

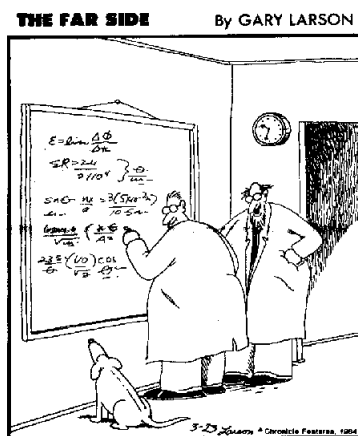
**Phys 402
Spring 2009
Homework 4
Due Friday, February 27, 2009 @ 9 AM**

EXAM #1, covering all material up to and including this HW assignment will be held on Wednesday March 4, 2009 from 9:00 AM to 10:50 AM in Phys 1201.

1. Griffiths, 2nd Edition, Problem 6.16 **Commutators of L, S and J! Start with $[L_x, L_y] = i\hbar L_z$, $[S_x, S_y] = i\hbar S_z$, etc.**
2. Griffiths, 2nd Edition, Problem 6.17 **Add the relativistic and spin-orbit first-order energy corrections to get the fine structure formula. Consider the cases $j = l \pm \frac{1}{2}$ separately.**
3. Griffiths, 2nd Edition, Problem 6.29 **Perturbation of H-atom GS energy due to finite size of the nucleus. Be careful to write down the perturbing Hamiltonian H' correctly (it has 2 terms)!**
4. Griffiths, 2nd Edition, Problem 4.35 **Combine spin angular momenta for 2 and 3 spin-1/2 particles**
5. Griffiths, 2nd Edition, Problem 4.36 **Coupled vs. un-coupled representations of two spins. Use of CG tables.**

Extra Credit #6

- Griffiths, 2nd Edition, Problem 6.32 **Feynman-Hellmann theorem for expectation values of operators.**



"Ohhhhhh . . . Look at that, Schuster . . .
Dogs are so cute when they try to comprehend
quantum mechanics."

Physics 402
Spring 2009
Prof. Anlage

Discussion Worksheet for February 25, 2009

1. The Clebsch-Gordan coefficients allow us to go back and forth between the “coupled” and “un-coupled” wavefunctions for multiple-spin systems. Consider two spin-1/2 particles described by kets $\left| \frac{1}{2} m_1 \right\rangle$ and $\left| \frac{1}{2} m_2 \right\rangle$. Using Table 4.8 on page 188 of Griffiths, write down the triplet and singlet states of the coupled representation in terms of the uncoupled single-particle kets.

2. Consider again two spin-1/2 particles. Using Table 4.8 on page 188 of Griffiths, write down the uncoupled single-particle wavefunctions in terms of the coupled kets $|s m_s\rangle$.