Union College **Fall 2016**

**Astronomy 51: Introduction to Astronomy**

**Lab 5: Astrophotography;**

**Using the Celestron C6 Telescope as a Lens for the Digital Camera**

A. Gather your equipment:Telescope and Mount, Camera and tripod, T-ring adapter, Flashlight, low-power eyepiece, and star-and-planet locator.

1. In warm well-lighted room get familiar with your equipment.

a. Refresh your memory (from lab #2) about the operation of the camera.

 How do you set the camera on manual?

 How do you turn off the flash?

How do you set the shooting mode for “quick response remote” (Touch the ‘menu’ button, and then in the left column select the third option, and then in the right select ‘shooting mode’ and then scroll to either ‘remote’ setting and click ‘OK’).?

 How do you set the exposure time?

b. Follow the instructions below to learn how to attach the camera to the telescope:

 i. Take off the camera lens by depressing the button right next to the lens housing and turning the lens clockwise. Then attach the T-mount adapter – note that it attaches and locks by turning it ¼ turn *counter*clockwise. NOTE that the mount may not lock in, properly; if so, start over with a different rotational position. Then, remove the adapter from the camera and keep it, and the camera, ready.

 ii. Note that the telescope eyepiece holder is composed of the following parts. The outer most part and base is attached directly to the housing of the telescope; a silver collar screws into the outer part; and a number of rings and a black collar all screw into the silver part. Unscrew just the black collar.

 iii. Screw in the T-mount adapter where the black collar was. BUT, be careful that it goes in straight and do not tighten it too hard – this attachment has gotten stuck many times in previous labs.

 iv. Attach the camera to the T-mount, but NOTE that to attach the camera to the T-mount, you must turn the camera in the opposite direction that you turned the T-mount to screw it into the telescope. So, if you keep turning the camera, you will actually be loosening the T-mount from the telescope – try to lock the camera into the T-mount while not letting the T-mount loosen in its threads.

c. Take your camera off the telescope and pack it safely into the camera bag.

Carry your equipment (camera, telescope, + telescope mount) to the van. (Your instructor will carry the eyepieces and flashlights.)

**B. At the Park:**

1. Install the telescope mount onto the pier and install the telescope onto the mount. Don’t worry about the alignment with the N pole. Aim the telescope in the general direction of the Moon, and rotate the telescope in the mount (if needed) so that the eyepiece holder is at your eye level. Insert the low-power eyepiece and use the Moon to check the alignment of the finder scope (and correct it, if needed).

2. From the telescope, remove the eyepiece and the black collar in the eyepiece holder (and put both items safely in your pocket), and attach the T-ring adapter to the silver collar (remembering not to tight too hard). Attach the camera to the T-ring (***being very careful not to drop it***). Set the camera to “manual” and “quick response remote” shooting mode.

3. Focus the telescope on the Moon while looking through the viewfinder of the camera. Set the exposure time to as short as possible (1/4000th of a second). Look at the image. If it can be brighter, take a slightly longer exposure. Keep taking slightly longer exposures until the image starts to look over exposed. NOTE: the Moon is easy to focus on, but other celestial objects will be too faint to see in the camera’s viewfinder. So, try to **keep the telescope’s focus fixed for the rest of the lab**.

4. Move the telescope to aim at the **double cluster**, using the finderscope to set the field of view (the stars will not be visible in the viewfinder of the camera). Lock the axes and take exposure times from ½ second to 5 seconds.

5. Move the telescope to aim at the **galaxy in Andromeda**. Try exposures from ½ second to 10 seconds.

6. If it is high enough in the sky, try getting some similar exposure of the **Pleiades**. Try exposures from ½ second to 5 seconds.

**C. Dismantle and pack up ALL the equipment and return to the van. In the classroom, download your photos onto your flashdrive.**

Lab Report: Be sure to name your lab partner(s) and to write and sign the honor code affirmation.

1. Write a paragraph outlining how the camera is attached to the telescope, and the role that the telescope and the camera play. Recall lab #1 in which you learned that the objective focuses the light, and that a professional telescope then places a detector (film or CCD) at the focus. What is the telescope doing and what is the camera doing?

2. List the date of observation and describe observing conditions.

3. Give filenames to your images which include you and your partner’s names and that indicate what the photo is of. Upload your photos to the lab Nexus page.

4. Comment on your photos of the Moon:

a. How clearly did your photos come out? Which exposure worked best? Did the “auto” setting do a reasonable job?

b. Describe the different types of surface on the Moon? How are they different?

5. Comment on your photos of each object. In each case...

a. what exposure worked best?

b. describe the object, as it appears in your best photo of it.

6. Which objects did your attempts to photograph fail and why? Too little light? Too much streaking? Not in the field of view? Out of focus? Comment on the difficulty posed by the combination of the faintness of the objects and the streaking of the pictures. To make the objects visible you need long exposures, but that exacerbates the streaking problem. How, then, do professional astronomers get such pretty photos? Answer: by using telescopes with a motor which rotates the RA axis at the same rate as the sky. Comment on the need for this for astrophotography. Also, consider, then, the importance of getting the alignment with the N. pole correct, as this is needed in order for movement along the RA axis to actually move the telescope in exactly the direction that the stars move in the field of view.

7. Open your image files on your computer. Can you zoom in to get a magnified image? Considering the ease of magnifying images on the computer, discuss whether the “magnification” of a telescope is important to a professional astronomer.

8. Discuss, briefly, the different modes of using a telescope – viewing with the eye vs. taking photographs. Which mode do you think professional astronomers use for their studies? How does this match with the image often portrayed, such as in the comic below?

