Name	
Partner(s)	
Date	

Grade		
Category	**Max Points**	**Points Received**
On Time	5	
Printed Copy	5	
Lab Work	90	
Total	100	

Observings of The Sun

1. Introduction

The Sun is our prototype of a MAIN SEQUENCE star, and it is has provided us with much of what we know about stars in general. In addition, the Sun is the dominant object in the sky, and many of its characteristics are among the most interesting phenomena in astronomy. Examples are SUNSPOTS, PROMINENCES (huge arcs of material suspended above the surface of the Sun by magnetic fields) and SOLAR FLARES. Prominences can be seen in absorption on the disk of the Sun as long, dark lines called FILAMENTS.

This laboratory is well equipped for observations of the Sun, and it will provide students with a chance to make “real time” observations of the Sun in an observatory setting. The Sun is an interesting object to study in a telescope, because it changes from month to month and day to day. Sometimes it even changes from one minute to the next. Observations this year will be made at the time of SOLAR MINIMUM, when surface features like sunspots are rare. Try and check out the Sun again in 5 years, when it has swung around to the maximum state.

A general rule is to never directly look at the Sun through a telescope. Even looking directly at the Sun with the naked eye can damage the eye. Sunlight intensified through a telescope can cause permanent damage to the eye. The telescopes used in this project are perfectly safe, due to carefully engineered filters employed to reduce solar light to safe levels. If you are interested in solar observations of your own, either *use a telescope to project the Sun's image on a screen, or buy a special solar telescope. Make sure to get a good one, such as that used in this exercise.*

There are two types of observation which will be made in this week's project. Observations will be made at the eyepiece of a specialized telescope for solar observations called a **PERSONALIZED SOLAR TELESCOPE** made by the Coronado Filters Company. More will be said about this telescope in Section 2. These observations will be made during the regular lab period, although students are certainly welcome and encouraged to return for subsequent observations.

Additional observations will be made with solar data from research observatories available online on the internet. Real-time, or near-real-time images of the Sun are available from the **NATIONAL SOLAR OBSERVATORY** at Sunspot, New Mexico (http://www.sunspot.noao.edu) and the **SOHO** spacecraft approximately a million kilometers out in space in the direction of the Sun (http://sohowww.nascom.nasa.gov) .

2. Daly Observatory Images

During the next week, download an image of the Sun in hydrogen alpha from the National Solar Observatory or an ultraviolet image of the Sun from the SOHO spacecraft. Examine these images and compare them with those you made on the rooftop. You can also examine white light images from the NSO or Big Bear, or the SOHO spacecraft. Accurately sketch any important features and give each an appropriate label. Make sure to record the date and time of your observations, as you will need this information for the final section of this lab. **You will be required to do this 4 times over the next week. If you use Images from different sources, make sure you have properly rotated each image so your sources match orientations.**

DATE, TIME AND SOURCE:

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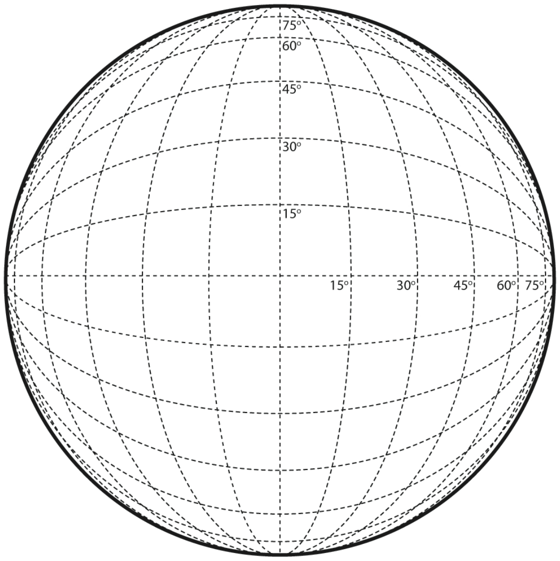

