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

Physics 115

UW–Eau Claire

**Solar Motion Simulator (SMS) Activity**

# Learning Objectives

1. **Describe the path of the Sun in the sky on a daily basis.**
   1. Use the SMS to model the motions of the Sun in the sky on a daily basis.
   2. Predict the position of the Sun in the sky at different times of day at your location.
      1. Compare these to the actual sunrise/sunset times?
2. **Understand how sunrise/sunset times (and consequently, the “length of a day”) vary throughout the year.** 
   1. Use the SMS to estimate the sunrise and sunset times at different times of the year.
   2. Predict sunrise/sunset times at different latitudes at different times of the year.
3. **Describe how the elevation of the Sun at noon changes depending on the season and latitude.**
4. Compare the path of the Sun observed from the southern hemisphere to that observed from the northern hemisphere.
   1. Still east-to-west

# Part 1: The Sun’s Daily Path

Objective: become familiar with how to use the SMS.

**Simulate the path of the Sun on the spring equinox (March 20ish):**

1. Observer’s Latitude: Swivel the Horizon Disk so that the southern tip of the disk lines up with an observer’s latitude of 30º N. (At UWEC, “Solar Arm” will be high in the “sky”.)
2. Solar Declination (time of year): Set the Sun Slider (representing the Sun) to be at a solar declination of 0º for the spring equinox.
3. Time of Day: (we’ll simulate one full day)
   1. Start with the Solar Arm rotated so that the “Sun” is just after midnight (say, 1 AM) as indicated by the “Time of day” marking on the bottom of the Solar Arm. Note that our Sun is *below* the horizon, so it’s night time for our observer.
   2. Slowly rotate the Solar Arm forward in time until the Sun crosses the plane of the Horizon Disk (going from night to day: “sunrise”). In this specific case, sunrise should happen at 6 AM when the Sun has an azimuth of 90º (due east).
   3. Rotate the Solar Arm so that the time is 12 (noon). The Sun should have risen far above the Horizon Disk. At this point, it is at its highest point in its daily path. Note that because the Sun is above the Horizon, it’s *day*.
   4. Fast-forward time by moving the Solar Arm to when the Sun crosses the Horizon Disk again. This time, since it’s moving from above the horizon to below the horizon, it’s *sunset*.
   5. Fast forward time to just before midnight (say, 23 or 11 PM). The Sun is now almost as far below the Horizon Disk as it will get, which should make sense: it’s approaching midnight.

Will the Sun always be the highest in the sky at noon? Justify your answer.

Which direction does the Sun move in the sky (east-to-west or west-to-east) Can it go the other direction?

# Part 3: Dependence of the Sun’s Peak Altitude on Latitude

The goal for this part is to see how the angle of the Sun at noon varies at different latitudes.

1. Put the Solar Arm in the noon position and keep it there. Keep the solar declination at 0º (corresponding to either equinox). Rotate the Horizon Disk to the following latitudes and fill in the table below.

|  |  |  |
| --- | --- | --- |
| Approximate observer’s latitude | Observer’s Location | Approx. Angle of Sun above horizon |
|  | North Pole |  |
|  | Eau Claire, WI |  |
|  | Quito, Ecuador |  |
|  | Sydney, Australia |  |
|  | South Pole |  |

Is the Sun always in the southern hemisphere at noon?

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| City | Approx. Latitude | Approx. Date | Approx. Noon Elevation | Sunrise Time | Sunset Time | Length of Daylight (hrs) |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
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