

# Homework #3

# PS405

Due: Thursday, February 16, 2017

1. Problem 5.9 from Griffiths "Introduction to Quantum Mechanics"  
Two non-interacting electrons are in the  $n=2$  state of a helium atom.
  
2. We did problem 5.11 in class where we calculated the "corrected" energy for two "interacting" electrons in the ground state of helium. Using the skills you developed in solving this problem, let's solve the following problem:

Let's assume we have a neutral helium atom with two "interacting" electrons where the first electron is in the  $n, \ell = (1,0)$  state and the second electron is in the  $n, \ell = (2,0)$  state. The pair of electrons can be in either a *singlet* or a *triplet* state. Calculate  $\langle \frac{1}{|\vec{r}_1 - \vec{r}_2|} \rangle$  for both possibilities and answer the following:

- a. What is the total energy for the two electrons in the *singlet* state?

$$E_{\text{singlet}} = \text{_____ eV}$$

- b. What is the total energy for the two electrons in the *triplet* state?

$$E_{\text{triplet}} = \text{_____ eV}$$

- c. Why is the energy different between the two states?