Astronomy 50 Spring 2008

Lab 2: Telescopic Observations of the Moon, Planets, and Stars

In this experiment, we’ll use small, portable telescopes to observe Mars, Saturn, the Moon (if available), and stars. Here we’ll concentrate on observing and describing the unique features of each of these solar system objects; the nature of and physics behind these characteristics are discussed in the course.

I. Introduction to the 6-inch Newtonian Telescope

1. Mount the telescope as instructed:
   Note the metal rings on the mount. The rings open up so that you can insert the telescope. Be careful not to turn so far that the knob falls off. Close the rings, slide the nuts with knobs into the slots and tighten. As you mount the telescope, rotate the position of the eyepiece and finder scope to a comfortable viewing height.

2. Get familiar with the telescope and its parts:
   a. The front of the telescope is the end by the eyepiece holder. (Do you understand why the eyepiece is by the front of the telescope?) There should be a dust cover on the front that easily pops off. Be sure not to lose this cover, or any dust cover, such as those on the finder scope and eyepieces.
   b. Note that the telescope can swing about two different axes. These correspond to the two celestial coordinates (RA and DEC – these are like lines of latitude and longitude in the sky). We won’t concern ourselves with these coordinates, but you should be comfortable with the range of movement of the telescope in each direction.
   c. Locks and fine-adjust knobs. Each of these two axes has lock handles which you use to fix the telescope in position when you want. These handles are black. It should be obvious to you when you turn the handles when they are locked. To unlock, you only need to turn these handles a 1/2 turn counterclockwise. There are also black knobs which enable you to turn the telescope on these axes more slowly and with more control. These are the fine-adjust knobs. They are used when you have the telescope close to, but not at, the position you want it to be. These knobs are used, for example, to help center an object in the field of view (either in the telescope or the finder scope).
   d. Altitude axis and lock. The whole mount (everything but the tripod) can move on a third axis. This determines the “altitude” of the main axis of the telescope mount, i.e. the angle above the horizon (or above the level) that the axis points. A dial near the base of the mount gives the altitude setting. Check that it is set to about 42. If it is not, then adjust using the two screws near the base of the mount.
   e. Finder scope. The miniature telescope attached to the big telescope (and that looks like a parasite fish following a whale) is known as the finder scope and is used for getting
the celestial object of interest into the field of view of the telescope. The finder scope, with its low magnification, has a much larger field of view than the telescope. So, it is much easier to line up the telescope to get a particular object into the field of view of the finder scope than it is to get into the field of view of the telescope. Once you get the object into the field of view of the finder scope, you can adjust the position of the telescope using the fine-adjust knobs to get the object at the center of the cross hairs of the finder scope. Then, if the finder scope is properly aligned, that object should be in the field of view of the telescope.

f. Eyepiece holder and focus knob. The telescope will not already have an eyepiece. The holder for the eyepiece should be obvious. Notice that it has a little set screw to lock onto the eyepiece when you put it in. On the eyepiece holder right by the telescope is the focus knob. Every time you put in a new eyepiece you will need to re-focus.

g. Setting circles. Note the silver and the black dial with silver numbers. If the telescope were properly aligned (which you won’t do here), these dials would enable you to determine what celestial coordinates the telescope is pointing to and therefore would help you to find faint objects.

3. Install the Eyepiece

Insert a long-focal length eyepiece into the eyepiece holder and lock it down. A long focal length means that it has poor magnification, and therefore a large field of view. You will find it very hard to get an object in the center of the field of view using the highest power eyepiece, so you should always start with a long-focal length eyepiece. Once you have the object in the center of the field of view of the lower power eyepiece, then you can put in the higher power eyepiece.

4. Check the alignment of the Finder Scope

The alignment of the finder scope with the telescope is very important. If the finder scope is not well aligned, you will find it very difficult to find any object. So, this is a very important step. However, once the finder scope is aligned it will probably stay aligned for a long time. If the finder scope has been aligned within the last year, you should find that the finder scope IS already aligned and so this step will be only a check. But, you should always take the few minutes necessary to check that it is indeed aligned. You never know who the last bozo to mess with the telescope was, and you’ll save yourself a lot of agony if you discover the finder scope is misaligned before you try to use to center an object. Find a distant, bright, and easy to see object (such as a distant street light) and move the telescope so that the object is in the center of the field of view of the telescope (you’ll probably need to focus) and lock the axes. Then check the finder scope. If the object is not exactly in the center of the cross hairs of the finder scope then you need to adjust the finder scope. To do so, use the three set screws on the finder scope. You’ll need to loosen one screw to turn another.
5. Move to the desired object.
   Typically, this involves aligning the telescope to known celestial coordinates and then
   moving the telescope to the coordinates of the object of interest. Here, we’re only
   interested in looking at bright, easily located objects, so we’ll skip these steps (covered
   extensively in Astro 51). Use the star chart provided to find Saturn or Mars, and adjust the
   two axes of the telescope until the planet appears in your finder scope. Then, lock down the
   silver lock handles and use the fine adjust knobs to center the planet in the finder scope.
   The planet should appear in the field of view of the telescope. To switch to a higher-
   powered eyepiece, be sure to center the planet in the field of view of the telescope first.

II. Observations of the Moon

Before using your telescope, estimate the angular size of the Moon using the cross staff.

Point your telescope at the moon.
A. Take a quick look at the Moon through the low-power eyepiece. Then remove the eyepiece,
   screw a Moon-filter into the eyepiece, and put the eyepiece back in. Look at the Moon again.
   Comment on the purpose of the Moon filter.
B. Can you see the whole Moon in your eyepiece? Considering the angular diameter of the
   Moon is about ½° in the sky, what is the angular field-of-view with the eyepiece? Put in
   a high-power eyepiece (with moon filter). What is the angular field-of-view of the high-
   power eyepiece?
C. Study the Moon and take note of the shadows. In particular, note the lengths of the shadows
   as you look at different spots on the Moon. Where are the shadows the longest? Why?
   You may think about why outside lab. (Ask your instructor outside lab if confused).
D. Compare the terrain of the dark regions, the maria, to that of the light regions, the highlands.

III. Observations of the Planets

Use the star chart supplied to find Mars and Saturn. Point your telescope at these planets and
look at them in awe for as long as you like. Describe what you see. Look carefully at each and
take note of all features that you can identify. You can later refer to your textbook to identify all
that you see. Be sure to look as many of the planets as you can with both the low and high power
eyepieces. Draw pictures for your hand-in sheets.
IV. Observations of a Star
Point your telescope at a bright star. Try to identify the star from your star chart and record its name. Look at the star with both the low power and high power eyepieces. Note how the appearance of the star compares with the planets.

V. Other Stellar Objects
Try to observe each of the following objects (as time allows) and make sketches of your observations. Use your Star and Planet Locator to find each object. Observe the object first using the low-power eyepiece, then with a high-power eyepiece. You will probably need to readjust your telescope position after you replace the eyepiece.
A. Mizar – the second star from the end of the handle of the Big Dipper
B. The Beehive Star Cluster in the Constellation Cancer.
C. Globular Cluster M13 in the constellation Hercules.
D. Nebula in Orion (if early enough in year, such as early April evenings)

VI. Dismantling the Telescope
1. Remove the eyepiece and puts its lens cover(s) on and give all your eyepieces to the instructor.
2. Put covers back on: the front of the telescope, both ends of the finder scope, and on the eyepiece holder.
3. Take the telescope off the mount and carry it to the van. (Avoid putting telescopes on the ground.)
4. Take the mount off the pier.
5. Carry all the parts back to the storage room and help put them away.