

Name: \_\_\_\_\_

CWID: \_\_\_\_\_

Section: \_\_\_\_\_

## Introduction

### Objectives

This lab is designed to help you understand the Sun's apparent motion in the sky over the course of the year. In Section 2 you are asked to answer some questions about the Sun's the apparent motion with the help of a diagram showing the Sun's position as seen from Fullerton. In Section 3 you will make observations of the Sun over several weeks and compare your observations to your answers from Section 2.

### Materials

Your eyes, a pencil or pen and this lab handout.

### Submission Deadline

You must give your completed lab assignment to your TA before your final lab session. However to complete this assignment you must start it **as soon as possible**. If you leave it too late to start you will not have enough time to complete it. It is *strongly suggested* that you complete this lab **before the second mid-term exam**.

## Understanding the Motion of the Sun

Figure 1 illustrates the sky as seen from Fullerton. It shows that the Sun's daily path across the sky (white line) is longest on June 21 and shortest on December 21. In addition, on June 21, which is called the summer solstice, the Sun reaches its maximum height in the southern sky above the horizon at about noon. Over the six months following the summer solstice, the height of the Sun at noon moves progressively lower and lower until December 21, the winter solstice. Thus, we see that the path of the Sun through the southern sky changes considerably over the course of a year.

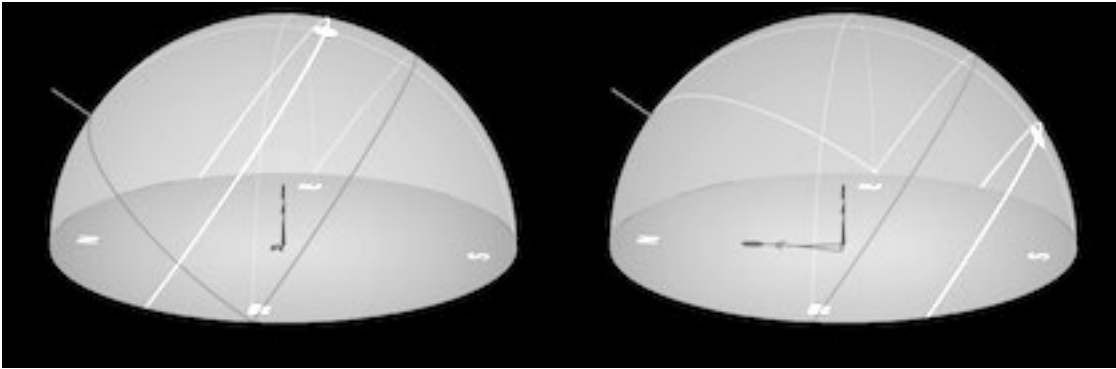


Figure 1: In the left image, the white line shows the path of the sun on June 21. In the right image, the white line shows the path of the sun on December 21. A white disk marks the position of the sun around noon.

1. Is the Sun ever directly overhead in Fullerton? Explain your answer.

2. According to Figure 1, in which direction would you look to see the Sun when it reaches its highest point in the sky today?

**Circle one:**      east    southeast    south      southwest    west

3. If it just after the winter solstice, how will the height of the Sun  at noon change over the next several months?

**Circle one:**      increases    stays the same    decreases

4. During what time(s) of the year would the sun rise:

(a) north of east?

(b) south of east?

(c) directly in the east?

5. Does the Sun always set precisely in the same location throughout the year? If so, explain why. If not, describe in what way the direction of where the Sun sets changes throughout the year.

## The Sunset Point

The motion of the Sun on the celestial sphere can be easily detected in observations of the sunset or sunrise. In this section you will record the point of sunset three times in a month and compare your observation to the answers to the question in the previous section. On your first evening observing the sun, you will need to make a sketch of the horizon from your observing location, so make sure you go out 20 minutes before sunset to give yourself chance to complete the sketch before your first observation. The sunrise and sunset times for September and October in Fullerton are given in Section 4 of this lab handout.

Choose an observing location with a clear view of the western horizon. All your observations must be made from exactly the same point, so make a note of the location you chose below. Good places to observe on campus are from top of the Nutwood Parking structure or the outside west staircase on the top floor of McCarthy Hall.

### Observing Location:

Make a sketch of the horizon from your observation location on page 5 of this lab packet. To do this, first draw a line in the middle of the page indicating the horizon (you can rotate the page sideways to give yourself more space). Now locate two or three easy to identify landmarks on the horizon, such as water towers, radio masts or distant buildings. You will be measuring the position of the sunset relative to these objects, so choose some objects near to and either side of the position of the Sun near sunset time. Mark the location of these objects on your diagram. Now, using your hand as an angular measuring device, measure the angular separation between the distant landmarks you have chosen. Mark the angular separation of these objects on your diagram.

Now wait for the Sun to set. Just as the Sun is setting, mark on your drawing the point where it goes below the horizon. Label this point with the time and date of the observation. Now, using your hand as an angular measuring device, measure the location of the sunset with respect to a convenient object on the horizon chosen as reference point. Mark this point on your drawing and report the angle, together with the time and date, in the first row of the table below. Mark L or R to indicate if the angle is to the left or to the right of the landmark.

After one week, return to the same observing location to measure and draw the location of the sunset point in the same way as above. After one more week has passed, make a third and final observation. Record your answers in the table below and on your diagram.

	<b>Date</b>	<b>Time</b>	<b>Landmark</b>	<b>Angle (L or R)</b>
Observation 1				
Observation 2				
Observation 3				

When your observations are complete, answer the following questions:

6. Has the sunset point moved along the horizon? In which direction?
  
7. Why did the sunset point move and why in that direction?
  
8. What is the average daily rate of motion (in degrees per day)?
  
9. Are your observations consistent with your answer to question 5 in Section 2? Comment on your answer.

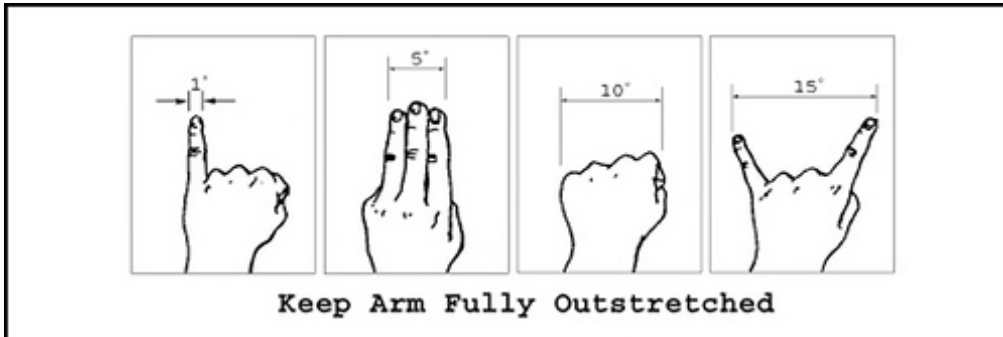


Figure 2: Angular measuring device

## Horizon Diagram