

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

continued ...

Table 1

| 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  | $\{m_{110}' \frac{1}{2}\frac{1}{2}0\}$  | $\begin{bmatrix} 0 & -1 & 0 & \frac{1}{2} \\ -1 & 0 & 0 & \frac{1}{2} \\ 0 & 0 & 1 & 0 \end{bmatrix}$ | -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 |