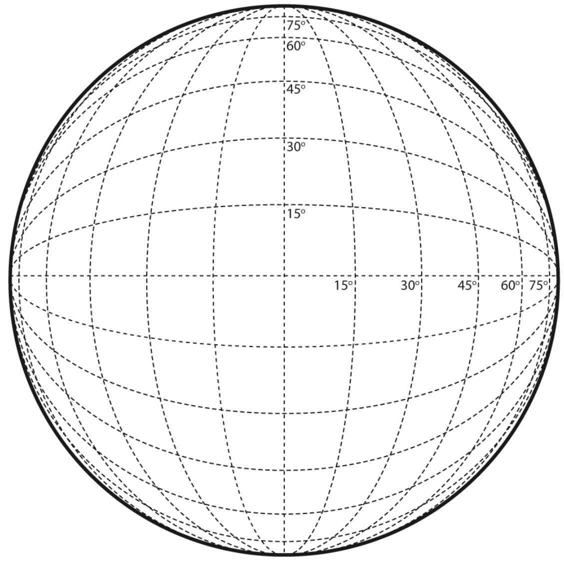

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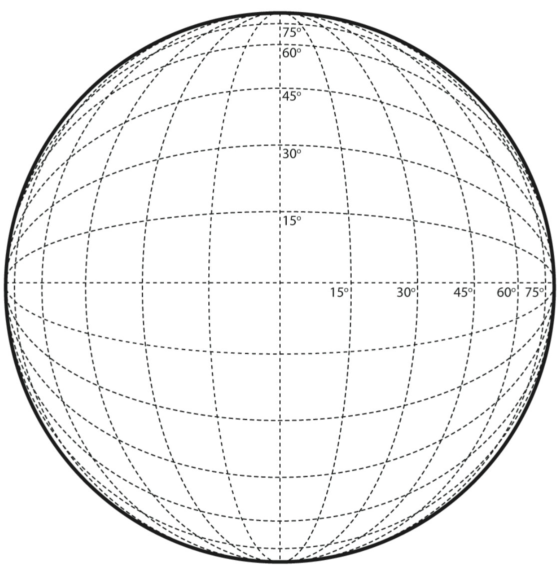

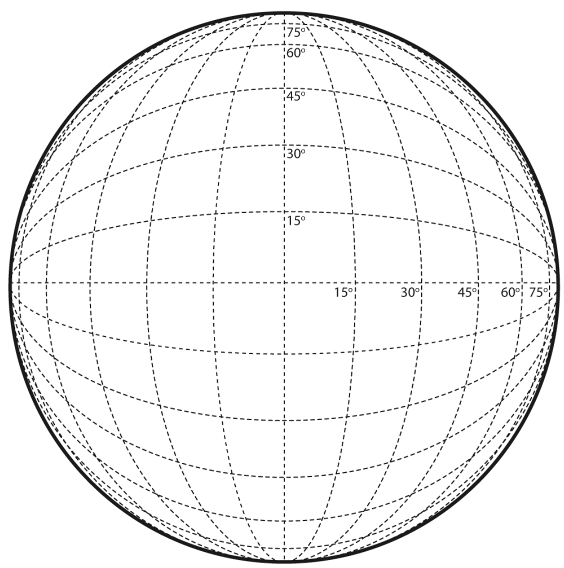

3. Measuring Solar Rotation

If you pick a feature on the solar surface, such as a sunspot or filament, and watch it over a period of several days, you will see it move across the solar disk from east to west. By measuring the rate of change of the feature with respect to time, you can determine the angular speed of rotation of the Sun, and thus its period.

The steps involved in measuring the angular speed of the Sun are as follows.

