

Texas Tech University Department of Physics
Astronomy 2401 Observational Astronomy
Lab 2:- Planning Observations

Introduction:

Observing time at the telescope is generally very limited. Therefore, in order to maximize the results of time spent at the telescope, it is necessary to be well prepared. This preparation includes such things as deciding what objects to observe and in what order, and what is the best equipment to observe with.

Objectives:

There are three principle objectives for this laboratory session.

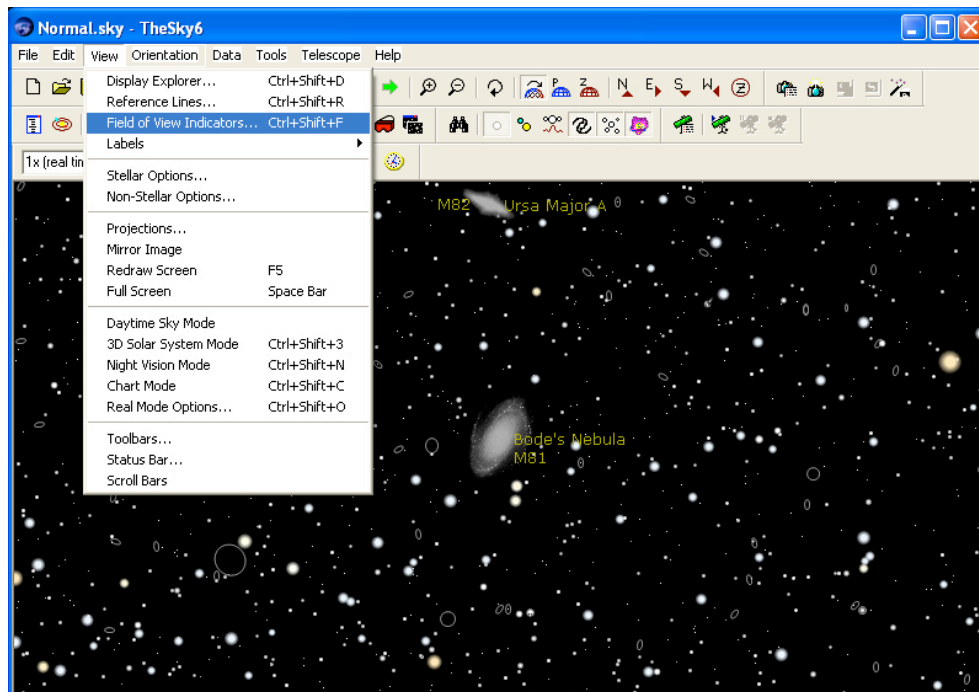
- (a) To understand how to compile a list of objects for imaging with a CCD.
- (b) To become familiar with the use of “The Sky” to decide which telescope/CCD combination to use for the observations.
- (c) To develop a schedule of observations of those objects.

Procedure:

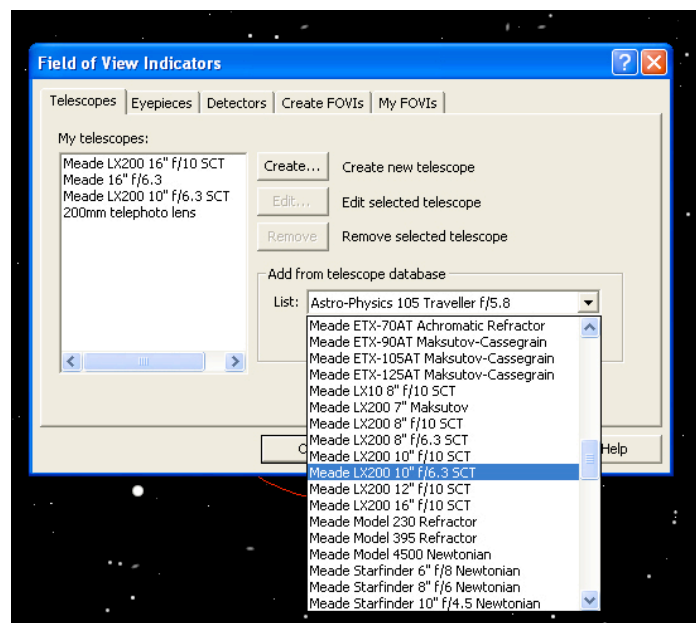
At the end of this lab is a sheet with a number of possible targets for you to image with the CCD. Using “The Sky” and the “Find” button, locate a number of the objects in this list. As you find each object, use the “Multimedia” menu on the information box to see an image of each object. Using that image and the description in “The Sky”, decide if that object is one that you would like to image for yourself. For each object, record your decision and your reasons why you either chose to accept that object or reject it. At the end of your search, you should have at least four objects that you would like to image. These objects should not all be the same type, (ie not all galaxies) but include at least 2 different types of objects.

