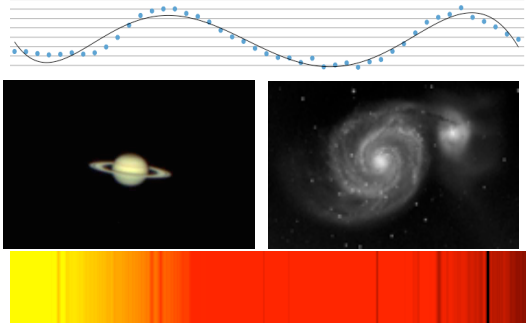
-ASTR 203 Astroimaging Techniques



Section I **-Astrophotography**

Lab 1 Galaxies
Lab 2 Clusters
Lab 3 Nebulae
Lab 4 Image Processing

Section II **-Photometry**

Lab 5 Eclipsing Binaries
Lab 6 Extrasolar Planets
Lab 7 Pulsating Variables
Lab 8 Photometry Processing

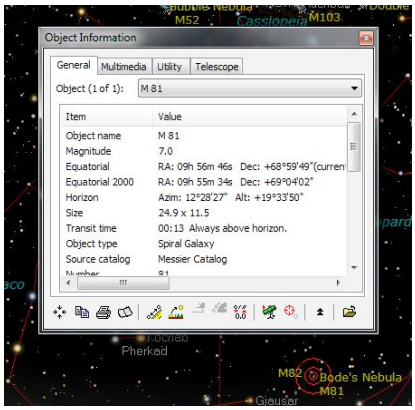
Section III **-Spectroscopy**

Lab 9 Stellar Spectra Using SGS Spectrograph
Lab 10 Processing SGS Spectra
Lab 11 Stellar Spectra Using Diffraction Grating
Lab 12 Processing Diffraction Grating Spectra.

Section I -Astrophotography

Procedure
Here we begin taking astroimages. Labs 1 thru 3 involve nightly startup procedures including focus and autoguider calibration covered on pages 10-14. During the imaging run, make notes on the target and imaging procedures, to save in the target folder.

In **TheSky6**, find your chosen target (i.e. M81) by left clicking the object on the sky map, or asking for your object in **Sky6** library available from the binoculars icon in the main window. Slew to target using the green slew button.



TheSky6 connected to M81.

Center the target on the main imager: In **CCDSoft**, choose Focus Tools / Continuous / Imager / Take Image with a 2 second exposure. In **TheSky6** main window, choose Telescope / Motion Controls and center your object in the field of view using the N S E W buttons.

To initiate autoguiding, in the **CCDSoft** Take Image tab choose Autoguider, set Bin to 2x2 and Reduction to Autodark. Take a Focus Tools 2-6 second exposure on the **Autoguider** chip, and locate a bright guide star. Position your chosen guide star somewhat away from the edge of the chip. (Exact centering of the guidestar is not required.)

In the **Autoguide** tab, choose Autoguider and set the correct exposure, usually 2-6 seconds, to achieve a signal strength ~ 7,000-10,000 (signal strength is displayed in **CCDSoft** autoguider window and represents the brightest star in the field). In the **Autoguider** image window, click on the chosen star. A small, blinking white box appears around the chosen guide star. Click the Autoguide button to begin autoguiding.

In the **Autoguide** tab, you will see **X** and **Y error** numbers showing corrections being made to the mount, in pixels. Wait for X and Y errors consistently below 1, as the guide star is being centered. You are now autoguiding, and ready to photograph your target.

In the **Take Image** tab, choose Imager, to set these parameters: Exposure, Delay, and Series (below). Make sure Reduction is None, as we will apply calibration frames later.

Exposure times vary with subject, but we typically use 300 seconds (5 minutes) for most deep sky objects. We later join multiple 300 second exposures (Lab 4) into a summed image. Also, if an airplane flies thru the field during the imaging run, only 5 minutes (1 exposure) of data will be lost, when removing the problem image.

Delay time should be set slightly longer than the autoguider exposure. This allows the autoguider to "catch up" with any unlikely errors occurring while the camera's shutter is closed, during each image download.

Series is the number of images taken. Five is a good starting point. More images add up to a stronger signal, and better signal-to-noise ratio. (SNR)
http://en.wikipedia.org/wiki/Signal-to-noise_ratio

Finally, in the **Auto Save** tab, select Choose Folder and create a folder on the desktop called: *Object / Today's Date / Your Name. (i.e. M81 090214 Jane)*

In the Auto Save tab, Check "Auto Save on" to save all images to the folder, or they will be lost!

Return to the **Take Image** tab and hit Take Series, to take the N images requested, and save them to the folder. You are now imaging and autoguiding, simultaneously! After taking the series, slew to, and image additional targets as time allows. Imaging more than one target per night is possible.