HW#11—ADDENDUM —Phys622—Spring 1998 Prof. Ted Jacobson
Due Friday, May 1, 1998 Room 4117, (301)405-6020
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3. A neutron travels along the positive z axis with velocity 2000 m/s. Initially, it travels in a region (region 1) of uniform magnetic field $B_0\hat{z}$ with spin 'up' in the $\hat{z}$ direction. It then enters another region (region 2), where the magnetic field is $\vec{B} = B_0\hat{z} + B_1\hat{x}$. After travelling for 20 m in this region without any deflection the neutron enters a third region where the magnetic field is once again $B_0\hat{z}$. Suppose $B_1 = 0.01B_0$, and $\mu_n B_0/\hbar = 60\mathrm{s}^{-1}$, where μ_n is the magnetic moment of the neutron.
The question: Calculate the probability that the spin is 'down' in the $\hat{z}$ direction after the neutron has traveled through region 2.

7. *New problem*: Problem 9.3 of Schwabl. Do this two ways. (i) The way Schwabl suggests in his hint, and (ii) by expanding the exponential operator $\exp(-i\alpha S_y/\hbar)$.