^{(E_g)}$	2	$E_g$	—	0	$\sqrt{3}yz$
9	$\mathbb{Q}_{2,1}^{(E_g)}$	2	$E_g$	—	1	$\sqrt{3}xz$
10	$\mathbb{Q}_3^{(B_{1u})}$	3	$B_{1u}$	—	—	$\sqrt{15}xyz$
11	$\mathbb{Q}_3^{(B_{2u})}$	3	$B_{2u}$	—	—	$\frac{\sqrt{15}z(x-y)(x+y)}{2}$

Table 11: Axial harmonics.

No.	symbol	rank	irrep.	mul.	comp.	form
1	$\mathbb{G}_{1,0}^{(E_g)}$	1	$E_g$	—	0	$X$
2	$\mathbb{G}_{1,1}^{(E_g)}$	1	$E_g$	—	1	$Y$
3	$\mathbb{G}_3^{(B_{1g})}$	3	$B_{1g}$	—	—	$\sqrt{15}XYZ$
4	$\mathbb{G}_3^{(B_{2g})}$	3	$B_{2g}$	—	—	$\frac{\sqrt{15}Z(X-Y)(X+Y)}{2}$
5	$\mathbb{G}_{3,0}^{(E_g,1)}$	3	$E_g$	1	0	$\frac{X(2X^2-3Y^2-3Z^2)}{2}$
6	$\mathbb{G}_{3,1}^{(E_g,1)}$	3	$E_g$	1	1	$-\frac{Y(3X^2-2Y^2+3Z^2)}{2}$
7	$\mathbb{G}_{3,0}^{(E_g,2)}$	3	$E_g$	2	0	$\frac{\sqrt{15}X(Y-Z)(Y+Z)}{2}$
8	$\mathbb{G}_{3,1}^{(E_g,2)}$	3	$E_g$	2	1	$\frac{\sqrt{15}Y(X-Z)(X+Z)}{2}$

- 
- Group info.: Generator =  $\{2_{001}|\frac{1}{2}\frac{1}{2}0\}$ ,  $\{4_{001}^+|\frac{1}{2}00\}$ ,  $\{2_{010}|0\frac{1}{2}0\}$ ,  $\{-1|0\}$

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

rep. SO	symmetry operations
$\{1 0\}$	$\{1 0\}$

*continued ...*

Table 12

rep. SO	symmetry operations
$\{2_{001} \frac{1}{2}\frac{1}{2}0\}$	$\{2_{001} \frac{1}{2}\frac{1}{2}0\}$
$\{2_{100} \frac{1}{2}00\}$	$\{2_{100} \frac{1}{2}00\}, \{2_{010} 0\frac{1}{2}0\}$
$\{2_{110} \frac{1}{2}\frac{1}{2}0\}$	$\{2_{110} \frac{1}{2}\frac{1}{2}0\}, \{2_{1-10} 0\}$
$\{4^+_{001} \frac{1}{2}00\}$	$\{4^+_{001} \frac{1}{2}00\}, \{4^-_{001} 0\frac{1}{2}0\}$
$\{-1 0\}$	$\{-1 0\}$
$\{m_{001} \frac{1}{2}\frac{1}{2}0\}$	$\{m_{001} \frac{1}{2}\frac{1}{2}0\}$
$\{m_{100} \frac{1}{2}00\}$	$\{m_{100} \frac{1}{2}00\}, \{m_{010} 0\frac{1}{2}0\}$
$\{m_{110} \frac{1}{2}\frac{1}{2}0\}$	$\{m_{110} \frac{1}{2}\frac{1}{2}0\}, \{m_{1-10} 0\}$
$\{-4^+_{001} \frac{1}{2}00\}$	$\{-4^+_{001} \frac{1}{2}00\}, \{-4^-_{001} 0\frac{1}{2}0\}$

Table 13: Symmetry operations.

No.	SO	No.	SO	No.	SO	No.	SO	No.	SO
1	$\{1 0\}$	2	$\{2_{001} \frac{1}{2}\frac{1}{2}0\}$	3	$\{2_{100} \frac{1}{2}00\}$	4	$\{2_{010} 0\frac{1}{2}0\}$	5	$\{2_{110} \frac{1}{2}\frac{1}{2}0\}$
6	$\{2_{1-10} 0\}$	7	$\{4^+_{001} \frac{1}{2}00\}$	8	$\{4^-_{001} 0\frac{1}{2}0\}$	9	$\{-1 0\}$	10	$\{m_{001} \frac{1}{2}\frac{1}{2}0\}$
11	$\{m_{100} \frac{1}{2}00\}$	12	$\{m_{010} 0\frac{1}{2}0\}$	13	$\{m_{110} \frac{1}{2}\frac{1}{2}0\}$	14	$\{m_{1-10} 0\}$	15	$\{-4^+_{001} \frac{1}{2}00\}$
16	$\{-4^-_{001} 0\frac{1}{2}0\}$								

