Quantum Mechanics and Atomic Physics 750:361

Prof. Sean Oh, Fall 2011

HW #10

Due date: Monday, Nov. 21, 2011, at the beginning of class

1. Reed, Prob. 7-21.

2. Reed, Prob. 8-1.

3. Reed Prob. 8-2(b): Do only (b) using the expression given in (a) for $Y_{l,l}$.

4. Reed, Prob. 8-4

5. A Hydrogen wavefunction is prepared in a linearly combined state, $\psi = A(\psi_{210} + 2\psi_{422})$; each of the following parts is worth one full HW problem.

(a) Find the normalization constant A

(b) What is the expectation value of H (Hamiltonian)?: Express it in terms of E_n, where E_n represents the Hydrogen atom energy corresponding to the principle quantum number n.

(c) What is the expectation value of L^2?

(d) What is the expectation value of L_z?

(e) If you construct a new wavefunction, $\psi_{new} = CL_+(\psi_{210} + 2\psi_{422})$, where C is a normalization constant and L_+ is the raising operator, what are the expectation values of H, L^2 and L_z of this new wavefunction?