

\* 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   | $\{2_{001} 0\}$              | $\begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$            | 1   | 1  |
| 3   | $\{2_{110} 00\frac{1}{2}\}$  | $\begin{bmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & -1 & \frac{1}{2} \end{bmatrix}$   | 1   | 1  |
| 4   | $\{2_{1-10} 00\frac{1}{2}\}$ | $\begin{bmatrix} 0 & -1 & 0 & 0 \\ -1 & 0 & 0 & 0 \\ 0 & 0 & -1 & \frac{1}{2} \end{bmatrix}$ | 1   | 1  |
| 5   | $\{-4_{001}^+ 0\}$           | $\begin{bmatrix} 0 & 1 & 0 & 0 \\ -1 & 0 & 0 & 0 \\ 0 & 0 & -1 & 0 \end{bmatrix}$            | -1  | 1  |
| 6   | $\{-4_{001}^- 0\}$           | $\begin{bmatrix} 0 & -1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & -1 & 0 \end{bmatrix}$            | -1  | 1  |
| 7   | $\{m_{100} 00\frac{1}{2}\}$  | $\begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & \frac{1}{2} \end{bmatrix}$   | -1  | 1  |
| 8   | $\{m_{010} 00\frac{1}{2}\}$  | $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & 1 & \frac{1}{2} \end{bmatrix}$   | -1  | 1  |
| 9   | $\{4_{001}^+' 0\}$           | $\begin{bmatrix} 0 & -1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$             | 1   | -1 |
| 10  | $\{4_{001}^-' 0\}$           | $\begin{bmatrix} 0 & 1 & 0 & 0 \\ -1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$             | 1   | -1 |
| 11  | $\{2_{100}' 00\frac{1}{2}\}$ | $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & -1 & \frac{1}{2} \end{bmatrix}$  | 1   | -1 |
| 12  | $\{2_{010}' 00\frac{1}{2}\}$ | $\begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & -1 & \frac{1}{2} \end{bmatrix}$  | 1   | -1 |
| 13  | $\{-1' 0\}$                  | $\begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & -1 & 0 \end{bmatrix}$           | -1  | -1 |

*continued ...*

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