10 - Celestron Telescope II: Operation

Purpose: Gain more experience setting up a 6" Celestron telescope, familiarize yourself with the software interface, and acquire an image with the CCD camera.
Due: At the end of class, answers to questions Q1–Q13 on your own sheet of paper, one Observing Log Sheet, and one image uploaded to Laulima's Drop Box.

Materials:

6" Celestron telescope and case	Laptop, power cord, and case
Tripod	Telescope Check-In/Out Sheet
Silver case of eyepieces, CCD, etc.	Observing Log Sheet

Information:

This laboratory exercise builds on the experience you obtained last class when you learned to set up and operate a 6" Celestron telescopes In this lab, you will set up the equipment, utilize the hand paddle, learn to use the CCD[1] camera and record a CCD image with the telescope. You will be required to load that image (clearly labeled) into Laulima's Drop Box.

IMPORTANT:
The list below is similar to the one you followed during last class. You are required to go through this list to remind yourself of what and what not to do:

- DO NOT LEAN ON OR APPLY FORCE TO THE OPTICAL TUBE (orange).
- DO NOT FORCE ANY KNOB BEYOND ITS LIMIT. If it won't turn or move, do not force.
- DO NOT TOUCH THE CORRECTOR PLATE (top glass in the tube).
- DO NOT TOUCH ANY LENSES, MIRRORS, or OTHER GLASS SURFACES.
- DO NOT BLOW ON THE LENSES.
- DO NOT LEAN ON THE TRIPOD.
- BE CAREFUL WITH CABLES
- WATCH WHERE YOU AND THE TELESCOPE ARE MOVING.

CHECKOUT:

Q1) Complete and sign the Telescope Equipment Check-In/Out Sheet, which includes a signature from the instructor or TA signature, who will then file the form. You will always complete and submit the Check-Out Sheet when using a telescope.

[1] CCD stands for "charge-coupled device" and is a type of detector.

Part I: Telescope Assembly and Alignment

The basic steps for assembling the telescope are below; there are differences from last time. Ask for help whenever in doubt:

1. Screw tripod leg spacer into tripod and extend lends to desired length. Make sure all bolts are hand tight.
2. Level tripod platform (bubble level included).
3. Carefully lift telescope onto tripod platform.
4. One partner hold telescope while other affixes it to tripod with the three bolts (hand tightened).
5. Verify the telescope is mounted properly (notch in arm should align with mirror-side plastic rim).
6. One partner hold the telescope while the other unscrews the quick-release lock. Carefully raise the telescope one-third (1/3) of the way up. Fasten it by screwing it hand tight.
7. Plug in the power cord to the telescope, wrap once around leg to secure it (if possible), and plug into outlet with the power-brick resting on a surface.
8. Remove the front cap and store. Do not touch the corrector plate.
9. Remove the end cap and store in the tripod leg spacer/accessory tray.
10. Insert eyepiece assembly (45° mirror plus 25mm eyepiece) at the back-end of the telescope.
11. Affix the finder-scope (do not over-tighten. This strips the screws. Make sure to turn off the finder-scope when not in use.)
12. Turn on the telescope (power switch).

13. We will do a simulated "One Star Align" on the hand-paddle. Instructions below:

Message	Instruction	What you should do…
Verifying Packages	Please Wait….	Wait
NextStar SE	Press Enter to begin alignment	Hit ENTER
Select Method	SkyAlign	Using the scroll buttons (6 and 9) select type of alignment method to use. If working with: a) stars at night, use SkyAlign, One Star Align, Two Star Align, or Auto Two Star. b) Sun, Moon, or planets, use Solar Sys. Align For now, use One Star Align. Choose your method by selecting the ENTER button.
Time hh:mm:ss	Enter the current time	Using an accurate clock (computer clock or GPS clock) enter current local time with the numbers on hand control.
Select One	Select AM or PM	Use Scroll buttons (6 and 9) to select AM or PM; then ENTER.
Select One	Select whether your site follows Daylight Saving or Standard Time	Select Standard Time since in Hawai`i we do not follow Daylight Savings Time. Hit ENTER.
Select TimeZone	Select the time zone you are observing from.	Using the Scroll buttons select Hawaii USA and hit ENTER.
Date mm/dd/yy	Enter the current date	Using the numbers in the control, enter the current date. For November 24, 2015, enter 112415. Hit ENTER when done.

