Physics 330, Spring 2009
HW#6 30 points

Problems from Tipler and Llewellyn:

1. **7.2 (5 points)** A particle is confined to a three-dimensional box that has sides $L_1, L_2 = 2L_2$, and $L_3 = 3L_1$. Give the set of quantum numbers n_1, n_2, n_3 that correspond to the lowest 10 energy levels of this box.

2. **7.9 (5 points)** If n=3, (a) what are the possible values of l? (b) For each value of l in (a), list the possible values of m. (c) Using the fact that there are two quantum states for each combination of values of l and m because of electron spin, find the total number of electron states with $n = 3$.

3. **7.10 (5 points)** Determine the minumum angle that $\vec{L}$ can make with the z axis when the angular momentum quantum number is (a) $l = 4$ and (b) $l = 2$.

4. **7.27 (5 points)** Write down the wave function for the hydrogen atom when the electron's quantum numbers are $n = 3, l = 2$, and $m_l = -1$. Check to be sure the wave function is normalized.

5. **7.30(5 points)** Assuming the electron to be a classical particle, a sphere of radius 10^{-15} m and a uniform mass density, use the magnitude of the spin angular momentum $|\vec{S}| = \sqrt{s(s+1)}\hbar = \sqrt{\frac{3}{4}}\hbar$ to compute the speed of rotation on the sphere's equator. How does your result compare with the speed of light?

6. **7.33 (5 points)** (a) The angular momentum of the yttrium atom in the ground state is characterized by the quantum number $j = \frac{3}{2}$. How many lines would you expect to see if you could do a Stern-Gerlach experiment with yttrium atoms? (b) How many lines would you expect to see if the beam consisted of atoms with zero spin but $l = 1$?