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

	1	$2_{001}$	$2_{100}$	$2_{110}$	$4^+_{001}$	$-1$	$m_{001}$	$m_{100}$	$m_{110}$	$-4^+_{001}$
$A_{1g}$	1	1	1	1	1	1	1	1	1	1
$A_{2g}$	1	1	-1	-1	1	1	1	-1	-1	1
$B_{1g}$	1	1	1	-1	-1	1	1	1	-1	-1
$B_{2g}$	1	1	-1	1	-1	1	1	-1	1	-1
$E_g$	2	-2	0	0	0	2	-2	0	0	0
$A_{1u}$	1	1	1	1	1	-1	-1	-1	-1	-1
$A_{2u}$	1	1	-1	-1	1	-1	-1	1	1	-1

*continued ...*

Table 14

	1	2 <sub>001</sub>	2 <sub>100</sub>	2 <sub>110</sub>	4 <sub>001</sub> <sup>+</sup>	-1	m <sub>001</sub>	m <sub>100</sub>	m <sub>110</sub>	-4 <sub>001</sub> <sup>+</sup>
$B_{1u}$	1	1	1	-1	-1	-1	-1	-1	1	1
$B_{2u}$	1	1	-1	1	-1	-1	-1	1	-1	1
$E_u$	2	-2	0	0	0	-2	2	0	0	0

Table 15: Parity conversion.

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

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

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

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

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

Table 18: Virtual-cluster sites.

No.	position	No.	position	No.	position	No.	position
1	$\begin{pmatrix} 2 & 1 & 1 \end{pmatrix}$	2	$\begin{pmatrix} -2 & -1 & 1 \end{pmatrix}$	3	$\begin{pmatrix} 2 & -1 & -1 \end{pmatrix}$	4	$\begin{pmatrix} -2 & 1 & -1 \end{pmatrix}$
5	$\begin{pmatrix} 1 & 2 & -1 \end{pmatrix}$	6	$\begin{pmatrix} -1 & -2 & -1 \end{pmatrix}$	7	$\begin{pmatrix} -1 & 2 & 1 \end{pmatrix}$	8	$\begin{pmatrix} 1 & -2 & 1 \end{pmatrix}$
9	$\begin{pmatrix} -2 & -1 & -1 \end{pmatrix}$	10	$\begin{pmatrix} 2 & 1 & -1 \end{pmatrix}$	11	$\begin{pmatrix} -2 & 1 & 1 \end{pmatrix}$	12	$\begin{pmatrix} 2 & -1 & 1 \end{pmatrix}$
13	$\begin{pmatrix} -1 & -2 & 1 \end{pmatrix}$	14	$\begin{pmatrix} 1 & 2 & 1 \end{pmatrix}$	15	$\begin{pmatrix} 1 & -2 & -1 \end{pmatrix}$	16	$\begin{pmatrix} -1 & 2 & -1 \end{pmatrix}$

Table 19: Virtual-cluster basis.

symbol	1	2	3	4	5	6	7	8	9	10
$\mathbb{Q}_0^{(A_{1g})}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$
$\mathbb{Q}_1^{(A_{2u})}$	$\frac{1}{4}$	$\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$
$\mathbb{Q}_{1,0}^{(E_u)}$	$\frac{\sqrt{10}}{10}$	$-\frac{\sqrt{10}}{10}$	$\frac{\sqrt{10}}{10}$	$-\frac{\sqrt{10}}{10}$	$\frac{\sqrt{10}}{20}$	$-\frac{\sqrt{10}}{20}$	$-\frac{\sqrt{10}}{20}$	$\frac{\sqrt{10}}{20}$	$-\frac{\sqrt{10}}{10}$	$\frac{\sqrt{10}}{10}$
$\mathbb{Q}_{1,1}^{(E_u)}$	$\frac{\sqrt{10}}{20}$	$-\frac{\sqrt{10}}{20}$	$-\frac{\sqrt{10}}{20}$	$\frac{\sqrt{10}}{20}$	$\frac{\sqrt{10}}{10}$	$-\frac{\sqrt{10}}{10}$	$\frac{\sqrt{10}}{10}$	$-\frac{\sqrt{10}}{10}$	$-\frac{\sqrt{10}}{20}$	$\frac{\sqrt{10}}{20}$
$\mathbb{Q}_2^{(B_{1g})}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$
$\mathbb{Q}_2^{(B_{2g})}$	$\frac{1}{4}$	$\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$
$\mathbb{Q}_{2,0}^{(E_g)}$	$\frac{\sqrt{10}}{20}$	$-\frac{\sqrt{10}}{20}$	$\frac{\sqrt{10}}{20}$	$-\frac{\sqrt{10}}{20}$	$-\frac{\sqrt{10}}{10}$	$\frac{\sqrt{10}}{10}$	$\frac{\sqrt{10}}{10}$	$-\frac{\sqrt{10}}{10}$	$\frac{\sqrt{10}}{20}$	$-\frac{\sqrt{10}}{20}$
$\mathbb{Q}_{2,1}^{(E_g)}$	$\frac{\sqrt{10}}{10}$	$-\frac{\sqrt{10}}{10}$	$-\frac{\sqrt{10}}{10}$	$\frac{\sqrt{10}}{10}$	$-\frac{\sqrt{10}}{20}$	$\frac{\sqrt{10}}{20}$	$-\frac{\sqrt{10}}{20}$	$\frac{\sqrt{10}}{20}$	$\frac{\sqrt{10}}{10}$	$-\frac{\sqrt{10}}{10}$

