

Recitation #13
Quantum 521

The wave function of a particle subjected to a spherically symmetrical potential $V(r)$ is given by

$$\psi(\vec{r}) = (x + y + 3z)f(r)$$

1. Is $\psi(\vec{r})$ eigenfunction of L^2 ? If so, what is the eigenvalue ℓ ? If not, what are the possible values of ℓ we can get when L^2 is measured?
2. What are the probabilities to measure the azimuthal quantum number with value m ?
3. If $\psi(\vec{r})$ is an energy eigenstate, find the potential $V(r)$. Recall, time independent Schrodinger is

$$\left[\frac{-\hbar^2}{2m} \hat{P}_r^2 + \frac{1}{2mr^2} \hat{L}^2 + V(r) \right] \psi = E\psi$$