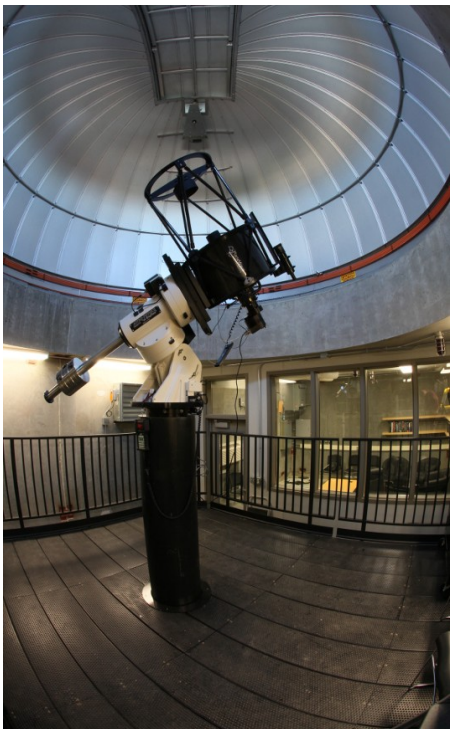
Using the Observatory



Modern professional astronomers do not look through the eyepiece of a telescope in the course of making scientific discoveries. Modern research grade telescopes are very complex pieces of equipment and, often, the astronomer is not even allowed direct access. Most professional observatories are fully automated and it is the responsibility of a Telescope Operator (TO) to control the telescope with one or more computers. Rather than eyepieces, the telescopes have electronic detectors that are used to make a variety of measurements. The astronomer's job is to analyze and interpret the data gathered by those detectors. Tonight, you'll be operators and gather data. Later in the semester, you'll be astronomers and do some analysis on the data that we have gathered.

Our observatory is designed to have the look and feel of a professional facility. The telescope is mounted on a robotic mount and is equipped with a science grade digital camera. The dome moves under computer control and always stays synchronized with the telescope. The computers that control the system, and the people using those computers, stay in the comfort of a friendly climate controlled control room (with cushy chairs). The members of your group, under the guidance of the TA, will assume the roles of telescope operator (point the telescope), observer (run the camera), data recorder (keep the log), and staff scientist (boss everyone around). You will use the telescope and camera to gather data on several different objects, so everyone will have a chance to play each role.

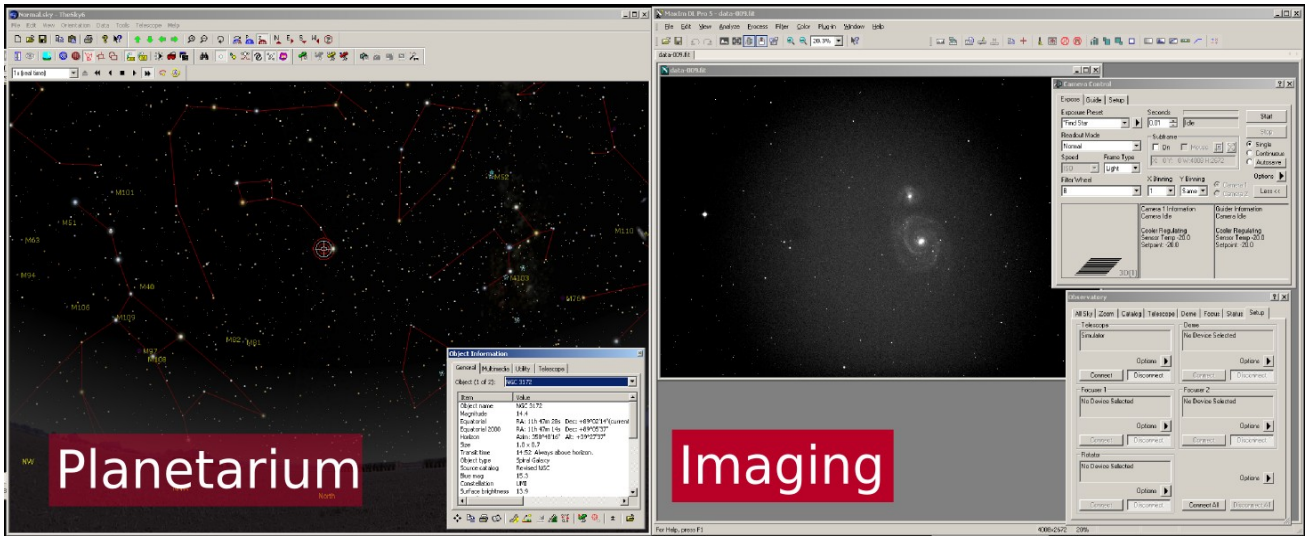
Taking Astronomical Images

As any good photographer knows, a good picture in low light requires a long exposure. Because objects in space are dim, it takes a long exposure to build up a high quality image. Also, because our camera is monochrome (black and white), we need to take several images through different colored filters to create a full color image. A high quality full color image can represent several hours of total exposure time.

