Physics 106 – Mini-Lab
Atomic Spectra

(See http://www.physics.rutgers.edu/ugrad/106/labs.html for lab write-up guidelines.)

At the MSLC desk, obtain a diffraction grating and also get the key to the room in which discharge tube apparatus is set up. Please note that this setup will only be available at the MSLC after the spring break. Go to the room and familiarize yourself with the apparatus, which is a carousel that allows you to rotate each of three different discharge tubes into position (the active tube will be the one opposite the power switch). Don’t touch the discharge tubes themselves; they could break, and they can get very hot during operation.

Also note the wall chart showing the known emission spectra of various elements.

Turn on the power switch. One at a time, rotate each tube into position. (It may take a few seconds for the discharge tube to turn on; this is normal.) Holding the diffraction grating in front of your eye, and looking at the diffracted image to the left or right of the straight-ahead one, observe the line spectra originating from the discharge tube. You may find that it works best if you keep the diffraction grating close to your eye, and if you stand back several feet from the apparatus. You may also want to turn down the room lights.

Using the grating labeled “600 lines/mm” try to identify the chemical element in the discharge tube by comparing the pattern with those shown on the wall chart. Repeat for the other two discharge tubes. Report the results of your detective work.

Also describe qualitatively how the line positions change when you use the grating with 300 or 100 lines per mm, and discuss.

Write a paragraph on spectral lines and what they tell us about the physics of atoms. In particular, how is the frequency of light coming from one of these lines related to some property of the atom that it is coming from?