Quiz 1
PHY 4605
Friday, January 13

Each problem is worth 10 points. Please show as much work as possible for credit.

1. Consider a system in a superposition of angular momentum states,

\[ |\psi\rangle = \frac{1}{\sqrt{2}} |l = 1, m = 0 \rangle + \frac{1}{\sqrt{2}} |l = 1, m = 1 \rangle \]

Compute the following expectation values for this state:

a) \( \langle L^2 \rangle \)

b) \( \langle L_z \rangle \)

c) \( \langle L_y \rangle \)

d) \( \langle L_z \rangle \)

e) \( \langle L_z^2 \rangle \)

2. For the quantum state above, an exact measurement of \( L_z \) is performed. With what probability does this measurement result in \( L_z = \hbar \)? If the measurement returns exactly \( L_z = \hbar \), determine the new state of the system. For this new state after the measurement, again compute the expectation values considered in Problem 1.