Now that you have your 4 objects, the next step is to choose which telescope and CCD to use for the imaging. While there are several combinations available, the telescope/CCD combination you will be using for most of this course will be a 12” Meade Schmidt-cassegrain with an ST9 CCD. The telescope can be used at 2 focal ratios, f/10 with and f/6.3. Depending on the size and type of your object, either of these could be the most suitable for your objects. A shorter focal length will provide a larger field of view. For example, if you decided to image a large nebula such as M17, you would need to use the telescope at f/6.3. On the other hand, a very small planetary nebula such as M57 would be best imaged at f/10”.

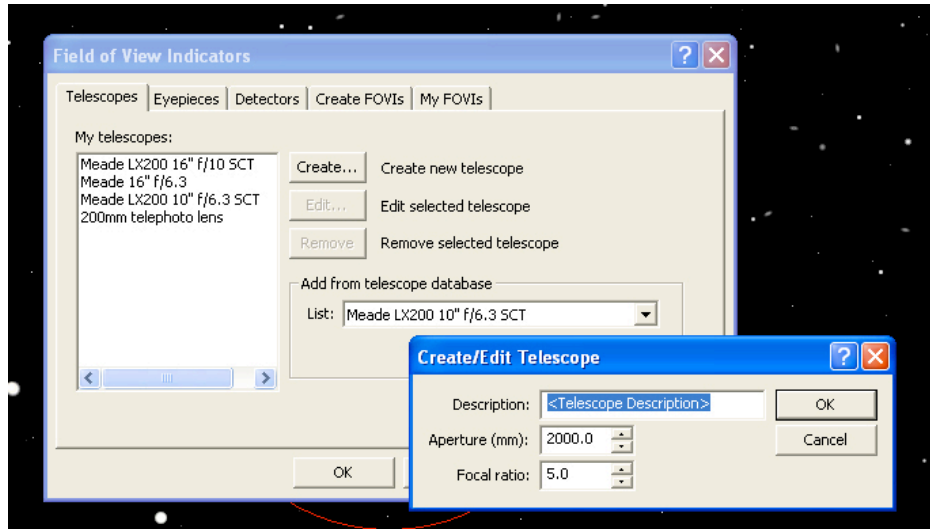
The way to decide which telescope would best suit your objects is to use the field of view indicators in “The Sky”. To display these go to the “View” menu at the top of the screen. Click on “View” and then click on “Field of View Indicators” in the menu that appears.



