Lecture 23

The Hydrogen Atom
The Pieces of the Course

• Wave particle duality
• Bound states of quantum mechanical potentials
• Quantum mechanical states of optical radiation field
• Interaction of quantized light and matter
Summary of the quantum postulates

- There is a (normalized) state vector
- Unitary evolution of the state vector is generated by a Hamiltonian
- Measurements are represented by Hermitian operators that place the system in a measurement eigenstate
- A composite state vector is represented in a basis that is an outer product of the basis sets of its component state vectors
Topics From Last Time

- The scalar wave equation in 3-D
- A guess for the state vector and the unitary evolution after a projective measurement
- SoV in 3-D
- Spherical Harmonics
- Radial eigenfunctions for a well
- Degeneracies in 3-D SHOs
Week after the Midterm

- A project discussion on 10/20
- The hydrogen atom
- Transition from Robinett to Schleich and chapter 1 of Schleich
- A project proposal due date 10/24
- Problem set on chapters 16-18 due on 10/27
Topics for Today

• Quick summary of 3-D wavefunctions, Hamiltonians and solutions
• The electron nucleon wave function
• The electron nucleon Hamiltonian
• Center of mass coordinates
• The difference Hamiltonian and wavefunction
• The H atom wavefunctions