1. For each day, note the location of a solar feature that was visible for a majority of your observations. This feature should follow a constant line of **LATITUDE** on your images.
2. Record **LONGITUDE** (θ) of the feature in Table 2 found below. Use negative numbers for θ if the feature is to the left (east) of the center and positive values of θ if it is to the right (west). For many of your measurements you will need to estimate the position between grid spaces. Do the best you can.
3. Make a graph in which you plot theta as a function of time in days from the start of your observation. Each observation will be separated by 1.00 days if you make your observations at the same time each day. If you make observations at different times (i.e. at 2PM one day and 9 AM) the next, correct your data appropriately.
4. **To account for the earth's motion between your observations, add 1 degree per day to your longitude measurements before you plot them.** This needs to be done to effectively measure the sidereal rotation period of the Sun.
5. When you have plotted all of your data points, draw the line through them. The slope of this line will be the angular rotation speed of the Sun, and will have units of degrees/day. This final value for the rotational speed of the Sun can be denoted by the variable **W**, and has units of degrees/day. Do all of your calculations in the space provided.
6. Finally, the rotational period **T** of the Sun is given by

$$T = \frac{360^{\circ}}{W}$$

If there are several features on the surface of the Sun, see if you get the same value for W and T for features at different solar latitudes.

TABLE 2 – SOLAR FEATURE POSITIONS

DATE AND TIME OF DAY	THETA(DEGREES)	CORRECTED THETA

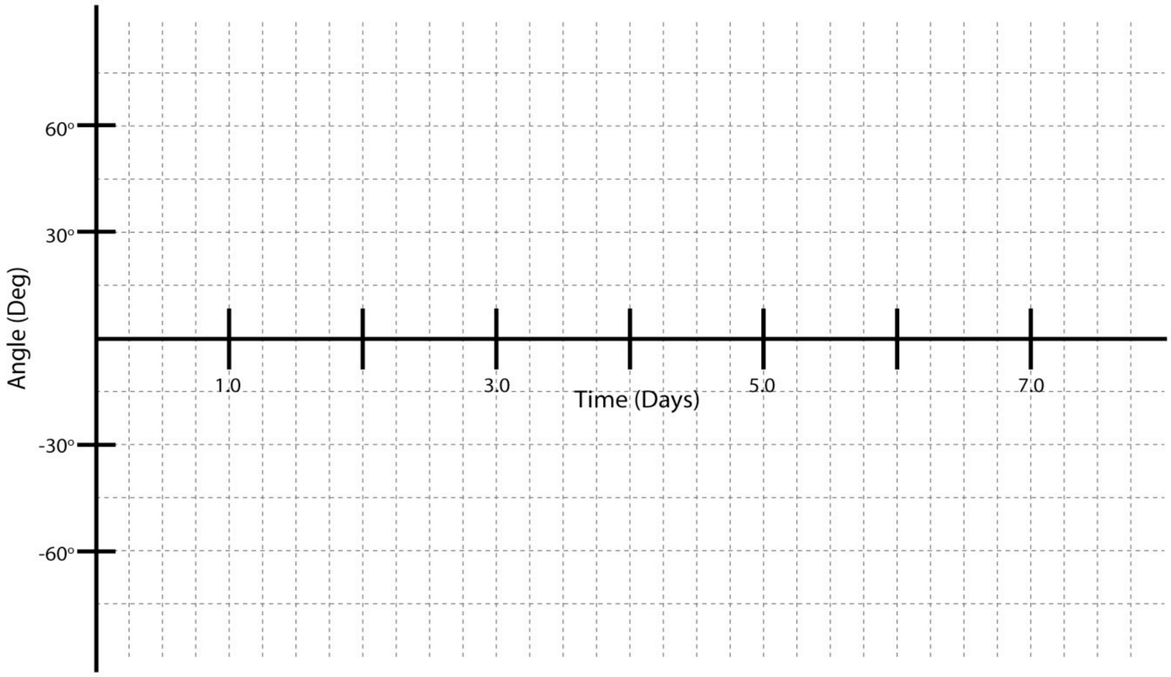

FIGURE 3 – SOLAR FEATURE PLOT

TABLE 3 – SOLAR ROTATION CALCULATION

SLOPE	
T (PERIOD)	