PHYS410 Quantum Mechanics
Homework 7
due Thursday, Apr 17, 2014

Problem 1.
1) Find $\langle r \rangle$ and $\langle r^2 \rangle$ for an electron in the ground state of the hydrogen atom.
Express answers in terms of the Bohr radius.
2) Find $\langle x \rangle$ and $\langle x^2 \rangle$ for an electron in the ground state of the hydrogen atom.
3) Find $\langle x^2 \rangle$ for an electron in the state $n = 2, l = 1, m = 1$ of the hydrogen atom.
4) What is the most probable value of r for an electron in the ground state of the hydrogen atom?

Problem 2.
A hydrogen atom starts out in a linear combination of the stationary states with $n = 2, l = 1, m = 1$ and $n = 2, l = 1, m = -1$:

$$\psi(\vec{r}, 0) = \frac{1}{\sqrt{[2}}(\psi_{211} + \psi_{21-1})$$

1) Write down the explicit wave function in terms of r, θ, ϕ and simplify it.
2) Find the expectation value of the potential energy.