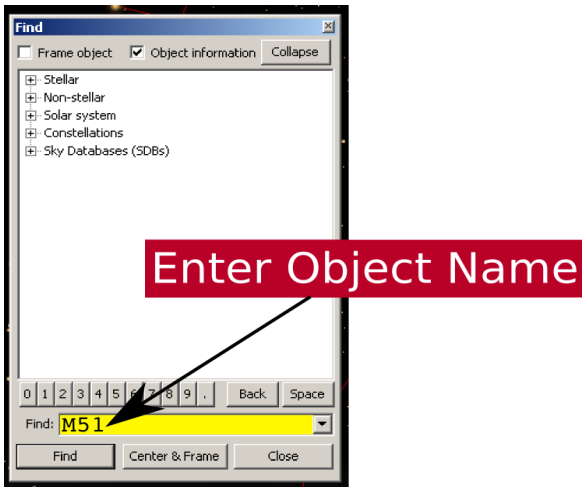
Since we have a limited amount of time at the telescope, we will not be able to take hour long exposures. Luckily, we can combine many short exposures to make one long exposure. Your time at the telescope will be spent taking a few short exposures of several different objects. In a lab later this semester, we'll turn these short exposure images into full color pictures.

Step 1: Pointing the Telescope

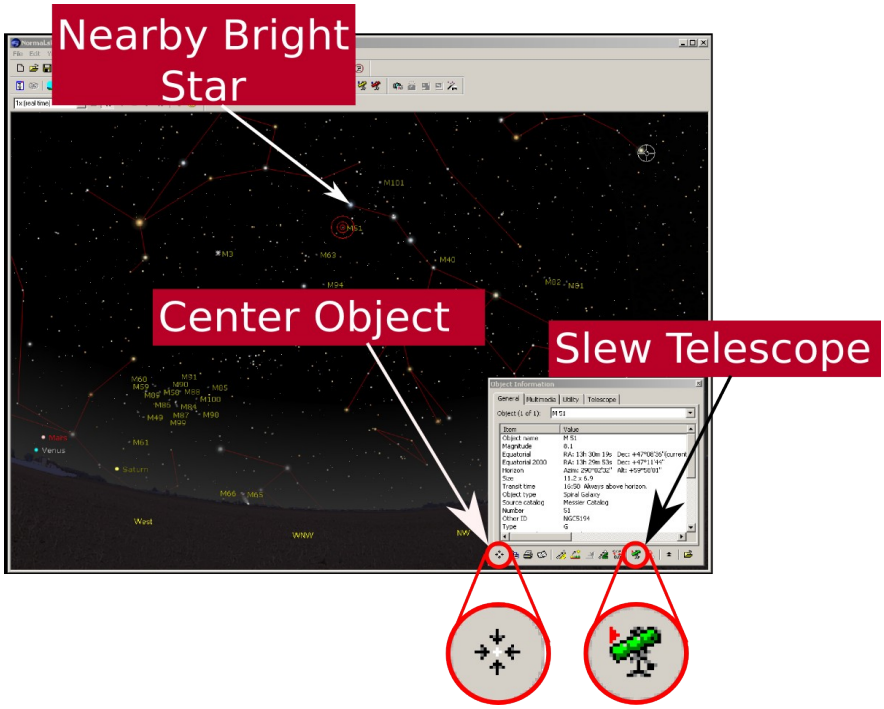
When you start, the telescope will be pointed at a random position in the sky so, first, we need to point the telescope at our object. Below is what you'll see when you sit down at the telescope. The left screen (TheSky) is used to locate objects and point the telescope. The right screen (MaximDL) controls the camera and manipulates images.



1. In the TheSky, choose **Edit->Find** to bring up the *Find* dialog. Enter the name of the object in the text box at the bottom of the dialog and click the '**Find**' button.