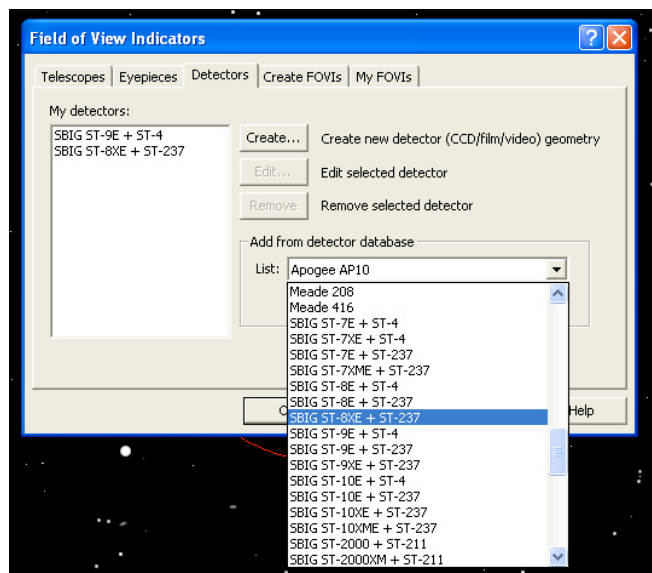
This will bring up a dialog box with a number of menus. The first thing to do is to enter the details of the telescope and CCD combination. Click on the “Telescope” and then go to the small window that says “Add from telescope database”. Click on the arrow at the right of this window and scroll down until you find “Meade LX200 12” f/10 SCT”. Click on this telescope and then the “Add” button.



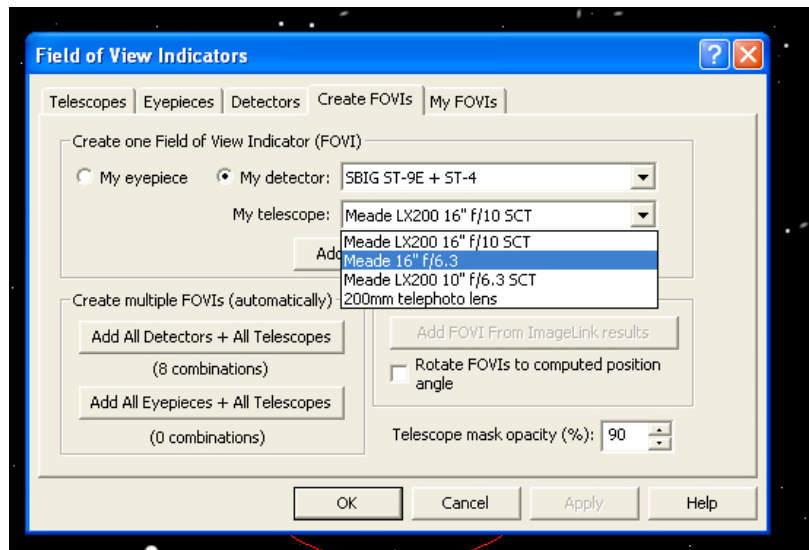
The other focal ratio is not in the database, so you must create it yourself. To do this, click on the “**Create**” button. In the “**Description**” window, type “**12” f/6.3 SCT**”. Then set the **aperture** to “**305**” and the **focal ratio** to “**6.3**”. Then click “**OK**”.



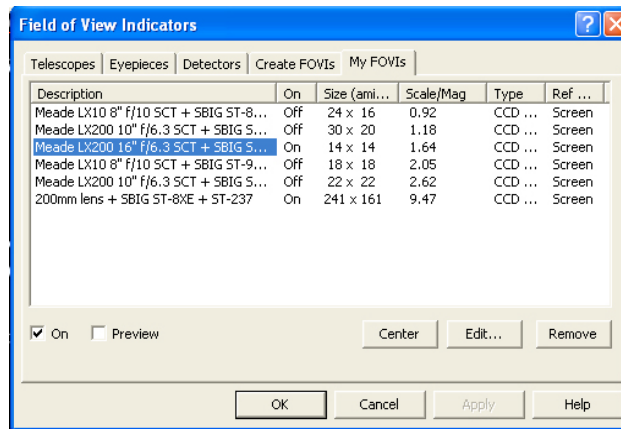
Now you have the two telescopes entered, you have to enter the CCD. To do this, click on the “**Detectors**” tab. Click on the arrow on the right of the small “**List**” window and scroll down until you find “**SBIG ST9-XE + ST-237**”. Click on this CCD and then click the “**Add**” button.



