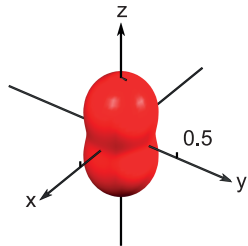


(a)

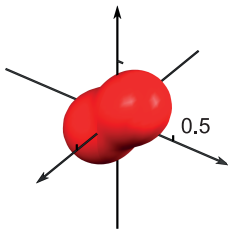
$$\begin{pmatrix} \frac{1}{2} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{1}{2} \end{pmatrix}$$



$$\hat{I}_{1z}\hat{I}_{2z}$$

(b)

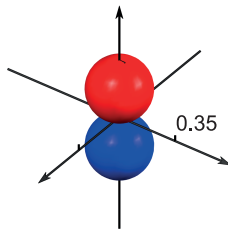
$$\begin{pmatrix} \frac{3}{8} & -\frac{i}{8} & -\frac{i}{8} & -\frac{1}{8} \\ \frac{i}{8} & \frac{1}{8} & \frac{1}{8} & \frac{i}{8} \\ \frac{i}{8} & \frac{1}{8} & \frac{1}{8} & \frac{i}{8} \\ -\frac{1}{8} & -\frac{i}{8} & -\frac{i}{8} & \frac{3}{8} \end{pmatrix}$$



$$\hat{R}_x(-\frac{\pi}{4})\hat{I}_{1z}\hat{I}_{2z}\hat{R}_x(\frac{\pi}{4})$$

(c)

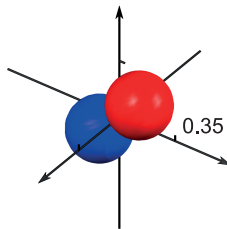
$$\begin{pmatrix} \frac{1}{4} & 0 & 0 & 0 \\ 0 & \frac{1}{2} & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{1}{4} \end{pmatrix}$$



$$\frac{1}{4}(\hat{I}_{1z} - \hat{I}_{2z})$$

(d)

$$\begin{pmatrix} \frac{1}{4} & \frac{i\sqrt{2}}{16} & -\frac{i\sqrt{2}}{16} & 0 \\ -\frac{i\sqrt{2}}{16} & \frac{2+\sqrt{2}}{8} & 0 & -\frac{i\sqrt{2}}{16} \\ \frac{i\sqrt{2}}{16} & 0 & \frac{2-\sqrt{2}}{8} & \frac{i\sqrt{2}}{16} \\ 0 & \frac{i\sqrt{2}}{16} & -\frac{i\sqrt{2}}{16} & \frac{1}{4} \end{pmatrix}$$



$$\hat{R}_x(-\frac{\pi}{4})\frac{1}{4}(\hat{I}_{1z} - \hat{I}_{2z})\hat{R}_x(\frac{\pi}{4})$$