14. We will pretend that we have identified a single star in the sky (e.g. Sirius in Canis Major, Pollux in Gemini, etc.) and use One Star Align. Focus knob is at the back-end of the telescope.

    Q2) On your separate sheet of paper record the name of the star you are using during your simulation and the object in the room you are identifying as your "star." Follow the instructions below to align on it.

Message	Instruction	What you should do …
Select Star 1	Look around the "sky" to identify a "star" (simulate this since you are in the classroom unable to look at the sky).	Use the scroll buttons (6 and 9) to cycle through the names of the stars available in the list. Hit ENTER.
Center _____ (where the blank is the name of the star selected)	Using the arrows that move the telescope up-down-right-left, simulate centering your chosen "star" in the finder-scope.	Look through the finder-scope. Use the red light in finder-scope to center the "star" and turn off the light when you are done. Hit ENTER when done.
Align _____ (where the blank is the name of the star selected)	Set up the MOTOR SPEED to a low speed. Using the up-down-right-left buttons, simulate centering your chosen "star" in the eyepiece.	Look through the eyepiece. Slowly bring the "star" in the center of the telescope. Hit ALIGN when done.
Align Success - Starpointer off	You are done.	Verify that the red light in the finder-scope is off. Your telescope thinks that it is pointing at your chosen "star." From now on, it should be able to move to other stars, solar system object, or deep sky objects (nebulae, cluster, galaxies, etc.) automatically. If you listen carefully, you will hear the telescope tracking.

15. Proceed to specific lab tasks.

QUESTIONS/TASKS:
Answer the following questions (Q3–Q9) on your separate sheet of paper:

Q3) Describe what happens when you hit the SOLAR SYSTEM (button 1) and follow the prompts.

Q4) Explain how you can change the tracking rate from Sidereal to Solar.

Q5) What information does View Time-Site from the MENU item provide?

Q6) Describe what happens whey you hit STARS (button 2) and follow the prompts.

Q7) Describe what happens when you hit SKY TOUR (button 5) and follow the prompts.

Q8) Describe what happens when you hit DEEP SKY (button 3) and follow the prompts.

Q9) Provide instructions on how to move the telescope at its slowest speed.

Part II: CCD Camera

The following instructions will guide you to taking a digital image, which you will have to sketch the object from the eyepiece (Q10) and upload the digital image to Laulima (Q11).

1. Remove the 45° diagonal and eyepiece. Safely store the 45° diagonal.
2. Insert the flip mirror. Be very careful to secure it; do not twist it without loosening the screws. The 45° port will have the eyepiece and the other (straight back), the CCD camera.
3. Make absolutely sure that tracking is off.
4. If the telescope slips off target during acquisition, it may be unbalanced with the heavy assembly on the back. In this case, as a team, carefully un-screw the quick release and slide the telescope so that the back is as close to the mount arm as possible (in the notch) and hand tighten.
5. Look through the eyepiece and focus on an object far away in the lab room. The focus knob is at the back-end of the telescope.

   Q10) Record this observation on the Observing Log Sheet provided.

6. Connect the CCD camera to the computer. Load up the iCAP software to control the acquisition of images with the CCD camera.
7. Send the image to the CCD camera by flipping the mirror. Adjust the focus as needed so that the live image is as sharp as possible. You can do so either with the focus knob or by moving the camera in and out of the flip mirror housing very carefully.
8. Flip the mirror again. Loosen the eyepiece and gently pull the eyepiece out so that the image is sharp. Secure the eyepiece. Do not change the focus of the telescope with the focus knob. Verify that the image on the CCD and on the eyepiece are both in focus.
9. Capture an image of the object you are pointing.

   Q11) Save the image and upload to *each group memb*er's Laulima's Drop Box with a suitable name. Record the name of the file and your UHH username.

   Q12) In the circle provided in the Observing Log Sheet (Q10), draw a rectangle that represents as closely as you can the area imaged by the camera. Clearly label the rectangle.

SHUTTING DOWN:

Students will properly power-off the telescope, disassemble, and return all pieces to their original storage place (including caps). This has to be done very carefully and in the correct order. The instructor and TA will be there at all times to help.

Q13) Have the instructor or TA initial your answer sheet that the equipment is properly stowed and that you may leave.