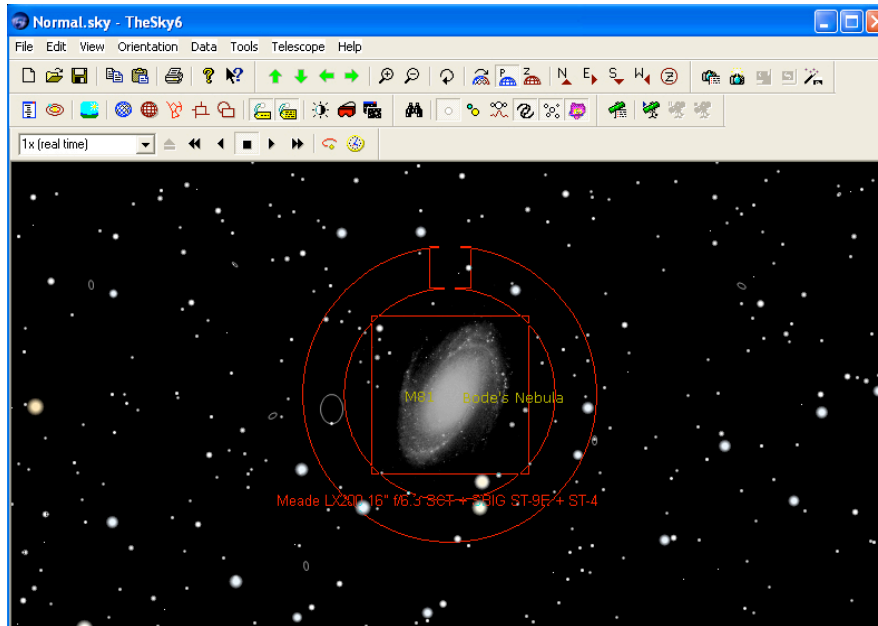
ALMOST FINISHED! Now you have to tell “The Sky” which CCD goes with which telescope. Click on the “**Create FOVIs**” tab, and choose “**My Detectors**”. From the “**My Detectors**” panel, choose the ST9-XE. Then go to the “**My Telescopes**” panel and choose the 12” f/10. Then click the “**Add My FOVI**” button. Repeat the procedure but this time choose the 12” f/10 telescope.



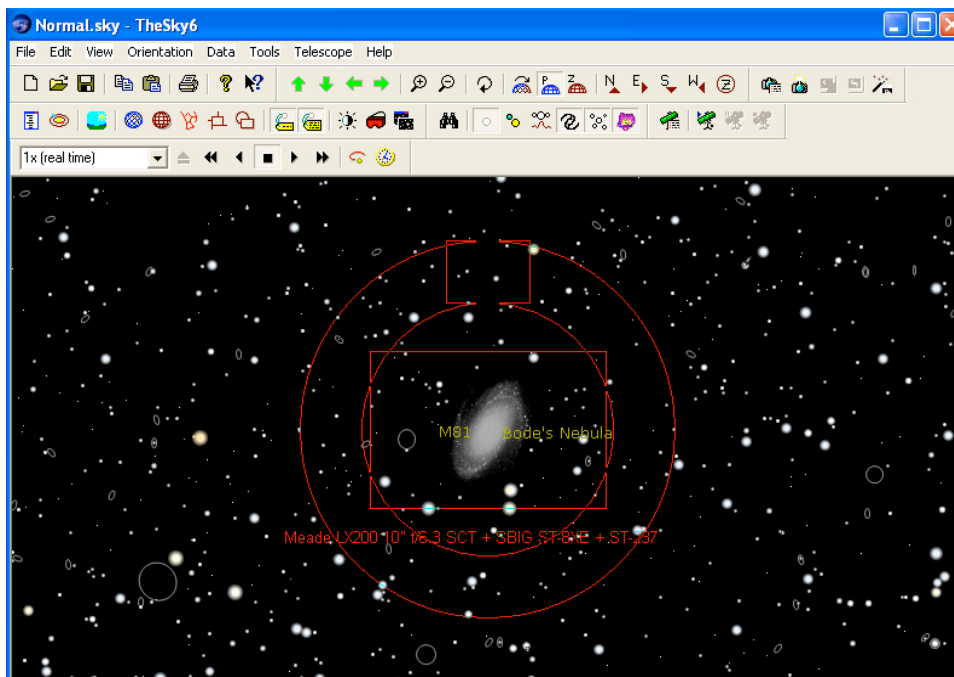
Now you should click on the tab “**My FOVIs**”. This will bring up a list of the 2 telescope/CCD combinations you just created. To activate any of them, click on the telescope under “**Description**” and then tick the box marked “**On**”, situated in the bottom left corner. This will turn that indicator “on”. To turn it off, just untick the “**On**” box. As a general guide, it is best not to have more than 2 active at any one time to avoid confusion. Ignore the “**Preview**” box.



