Quiz 2
PHY 4605
Friday, January 20

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

1. A dumbbell molecule (rigid rotor) is in a rotational state described by the wave function

\[ \psi(\theta, \phi) = \sqrt{\frac{1}{6}} Y_0^0 + \sqrt{\frac{1}{6}} Y_{-1}^{-1} + \sqrt{\frac{4}{6}} Y_0^2 \]

a) Verify that this wave function is normalized.

b) Evaluate \( \langle l = 1, m = 1 | \psi \rangle \)

c) Evaluate \( \langle l = 0, m = 0 | \psi \rangle \)

2. For the state \( |\psi\rangle \) defined in problem 1, evaluate the following expectation values.

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

b) \( \langle L_z \rangle \)