Physics 355 - Problem Set #4, due Sep. 26, 2005

1. Energy of particles in the nucleus

   (a) Suppose that the potential seen by a neutron in a nucleus can be represented (in one dimension) by a square well of width 10^{-12} cm with very high walls. What is the minimum kinetic energy of the neutron in this potential in MeV ?

   (b) Can an electron be confined in a nucleus ? (Hint. answer the following questions)

   - using the same assumption as in (a) - nucleus can be represented (in one dimension) by a square well of width 10^{-12} cm with very high walls - calculate the minimum kinetic energy, in MeV, of an electron bound within the nucleus.
   - Since the electron does not feel the nuclear force, it would have to be contained by the Coulomb attraction to the protons. Calculate the approximate Coulomb potential energy, in MeV, of an electron at the surface of the nucleus of charge, say, $+50e$.

2. Griffiths, problem 2.38

3. Griffiths, problem 2.10

4. Griffiths, problem 2.11

5. Griffiths, problem 2.13

6. *What do you get when you cross an infinite square well with a harmonic oscillator ?*

   Consider the following "half-harmonic" oscillator potential:

$$V(x) = \infty \quad x < 0 \tag{1}$$

$$V(x) = \frac{1}{2}kx^2 \quad x \geq 0 \tag{2}$$

   (a) Compare the allowed wave functions for stationary states of this system with those for a normal harmonic oscillator having the same values of k and m.

   (b) What are the allowed quantized energies for this system ?