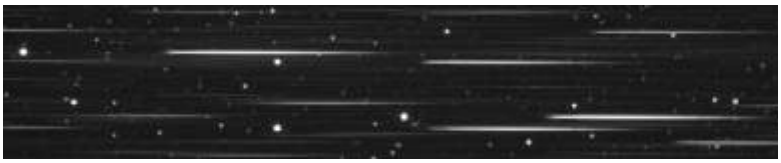
Lab 11 -Stellar Spectra Using Diffraction Grating

Purpose

In this experiment we use a 100 or 200 lines/mm diffraction grating filter mounted in the ST-10 camera, http://en.wikipedia.org/wiki/Diffraction_grating on the 140mm refractor, to take low-resolution spectra. Setup procedures in preparation for imaging, are the same as those covered in **Section I**.

The diffraction grating separates light into it's component wavelengths, and yields spectra of every star in the field. Using RSpec software, we then isolate and analyze the spectra of our specific target. http://www.rspec-astro.com



Stars and spectra with diffraction grating. CCDSoft.

This method is called "slitless" spectroscopy, and allows us to take spectra of fainter stars, determine the redshift of distant quasars, http://en.wikipedia.org/wiki/Quasar and track activity in type1a supernovae. http://www.rochesterastronomy.org/supernova.html

Procedure

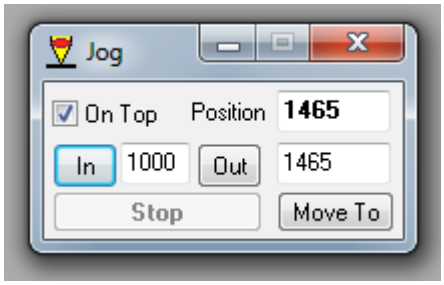
Using TheSky6, prepare a list of 3-5 stars, or choose an object of particular interest currently in the sky. These may be carbon stars, Wolf-Rayet stars or even a current, bright supernova. http://en.wikipedia.org/wiki/Wolf–Rayet_star

Power on the mount, camera, focuser, sync to the sky, and calibrate the autoguider as usual. After autoguider calibration, find and slew to a 3rd - 4th magnitude star for focusing. Unlike a star image, the spectrum of the star is spread out or dispersed, and focusing is performed on the spectrum image.

With the imaging chip binned 1x1 and no autodark, take a 1-2 second exposure in Focus Tools. Draw a horizontal rectangle (subframe) around the stellar spectra only, and take continuous images for focusing.

Subframe of spectra only, for focusing. CCDSoft.

In FocusMax, choose the Jog command, which allows manual focus. Observe the spectra's ADU count in CCDSoft, and adjust the focus In Out until best focus is achieved. (i.e.1465) Again, best focus is the highest ADU count. The star's spectra is now focused and ready for imaging.



FocusMax Jog window.

Slew to target in TheSky6. Find a guide star on the guide chip, initiate autoguiding, and confirm X and Y errors below 1.0. In CCDSoft under Autosave, create a desktop folder for your images called Object_Date_Your name (i.e. SN2014J 031214 Alex)

We will now determine the exposure time for your target. With the autoguider running and autosave turned off, in the Take Image tab, take a 5 second bin 1x1 image. Crop (subframe) to your target *spectra only*, excluding the star. Determine now, the exposure time needed for a signal of about 20,000 to 40,000 ADU for later processing in RSpec. This will be the exposure for your target.

Turn Autosave on, uncheck the Subframe box and set the exposure time under Take Image, to the exposure just determined. With the autoguider running, take 10-20 images of your target, saved to the folder. These will later be dark subtracted and median combined, in CCDStack, for RSpec processing in Lab 12.