Quantum Mechanics and Atomic Physics 750:361

Prof. Sean Oh, Fall 2011

HW #12

Due date: **Wednesday, Dec. 7**, 2011, at the beginning of class: no late HW will be accepted.

1. For two electrons in an infinite potential well (0<x<L), construct total wavefunctions of the first excited states, ignoring the electron-electron Coulomb potential. For this problem, use the following notation. $\psi_n(x_1)$ ($\psi_n(x_2)$) implies the first (second) electron occupying the n'th energy eigenfunction of the infinite potential well problem. χ_S (χ_T) represents the singlet (triplet) spin state.

2. In the above problem, ignoring the electron-electron interaction, find the energy of the system in terms of E_1, where E_1 represents the lowest energy of a single electron occupying the infinite potential well.

3. In the above problem, still ignoring the electron-electron interaction, find the probability density of both electrons occupying x=L/4 if the electrons are in the triplet spin state.

4. In the above problem, if you include electron-electron Coulomb interaction, which state will have a lower energy: the triplet or the singlet state? Is this energy higher or lower than the value you obtained in Prob. 2 above.

5. Reed, Prob. 8-8

6. Reed, Prob. 8-9

7. "Tb" in periodic table has 65 electrons. Using the rules discussed in class, figure out its most likely electron configuration (starting with 1*s* all the way up to the highest energy subshell with the number of electrons in each subshell, as done in class: e. g. Al(Z=13) has its electron configuration of $1s^2 2s^2 2s^6 3s^2 3p^1$). Also find each of the angular momentum quantum numbers and the spectroscopic notation of the ground state electron configuration.