SPINS Lab 4

Instructor Version

In this lab the students must figure out how the magnetic field affects the spin states. They have done an experiment earlier (part 2 of Lab 2) that will get them started. If the whole class puts together those results, then they may already have a good idea what is going on. Rather than provide a method, I have asked the students to design and perform their own experiments. They should treat this as a puzzle to be cracked.

Do the following for both the spin-1/2 and spin-1 cases.

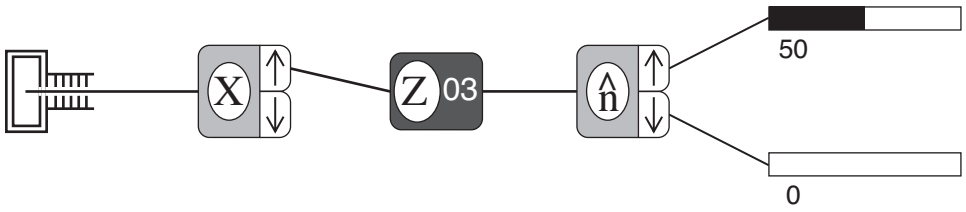
1. Design an experiment to study the effect of the magnetic field on the spin of the atoms.

2. Perform the experiment and record your results.

3. From your measurements, develop an hypothesis about the effect of the magnetic field.

4. Design a simple experiment that will conclusively confirm your hypothesis.

4. The ideal confirmation experiment is shown below (with the angles for $\hat{\mathbf{n}}$ *being* $\theta = 90^\circ$ *and* $\phi = 30^\circ$ *for the case of* $B_z = 3$*).*



5. Determine the relevant scale and units of the number used to characterize the magnetic field.

5. The magnetic field variable in the program is proportional to the spin precession angle $\omega_0 t$*, which is the product of the Larmor frequency and the time of interaction. The Larmor frequency is proportional to the magnetic field strength. For spin 1/2, the angle is 10˚ times the shown value. For spin 1, the angle is 5˚ times the shown value.*