Physics 492: Recitation #4
February 12, 2016

1. The typical binding energy/nucleon is $\sim$ 8MeV. Compare the Coulomb repulsion energy between two protons inside a nucleus to this number.

2. Consider the proton and neutron to be an isospin doublet treating proton and neutron as "identical" fermions. The deuteron has total angular momentum $J = 1$. Show that the iso-spin of a hypothetical neutron-neutron bound state must be $I = 0$.

   The reason the neutron-neuron bound state does not exist is because the nuclear force is spin dependent and the binding is stronger between nucleons with aligned spins, just enough to bind the deuteron.

3. For the three dimensional finite well potential of depth V_0 and radius a, find an inequality in terms of these parameters for the bound state to exist. Recall with

$$\psi = \frac{u(r)}{r} Y_{\ell m}$$

   the equation for u is,

$$\frac{-\hbar}{2\mu} u'' + \left[\frac{\ell(\ell+1)}{2\mu r^2} + V(r) \right] u = Eu$$

   Hint: sketch the wave function $u(r)$.