Part 37.2

$$S_x = \chi_\pm^{\ x} = \frac{1}{\sqrt{2}}\begin{pmatrix}1\\ \pm 1\end{pmatrix}$$

$$S_x \chi_+^{\ x} = \frac{1}{\sqrt{2}}\begin{pmatrix}\alpha\\ \alpha\end{pmatrix}$$

$$= \frac{1}{\sqrt{2}}\begin{pmatrix}1\\ 1\end{pmatrix}\alpha$$

$$S_x \chi_-^{\ x} = \frac{1}{\sqrt{2}}\begin{pmatrix}\alpha\\ -\alpha\end{pmatrix}$$

$$= \frac{1}{\sqrt{2}}\begin{pmatrix}1\\ -1\end{pmatrix}\alpha$$

remain the same

changes

$\frac{1}{\sqrt{2}}$ also remains the same

$$S_x\left(\chi_\pm^{\ x}\right) = \frac{1}{\sqrt{2}}\begin{pmatrix}1\\ \pm 1\end{pmatrix}\pm\frac{\hbar}{2}$$

also changes

$$S_x \chi_+^{\ x} = \frac{\hbar}{2}\left(\chi^x\right)$$

$$S_x \chi_-^{\ x} = -\frac{\hbar}{2}\left(\chi^x\right)$$