

Discharge Spectra Lab

In this lab, you will observe the discharge spectra from Helium and Hydrogen. You will first do this with the diffraction-based spectrometers which I have provided. These spectrometers do little more than give a hint that a proper measurement could be made with a more refined instrument. Never-the-less, they do provide useful insight.

Secondly, I have been able to provide you with the resurrected optical spectrometer which is a prism-based instrument. In order to properly use one of these instruments, each line is positioned at the angle of minimum deviation (which changes for each frequency) for a 60° prism of the correct index of refraction at the calibration frequency. My prism is close to being correct, although it is not exactly correct. There are far too many settings required for the measurement which is ultimately accomplished with a scale on the platen of the spectrometer. Rather than require you to make precise measurements with this instrument, I instead ask that you turn the single knob which rotates the telescope through angles allowing correct viewing of each of the spectral lines. You should note on the platen that the frequency of the observed line is approximately within range (this is partially because I have calibrated the instrument to do this). However, learning how to read the scale is beyond what I wish to teach in today's lab (It is also something that most likely you would soon forget anyway). Never-the-less, I want you to see that precise optical measurements of discharge spectra can be made with such instruments and indeed, they were made with such instruments. I particularly like it that our optical spectrometer is labeled with a tag indicating it was destined for the antiques showcase.

The precise frequencies that the spectrometers provide are located in your spreadsheet. You have a very important task now. You must provide a very simple sequence of integer numbers which describes the observed optical spectra for helium and for hydrogen. There is at least one very important rule: what ever the number is that you choose for n_1 (choose an integer only), it must remain the same. n_2 can vary but only by integer values and it must always be greater than n_1 . With these rules in mind, your completion of the spectra lab will be shown by having obtained the required sequence of integers.

I have also provided square deviations and the standard deviation of the square deviations on the spreadsheet. However, I suggest not to rely too heavily upon this; instead look for nice simple sequences.

Ultimately, you must provide a simple formula relating the observed spectra to the integer sequence which you have developed. You will probably want to refer to your text book for help in describing your results.