

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

*continued ...*

Table 1

| No. | tag                               | matrix (polar)  | det | TR |
|-----|-----------------------------------|---|-----|----|
| 14  | $\{-4_{001}^{+'} 00\frac{1}{2}\}$ | $\begin{bmatrix} 0 & 1 & 0 & 0 \\ -1 & 0 & 0 & 0 \\ 0 & 0 & -1 & \frac{1}{2} \end{bmatrix}$ | -1  | -1 |
| 15  | $\{-4_{001}^{-'} 00\frac{1}{2}\}$ | $\begin{bmatrix} 0 & -1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & -1 & \frac{1}{2} \end{bmatrix}$ | -1  | -1 |
| 16  | $\{m_{001}' 0\}$                  | $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & -1 & 0 \end{bmatrix}$            | -1  | -1 |