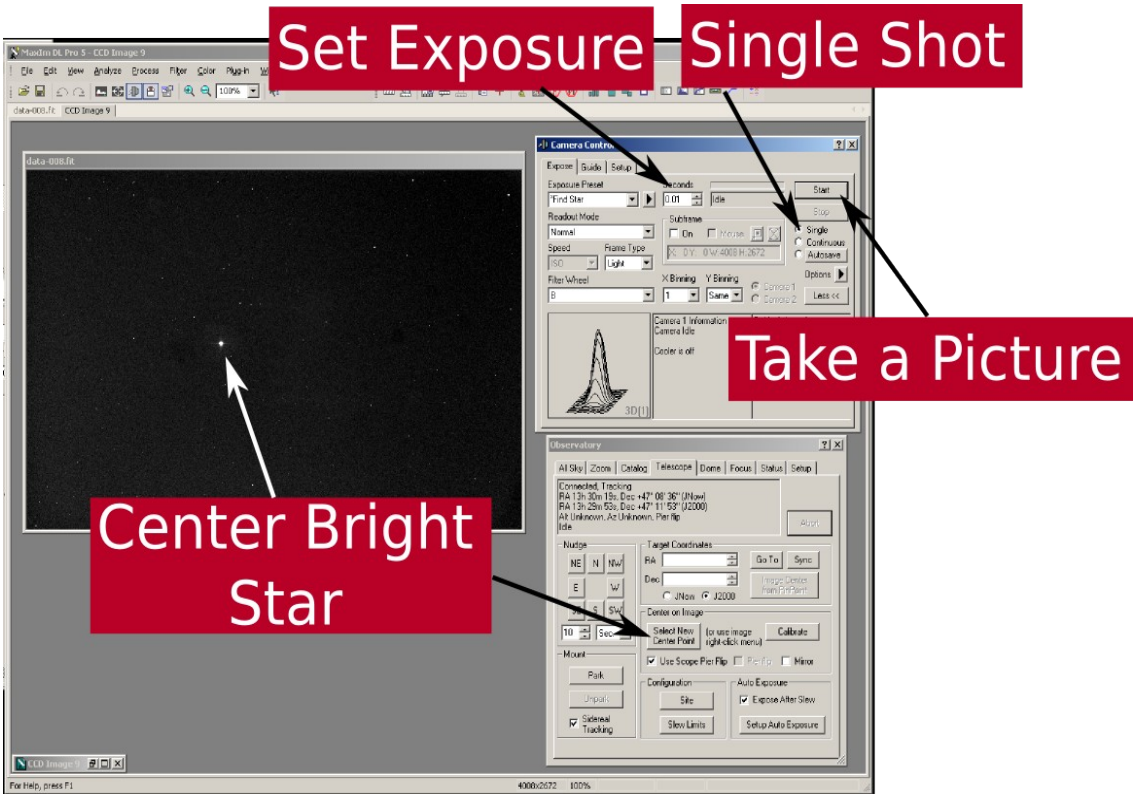


2. At the bottom of the *Object Information* dialog, click on the '**Center Object**' button (highlighted in the image below). You should see a red target on your object



3. Find a bright star near your target in the planetarium window. We're going to point the telescope here to make sure we're aligned properly.
4. Click on the bright star (the red target will point to it) and then click the **'Slew Telescope'** button. The telescope will move to the star.

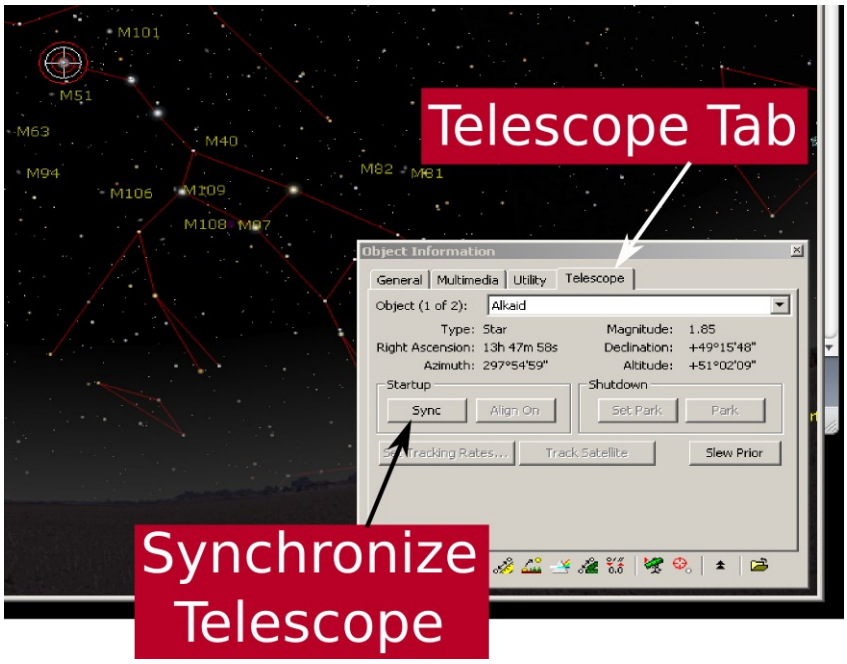
5. In the MaximDL window in the *Camera Control* dialog: click the **'Single'** radio button (we want one test image), set the exposure time to **0.1** seconds, and then click the **'Start'** button to take a picture. It takes about 26 seconds for the image to download, so be patient!



