

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

*continued ...*

Table 1

| No. | tag                                     | matrix (polar)  | det | TR |
|-----|---|---|-----|----|
| 14  | $\{-4_{001}' \frac{1}{2}\frac{1}{2}0\}$ | $\begin{bmatrix} 0 & -1 & 0 & \frac{1}{2} \\ 1 & 0 & 0 & \frac{1}{2} \\ 0 & 0 & -1 & 0 \end{bmatrix}$ | -1  | -1 |
| 15  | $\{m_{110}' \frac{1}{2}\frac{1}{2}0\}$  | $\begin{bmatrix} 0 & -1 & 0 & \frac{1}{2} \\ -1 & 0 & 0 & \frac{1}{2} \\ 0 & 0 & 1 & 0 \end{bmatrix}$ | -1  | -1 |
| 16  | $\{m_{1-10}' \frac{1}{2}\frac{1}{2}0\}$ | $\begin{bmatrix} 0 & 1 & 0 & \frac{1}{2} \\ 1 & 0 & 0 & \frac{1}{2} \\ 0 & 0 & 1 & 0 \end{bmatrix}$   | -1  | -1 |