Bilkent University Physics Department

Phys 326 (Spring 2014) Homework 1 Due March 3 2014

Rotate the spin states $|\uparrow_x\rangle$, $|\downarrow_x\rangle$, $|\uparrow_y\rangle$, $|\downarrow_y\rangle$, $|\uparrow_z\rangle$, and $|\downarrow_z\rangle$ around the axis defined by the unit vector $\hat{\mathrm{n}} = (\hat{\mathrm{x}} + \hat{\mathrm{y}} + \hat{\mathrm{z}})/\sqrt{3}$ by 120^o. Discuss your result.

The following problem is assigned to those students who did not attend class on Thursday, February20th. Grade from this part of the homework will enter the geometric average of the grades of these students separately, so it must be completed in order to obtain a finite average. Other students may turn it in for extra credit.

The total energy operator of a two-spin system is given as $H = \alpha\vec{B}\cdot\vec{S} + \beta\vec{S}_1\cdot\vec{S}_2$ where α and β are constants, $\vec{S}$ is the total spin operator and $\vec{S}_1$ and $\vec{S}_2$ are the individual spin operators. A uniform magnetic field $\vec{B} = B_0\hat{z}$ is acting on the system. Find the eigenstates and the energy eigenvalues of the system.