



THE UNIVERSITY OF CHICAGO

THE DIVISION OF THE PHYSICAL SCIENCES

PHYSICS DEPARTMENT

PHYS 441

LECTURE 10: QUANTUM MECHANICS OF THE ATOM

1. The wave function $\psi(r, \theta, \phi)$ is a function of position and time. It is a complex-valued function. The probability density is given by $|\psi|^2$.

2. The Schrödinger equation is $\hat{H}\psi = E\psi$.

3. The Hamiltonian operator is $\hat{H} = -\frac{\hbar^2}{2m}\nabla^2 + V(r, \theta, \phi)$.

4. The wave function must be single-valued, continuous, and finite.

5. The energy eigenvalues are discrete for bound states.

6. The angular momentum operators are \hat{L}^2 and \hat{L}_z .

7. The eigenfunctions of \hat{L}^2 and \hat{L}_z are the spherical harmonics Y_{lm} .

8. The radial wave function $R_{nl}(r)$ is a function of the radial distance r .