6. The bright star should show up in your image, but possibly not centered. We want to center the star and re-calibrate the telescope. In the Observatory dialog, click the **'Select New Center Point'** button and then click on the star in the image.

7. Take another image to verify that the star is centered in the frame.

8. In the TheSky window, choose the **'Telescope'** tab in the Object Information dialog. Press the **'Sync'** button to re-synchronize the telescope.

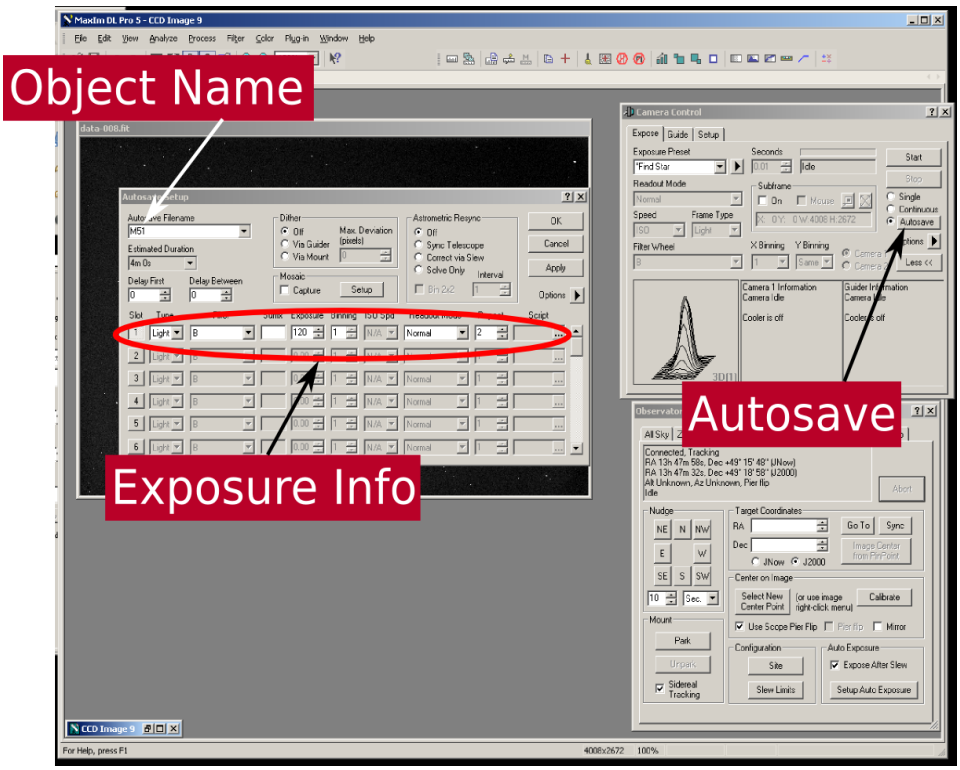


9. In the TheSky window, click **Edit->Find**. Ensure the Find box still has your object in it and then click **'Find'**.

10. Press the Slew Telescope button again. The telescope should now be pointed so that your object will appear in the center of the image when you take a picture.

Step 2: Gathering Data

1. In the MaximDL window in the *Camera Control* dialog, press the **'Autosave'** button. The *Autosave Setup* dialog will appear.



2. Enter your object name in the **'Autosave Filename'** field.

3. Fill out the exposure information.
   - 3.1. Make sure the **'1'** button is selected under **Slot**.
   - 3.2. Make sure **Type** is set to *Light*.
   - 3.3. Select the desired filter (Red, Green, Blue, or Luminance). Consult your TA regarding which filter to use.
   - 3.4. In the **Suffix** field, put the first letter of the filter that you chose (R, G, B, or L)

3.5. Pick an **Exposure** time between 60 and 180 seconds. Pick 60 if this is the first exposure and higher if warranted by the first image (Your TA may have a suggestion).

3.6. Make sure **Binning** is set to 1.

3.7. Make sure **Readout Mode** is set to *Normal*.

3.8. Set **Repeat** to 1.

4. Press **'Ok'** in the *Autosave Setup* dialog and then press **'Start'** in the Camera Control dialog to take a picture.

5. Have the log keeper fill out the observing log with the relevant details of the image that you've taken.

6. If everything looks good in the image, take a couple more. If, needed, open the *Autosave Setup* dialog and adjust the **Exposure** time.