Physics 491: Recitation #8
October 21, 2016

1. For the spin-1 state represented in the z-basis as,

$$N \begin{pmatrix} 1 \\ 2 \\ 3i \end{pmatrix}$$

where N is a normalization factor, find the probabilites to measure each of the allowed values of the spin along the z-direction.

Find $\langle \hat{S}_z \rangle$.

Find $\langle \hat{S}_x \rangle$. Recall we found the matrix

$$\hat{S}_x = \frac{\hbar}{\sqrt{2}} \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{pmatrix}$$

2. Example 4.2 calculates the time evolution of an electron state that at $t = 0$ is $|+z\rangle$ due to a magnetic field along the x-direction. The Hamiltonian is $\hat{H} = \omega_0 \hat{S}_x$. Show that the time evolution operator $e^{-i\hat{H}t/\hbar}$ in the z-basis is:

$$\hat{1} \cos\left(\frac{\omega_0 t}{2}\right) - i\hat{\sigma}_x \sin\left(\frac{\omega_0 t}{2}\right)$$

Use this to calculate the time evolution of $\langle \hat{S}_z \rangle$.