

\* symmetry operation

Table 1: Symmetry operations for 3d polar vector.

| No. | tag                              | matrix (polar)  | det | TR |
|-----|----------------------------------|---|-----|----|
| 1   | $\{1 0\}$                        | $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$             | 1   | 1  |
| 2   | $\{4_{001}^+ 0\}$                | $\begin{bmatrix} 0 & -1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$            | 1   | 1  |
| 3   | $\{4_{001}^- 0\}$                | $\begin{bmatrix} 0 & 1 & 0 & 0 \\ -1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$            | 1   | 1  |
| 4   | $\{2_{100} 0\}$                  | $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & -1 & 0 \end{bmatrix}$           | 1   | 1  |
| 5   | $\{2_{010} 0\}$                  | $\begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & -1 & 0 \end{bmatrix}$           | 1   | 1  |
| 6   | $\{2_{001} 0\}$                  | $\begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$           | 1   | 1  |
| 7   | $\{2_{110} 0\}$                  | $\begin{bmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & -1 & 0 \end{bmatrix}$            | 1   | 1  |
| 8   | $\{2_{1-10} 0\}$                 | $\begin{bmatrix} 0 & -1 & 0 & 0 \\ -1 & 0 & 0 & 0 \\ 0 & 0 & -1 & 0 \end{bmatrix}$          | 1   | 1  |
| 9   | $\{1' 00\frac{1}{2}\}$           | $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & \frac{1}{2} \end{bmatrix}$   | 1   | -1 |
| 10  | $\{4_{001}^{+'} 00\frac{1}{2}\}$ | $\begin{bmatrix} 0 & -1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & \frac{1}{2} \end{bmatrix}$  | 1   | -1 |
| 11  | $\{4_{001}^{-'} 00\frac{1}{2}\}$ | $\begin{bmatrix} 0 & 1 & 0 & 0 \\ -1 & 0 & 0 & 0 \\ 0 & 0 & 1 & \frac{1}{2} \end{bmatrix}$  | 1   | -1 |
| 12  | $\{2_{100}' 00\frac{1}{2}\}$     | $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & -1 & \frac{1}{2} \end{bmatrix}$ | 1   | -1 |
| 13  | $\{2_{010}' 00\frac{1}{2}\}$     | $\begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & -1 & \frac{1}{2} \end{bmatrix}$ | 1   | -1 |

*continued ...*

Table 1

| No. | tag                           | matrix (polar)   | det | TR |
|-----|-------------------------------|--|-----|----|
| 14  | $\{2_{001}' 00\frac{1}{2}\}$  | $\begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & 1 & \frac{1}{2} \end{bmatrix}$  | 1   | -1 |
| 15  | $\{2_{110}' 00\frac{1}{2}\}$  | $\begin{bmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & -1 & \frac{1}{2} \end{bmatrix}$   | 1   | -1 |
| 16  | $\{2_{1-10}' 00\frac{1}{2}\}$ | $\begin{bmatrix} 0 & -1 & 0 & 0 \\ -1 & 0 & 0 & 0 \\ 0 & 0 & -1 & \frac{1}{2} \end{bmatrix}$ | 1   | -1 |