PHY 491

HW Assignment #2; September 12-19, 2011

1. Using the 1st order perturbation results for $E\_{mv}^{\left(1\right)}$ , where *mv* denotes mass velocity and $E\_{so}^{\left(1\right)}$, where *so* denotes spin-orbit show that

 $E\_{mv}^{\left(1\right)}+E\_{so}^{\left(1\right)}=E\_{fs}^{\left(1\right)}=\frac{\left(E\_{n}\right)^{2}}{2mc^{2}}\left(3-\frac{4n}{j+1/2}\right)$,

where *fs* denontes fine structure and *j* is the total angular momentum, orbital plus spin.

$$E\_{mv}^{\left(1\right)}=-\frac{\left(E\_{n}^{0}\right)^{2}}{2mc^{2}}\left[\frac{4n}{l+1/2}-3\right]$$

$$E\_{so}^{\left(1\right)}=\frac{\left(E\_{n}^{0}\right)^{2}}{mc^{2}}n\left[\frac{j\left(j+1\right)-l\left(l+1\right)-3/4}{l\left(l+\frac{1}{2}\right)(l+1)}\right]$$

If we add the above two we get $E\_{fs}^{\left(1\right)}$. However for s=1/2, j=l+1/2 or j=l-1/2. This means l=j-1/2 and l=j+1/2. Eliminate l from the above equation for each value of l. Do the algebra and you will get the answer in terms of j.