Physics 492 homework VIII, due Fri Feb 28

Reading: Chapter 8

Problems:

1. Prove that the spin-orbit term in the nucleon hamiltonian,

$$H_{so} = \frac{W_0}{\hbar^2}\,\vec{\ell}\cdot\vec{s}$$

shifts states with a given ℓ ($\ell \geq 1$), but different j, by

$$\Delta E_{so} = \begin{cases} \frac{W_0}{2}\,\ell & \text{for } j = \ell + \frac{1}{2} \\ -\frac{W_0}{2}\,(\ell+1) & \text{for } j = \ell - \frac{1}{2} \end{cases}$$

2. Williams, Problem 8.2. In the subspace of states with definite $\vec{j}^2$, the magnetic dipole operator may be simultaneously represented as $\vec{\mu}_j = (g_\ell\,\vec{\ell} + g_s\,\vec{s})\mu_N/\hbar$ and $\vec{\mu}_j = g_j\,\vec{j}\,\mu_N/\hbar$.

3. Williams, Problem 8.3.

4. (a) Williams, Problem 8.4. (b) Compare your answers to the measured spin and parities, given in the Table of Isotopes in the CRC Handbook or on the Web: http://www.nndc.bnl.gov/wallet/

5. Williams, Problem 8.6. The unit for the moment of inertia in nuclear physics is $\hbar^2$/keV.