*continued ...*

Table 19

symbol	1	2	3	4	5	6	7	8	9	10
$\mathbb{Q}_3^{(B_{1u})}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$
	$-\frac{1}{4}$	$-\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$				
$\mathbb{Q}_3^{(B_{2u})}$	$\frac{1}{4}$	$\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$
	$\frac{1}{4}$	$\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$				
$\mathbb{Q}_{3,0}^{(E_u,1)}$	$\frac{\sqrt{10}}{20}$	$-\frac{\sqrt{10}}{20}$	$\frac{\sqrt{10}}{20}$	$-\frac{\sqrt{10}}{20}$	$-\frac{\sqrt{10}}{20}$	$\frac{\sqrt{10}}{10}$	$\frac{\sqrt{10}}{10}$	$-\frac{\sqrt{10}}{10}$	$-\frac{\sqrt{10}}{20}$	$\frac{\sqrt{10}}{20}$
	$-\frac{\sqrt{10}}{20}$	$\frac{\sqrt{10}}{20}$	$\frac{\sqrt{10}}{10}$	$-\frac{\sqrt{10}}{10}$	$-\frac{\sqrt{10}}{10}$	$\frac{\sqrt{10}}{10}$				
$\mathbb{Q}_{3,1}^{(E_u,1)}$	$-\frac{\sqrt{10}}{10}$	$\frac{\sqrt{10}}{10}$	$\frac{\sqrt{10}}{10}$	$-\frac{\sqrt{10}}{10}$	$\frac{\sqrt{10}}{20}$	$-\frac{\sqrt{10}}{20}$	$\frac{\sqrt{10}}{20}$	$-\frac{\sqrt{10}}{20}$	$\frac{\sqrt{10}}{10}$	$-\frac{\sqrt{10}}{10}$
	$-\frac{\sqrt{10}}{10}$	$\frac{\sqrt{10}}{10}$	$-\frac{\sqrt{10}}{20}$	$\frac{\sqrt{10}}{20}$	$-\frac{\sqrt{10}}{20}$	$\frac{\sqrt{10}}{20}$				
$\mathbb{Q}_4^{(A_{2g})}$	$\frac{1}{4}$	$\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$
	$-\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$				
$\mathbb{Q}_{4,0}^{(E_g,1)}$	$-\frac{\sqrt{10}}{10}$	$\frac{\sqrt{10}}{10}$	$-\frac{\sqrt{10}}{10}$	$\frac{\sqrt{10}}{10}$	$-\frac{\sqrt{10}}{20}$	$\frac{\sqrt{10}}{20}$	$\frac{\sqrt{10}}{20}$	$-\frac{\sqrt{10}}{20}$	$-\frac{\sqrt{10}}{10}$	$\frac{\sqrt{10}}{10}$
	$-\frac{\sqrt{10}}{10}$	$\frac{\sqrt{10}}{10}$	$-\frac{\sqrt{10}}{20}$	$\frac{\sqrt{10}}{20}$	$\frac{\sqrt{10}}{20}$	$-\frac{\sqrt{10}}{20}$				
$\mathbb{Q}_{4,1}^{(E_g,1)}$	$\frac{\sqrt{10}}{20}$	$-\frac{\sqrt{10}}{20}$	$-\frac{\sqrt{10}}{20}$	$\frac{\sqrt{10}}{20}$	$\frac{\sqrt{10}}{10}$	$-\frac{\sqrt{10}}{10}$	$\frac{\sqrt{10}}{10}$	$-\frac{\sqrt{10}}{10}$	$\frac{\sqrt{10}}{20}$	$-\frac{\sqrt{10}}{20}$
	$-\frac{\sqrt{10}}{20}$	$\frac{\sqrt{10}}{20}$	$\frac{\sqrt{10}}{10}$	$-\frac{\sqrt{10}}{10}$	$\frac{\sqrt{10}}{10}$	$-\frac{\sqrt{10}}{10}$				
$\mathbb{Q}_5^{(A_{1u})}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$
	$-\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$				