Physics 344 Lab 2
Visual Observations with the 0.5 m Telescope

Take Data: September 14−19 (weather permitting, we will probably need longer)
Due: Thursday, September 27
Text Reference: Chapter 6

Purpose: For several hundred years, from the first use of a telescope for astronomical observations in 1609 until the introduction of astronomical photography in the mid 1800's, the human eye was the only detector available at the focus of a telescope. In this lab we will use the 0.5-meter telescope to view a variety of objects, and explore the limits of angular resolution and brightness that can be achieved. In addition, we will learn the mechanics of operating the telescope for future observations.

Note: For the visual observations, bring drawing paper, a pencil and an eraser. It can help to bring a flashlight for observations with the telescope. It can be cool at night in the dome - dress appropriately! Observations will not be held if it's cloudy or raining.

In your report on your observations, you should include the date and time of all observations, and the prevailing weather and sky conditions. Your grade will depend in part on how neat and accurate your sketches are.

Procedure: Follow all of the directions for observing with the 0.5-m telescope carefully. Be sure to note the cautions about weather conditions! *You* are responsible for protecting the telescope. Also be careful about bumping into things in the dome and injuring yourself! Please restrict your observations with the telescope to the following list until everyone in the class has had an opportunity to complete the lab – then you are welcome to observe as much as you want. You should work in groups of no more than three for this lab, and make sure that each person has a chance to carry out each of the observing tasks involved with operating the telescope. Be sure to note on your report who your observing partner(s) was/were.

1) **Setting up the telescope:** Refer to the handout for operating the telescope and follow the directions for starting up. There are no encoders on the axes of the telescope mount to tell the computer where the telescope is pointing. So an important part of starting up is to use the zenith and then a bright star to synchronize the telescope pointing in *The Sky* with where the telescope is actually pointing. This procedure ends with you using the *The Sky* to slew the telescope to a bright star, which you center in the finder and then in the main field of view using the joystick. In *The Sky*'s menu, you then synchronize the computer with the telescope. Then slew (under computer control) to another bright star to verify that everything is working correctly. It is best to pick two stars in the same half of the sky (east or west), to avoid the telescope reversing over the pole. Record in your report the stars that you used. Currently, Arcturus, Vega, Deneb, and Altair are reasonable choices, but you can use any bright stars that you can securely identify. Do not use the Moon or planets unless you are desperate.
2) **Planets:** Point the telescope to either Jupiter (early in the evening), Saturn, Mars, Neptune, or (later in the evening) Uranus and make a sketch of what you see. Experiment to find the optimum

magnification. Note the color of the planet and any markings on its surface. Can you see any moons? If so, sketch their location with respect to the planet.

3) **Binary Stars:** Observe the binary star γ Delphinus (SAO 106475) with the 38mm, 20mm, and 10mm eyepieces. The two stars of this system have magnitudes 4.5 and 5.5, and are separated by 9.6 arc-sec. Which eyepiece most clearly shows that there are two stars? Calculate the magnification for each of the three eyepieces. Can you detect differences in brightness or color between the two stars? Do the two stars form a line that is more nearly east-west or north-south (use the *Telescope/Motion Controls* function to offset 10 arc-seconds to determine the orientation)? Next use the eyepiece that seems best and try the closer double ρ Herculis (SAO 66001), magnitude 4.6 and 5.6, 4.1 arc-sec separation or 65 Psc (SAO 74295), magnitude 6.3 and 6.3, 4.4 arc-sec separation. If the seeing is good and you can resolve these stars, try the challenging ζ Aqr (SAO146107), magnitude 4.3 and 4.5 with 1.8 arc-sec separation. Finally, look at Albireo (SAO 87301), one of the prettiest double stars in the sky. Note the color and relative brightness of each star. Why are the relative brightnesses of the pair the opposite of what you would expect from their colors? Can you explain the apparent anomaly?

4) **Messier Object:** Pick one object from the Messier List (Recommendations: M57 – the Ring Nebula; M13 – a globular cluster; M31 – the Andromeda Galaxy) and observe it. (Make sure that the object is above the horizon when you attempt to observe it!) Choose a magnification appropriate for the object. Sketch and describe what you see.

5) **Open Cluster:** Select either the 20mm or the 26 mm eyepiece. Point the telescope to the bright star SAO 51001 in the open cluster M39. Center the star in the eyepiece, then offset to GSC 3594:2204. You should see the field of this cluster as shown in the attached charts (the field will be reversed, depending on which side of the pole you observe the object). Work your way through the following table of stars. You may not be able to see the faintest ones! Comment on your observations of each star. Compare your limiting magnitude with that calculated in class for this telescope.

Star	Magnitude
GSC 3594:2204	9.6
GSC 3594:1276	10.8
GSC 3594:2331	11.0
GSC 3594:212	11.6
GSC 3594:86	12.3
TP C	12.7
GSC 3594:384	12.9
GSC 3594:2539	13.3
TP A	13.6
TP B	14.0