Magnetic Torque Workshop Handout
BFY II University of Maryland July 22-24 2015

Magnetic Torque allows us to measure the magnetic moment imbedded in a snooker ball five different ways, each using different concepts from mechanics and E&M. In the process, we develop a 'gut' sense of magnetic moment of a particle as an intrinsic quantity that determines both the kind and magnitude of the object's interaction with magnetic fields.

We will start with a favorite qualitative experiment that clarifies the difference between sources of magnetic force and magnetic torque.

We will then work our way through several of the various methods for finding the magnitude of the magnetic moment. An overview of the experiments can be found on the TeachSpin website at http://www.teachspin.com/instruments/magnetic_torque/experiments.shtml

We will find the magnetic moment by:

1. Balancing a gravitational and Magnetic Torque

2. Setting the ball in simple harmonic motion, we will measure the period of oscillation as a function of the magnetic field and use the resulting graph to T^2 vs 1/B to find our magnetic moment.

3. We will set the ball spinning and use the built in strobe to find the spin frequency. From this we can find the angular momentum. Allowing the ball to precess we can both find the magnetic moment and 'discover' the gyromagnetic ratio.

4. We will look at some data from a measurement of magnetic field of the imbedded dipole as a function of distance to see both the inverse *cube* dependence and find the magnetic moment itself.

5. We will mention the use of the teeter-totter as yet another way to measure that magnetic moment.

6. AND THEN – the best fun – you will get a chance to make that snooker ball perform a Pulsed NMR spin-flip!