Once you have done this, click the “**OK**” button to return to the main screen. There you should see a rectangle surrounded by a pair of circles with a small rectangle between them. The large rectangle is the field of view of the CCD. The small rectangle between the two circles is the field of the autoguider. The circles show what could be visible in the autoguider if the CCD was rotated from north being up.



Examine each of the 4 objects you have chosen and decide which telescope/CCD combination would be most suitable. Things to watch out for are; is there a moderately bright star in the autoguider field of view; (we will talk about autoguiding in a later class) does the object fit within the field of view; what about surrounding objects, are they included; do you want them to be included? The example above shows the bright galaxy M81 and the field of view for a 16" telescope. In this instance, the galaxy barely fits in the field of the CCD. Also there is a good guide star, but it is right on the edge of the autoguider field of view. Finally, there is another galaxy just off to the left that does not fit in the field. In this case, it would be better to use a smaller telescope as shown below.



Now the galaxy fits comfortably with the field and the companion galaxy also. In addition, there are several stars within the field of view of the autoguider.

In your lab notebook list of all objects for the possible target list and your reasons for selecting/rejecting each one. For the four targets you selected for observation, record which telescope/CCD combination you think is most suitable, including your reasons for choosing that combination. Also record their J2000 RA and Dec for the next part of the lab.

You are now going to make an observing plan for the first CCD imaging observing lab. At this point you should switch to **TechJSkyCalc** to make the observing plan. You'll need to draft out a schedule of observations covering a total period of 3 hours for the date of the observing lab, which will be given to you by the instructor while you do this lab. Use TechJSkyCalc to pick which of your 4 objects will be the best to observe. Be sure to consider the rise and set times, airmass, and lunar conditions (Moon phase, angular distance between the Moon and your target, etc.). You will need to estimate how long it will take for you to set up the telescope and cool down the CCD, and take your calibration frames. Review the start-up procedures and imaging procedures in the course observing manual to make your time estimate. You will also need to estimate how long it will take at the end to close down. Then you need to consider how long it will take for you to get the telescope focused and pointing at each object. **Keep in mind that you should block out time for your lab partner to observe their object too.**

Finally, assume each image is of 3 minutes duration. You have to decide how many images of each object you can obtain (obviously the more the better) and in what order you will obtain them. (Initially all images will be monochrome, colour will come later!) For your target, record the optimal start time and end time based on airmass. Also record the times for the night when the airmass for target is greater than 2 and the times when airmass is greater than 3. That way you and your lab partner can prioritize whose target to observe first when you get to the telescope. You should also use this webpage, <http://irsa.ipac.caltech.edu/applications/finderchart/>, to make and download a finder chart. Record your schedule clearly in your observing/lab notebook, including pasting in your finder chart. You will be using all of this at the telescope soon!

Possible Targets

Galaxies	Emission Nebulae	Planetary Nebulae	Globular Clusters
M 31	M 8	M 27	M 2
M 33	M 16	M 57	M 15
M 74	M 17	M 76	
NGC 253	NGC 281	NGC 7008	
NGC 891	NGC 6888		
NGC 6946	NGC 7293		Open Clusters
NGC 7320	NGC 7635		M 11
NGC 7331			M 34
NGC 7497			NGC 869/884