Using the CCDSPEC astronomy spectrometer

The CCDSPEC is a grism-based visible light spectrometer that is intended for use on astronomical telescopes, but which can be used to measure the spectrum of any light coupled into it. Its sensor is an astronomy-style camera, which permits long exposures with minimal noise, and thus gives the spectrometer a very high sensitivity.

1 Optical setup

The input slit is 45 mm inside the end of the spectrometer. You may need a lens to put your light onto the slit. There is a viewport on the side of the spectrometer, intended to be observed with an eyepiece, which lets you see the slit and the light that falls around it. This is useful to verify what light is reaching the slit. If your light source is a diffuse object, then an eyepiece is not really needed; it is sufficent to see lots of light in the viewport.

2 QHY6 Camera

The CCDSPEC can be used with a variety of cameras, but the QHY6 is typical. This camera is powered mainly by its USB connection. There is also a socket for an external 12V supply, but this is only needed to run the fan and internal thermoelectric cooler for very long exposures (more than several seconds), in order to reduce the thermal background. The camera is screwed on to the spectrometer. If the spectrum is a little tilted, the orientation of the camera is probably slightly out.

3 OpenSkyImager

Astronomy cameras all require special control software. OpenSkyImager can be used with the QHY6. It is a little peculiar to set up, but astronomers seem to like it that way. Here are some minimal setup instructions.

There are essentially three operating modes: **`Show settings`**, **`Focus`** and **`Capture`**. To see a live display of the image, use the **`Focus`** mode. The update rate is essentially determined by the exposure time that you have set, which is typically slow. **`Capture`** saves a still image, and then stops.

3.1 Settings

Camera tab

- Model = QHY6, and click connect.
- Offset = 100, gain = 100.
- Binning = 1x1, capture size = full, download speed = fast, amp control = auto

Filename tab

- Select Desktop so that saved files show up on your desktop. The other options determine how the file name increments between exposures; the defaults are OK

3.2 Focus

- time = 500 ms or whatever exposure time you need.
- Click Start. The image should begin to update

3.3 Capture

- Click start. After an exposure, an image file should be stored in the location set in the filename tab, described above

4 Processing the image files

Images are saved in the fits format, a standard used in astronomy. You can open them in Fiji (ImageJ) for processing; drag and drop onto a running Fiji window works. Within Fiji, you would normally select a rectangle starting at the far left of the image and spanning the spectral lines, then plot a profile to show intensity as a function of pixel position. By use of a known spectrum, you can get a calibration to turn pixel position into wavelength.

5 Bibliography

- https://web.archive.org/web/20161017102251/http://elliott-instruments.co.uk/ccdspec.html
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