Phys 163; HW#8. Due Tues 10/31

1) PROBLEM 3.38. Hints: These matrices (A and B) are block-diagonal! Better yet, the non-diagonal portion of the block are the same as one of the Pauli matrices. So there is a nice shortcut to finding the eigenvalues and eigenvectors. (Just don't forget to multiply through by the constant for the eigenvalues.) There is an energy degeneracy but don't let that scare you; H is still diagonal.

2) Consider the state in problem 4.27.

A) Solve for the normalization constant A.

B) Find the expectation value $\langle S_x \rangle$ using matrix multiplication.

C) Find the expectation value $\langle S_x \rangle$ by explicitly working out the probability of each outcome, and summing over all possibilities.

D) Find the expectation value $\langle S_x \rangle$ by rewriting S_x in terms of raising and lowering operators S+ and S-, and writing the state in terms of χ_+ and χ_-. (You know what the raising and lowering operators do to these states.)

3) Problem 4.30.

4) Use the results of problem 4.30 to solve the following problem:

- On a spin-1/2 particle, you make a measurement of Sz, and get a positive answer. Next, you measure the spin angular momentum component in a direction 45 degrees from the z-axis. What might you get and with what probabilities?
- Finally, compare your answers to the probabilities you would expect if you instead measured the spin angular momentum component in a direction 90 degrees from the z-axis. Does your 45-degree answer seem to split the difference, or does it seem strangely biased?