PHYS 4073 - Quantum Mechanics- Homework Set 9

Reading Assignment: Chapter 4 Section 3 and 4

Due Wednesday November 17th at the beginning of class.

Griffiths' Problems

4.19

4.23

4.44

4.48

A1 Calculate the wavelength of the transition from the first excited state to the ground state of muonic hydrogen, a hydrogen atom where a muon has replaced the electron. Compare this value with the value you get when you incorrectly fail to use the reduced mass. Just for laughs, report the lifetime of such an atom.

A2 Calculate the energies of the lowest five energy states of an infinite spherical well of radius a in terms of the energy of the ground state of the well, E_0. Report the degeneracy of each state.

A3 Construct a normalized ψ_{744} wave function for the hydrogen atom.

A4 For an atom in the ψ_{432}, what energies, total angular momentum, and z-component of angular momentum can be observed? What is the expected distance of the electron from the origin and the uncertainty in the expected distance from the origin?

A5 A hydrogen atom is in the state

$$\psi = Ar^2 e^{-r/a}\cos(\theta)$$

where A is a constant to be determined by normalization. What is the lowest energy that can be observed for this state? What is the probability of observing this energy? What angular momentum (total and z components) can be observed with what probability?