

Phys 402: Applications of Quantum Mechanics

Homework III A (due 930am, Thursday, Feb 4, 2016)

Bloch Sphere for Spin-1/2 states

- 1) Show that the spin orientation, or the expectation value of spin operator in the state defined along the direction of unit vector \mathbf{n} on the Bloch sphere is precisely along the direction of \mathbf{n} .

- 2) For a spin initially pointing along an arbitrary \mathbf{n} -direction, describe its motion or trajectory on the Bloch sphere in the presence of an external magnetic field along the z -direction. You need to first calculate the spin wave the wave function at arbitrary time and prove the precession by computing the spin orientation as a function of time t .

- 3) Use the $SU(2)$ rotation operator we introduced during my lectures, show that a spin pointing along the z -direction when undergoing to a rotation around the y -axis by 90 degrees becomes a spin state pointing along the x -or minus x -direction.