Acquiring a spectrum with the SPEX 1250M

Overview

The SPEX 1250M spectrometer is controlled by a computer program called `SynerJY`. It allows control over many of the spectrometer's settings: wavelength, photomultiplier voltage, amplifier gain, etc. The `SynerJY` software controls the spectrometer via the MSD 2 and SpectrAcq2 units, through an IEEE-488 (or GPIB) interface. The MSD 2 controls the spectrometer itself, determinig such parameters as the active entrance and exit ports, and the wavelength setting. The SpectrAcq2 controls data collection; it produces the high voltage (HV) for the photomultiplier and contains amplifiers, analog-to-digital converters, and pulse counting electronics for collecting data.

Before using that SPEX 1250M, there are several *Do's* and *Don'ts* that you should be aware of:

- **Do** use UV goggles whenever working with a UV source, such as the quartz halogen lamp or the "penlight" mercury source.
- **Don't** touch optical surfaces.
- **Don't** exceed 1000 V across the photomultiplier.
- **Don't** expose the photomultiplier to room lights while the high voltage is on.
- **Don't** leave the photomultiplier's high voltage on when the spectrometer is not in use.
- **Don't** treat the entrance and exit slits roughly. They are delicate apparatus and require care.
- **Don't** reduce the entrance or exit slit widths below zero.
- **Don't** stare directly at the lamp.

Procedure for Setting up the SPEX 1250M

The following instructions are for acquiring a high resolution spectrum of mercury. Other spectra can be acquired using variations on these settings.

The entrance and exit slits are probably already set appropriately. If you do change them, do so with care. The slits are delicate and easily damaged. The micrometer readings are no longer reliable, so if the spectrometer is already set up, you probably don't need to touch them.

1. Log in to the computer with Username "\.physics" and password "physics".
2. Set the entrance slit height to either the bottom "dot" or to 0.2 cm by sliding the horizontal bar to the bottom dot or .2 setting.
3. The entrance and exit slit widths are probably already set to reasonable values. Only change them if necessary. Set the entrance and exit slit widths to 10 μm using the micrometers on the entrance and exit ports. Treat the slits, as you would any sensitive apparatus, with care. Notice that the smallest divisions on the micrometer dial are 2 μm.

4. Align a lamp in front of the entrance slit. When using a mercury discharge lamp, remove any glass in front of the lamp's opening. You should wear UV protective glasses, and do not to look directly at the Hg lamp (even when wearing protective glasses) so that your retinas and lenses are not damaged by the ultraviolet radiation.

5. Power up the SPEX MSD 2 and the SpectrAcq2 units. (The power strip is on the lower shelf of the optical table. Often, these are left on.)

6. Run the `SynerJY` program. Select `Collect`→`Experiment Setup`

7. When the `Monochromator Calibration` window pops up **DO NOT** change the number in the box or it will change the calibration of the spectrometer and it will not work properly until your instructor recalibrates it. Press the `OK` button.

Procedure for taking Optical Spectra

1. The `Experimental Setup` window allows you to set the parameters for data collection. The upper right hand corner allows you to set the `Start` and `End` wavelengths and the `increment` in nanometers or angstroms. The `start` and `stop` wavelengths can be anywhere between 0 and 1500 nm. A good starting value for the `increment` might be 0.01–0.001 nm, depending on the scan length.

2. The far left-hand column lets you set the detector and mirror options. Click the `Monos` button to set the entrance mirror position. The mercury lamp is usually set up on the side, or "Lateral" entrance. Don't change anything else in the `Monos` configuration.

3. Click on the `Detectors` button to set the `Integration Time` and the `High Voltage` for the photomultiplier. A reasonable `Integration Time` to begin with is 0.1 s, and the `High Voltage` can usually be set between 675 V and 900 V. A value of 850 V usually works well.

4. To collect data, click `Run` in the lower right-hand corner. The computer will graph the data as it is being collected.

5. Save your data. (You will probably find it most useful to create a folder on the Desktop for your work.) To export your data, click on the `Data` tab at the bottom of the graph, and then select `File`→`Export` to export your data to an ASCII file, suitable for import into other tools, such as *Mathematica* and `Excel`. The default `DAT` setting works well. It produces text files with two columns of numbers, separted by spaces. You can also choose `CSV` for the comma-separated values format.

6. When you are finished, turn off the photomultiplier's `High Voltage` (under `Collect` → `Experiment Setup`) and end the program. Turn off the lamp. Ask your instructor whether you should turn off the computer and the MSD 2 and SpectrAcq2 units if the spectrometer (often these are left on).