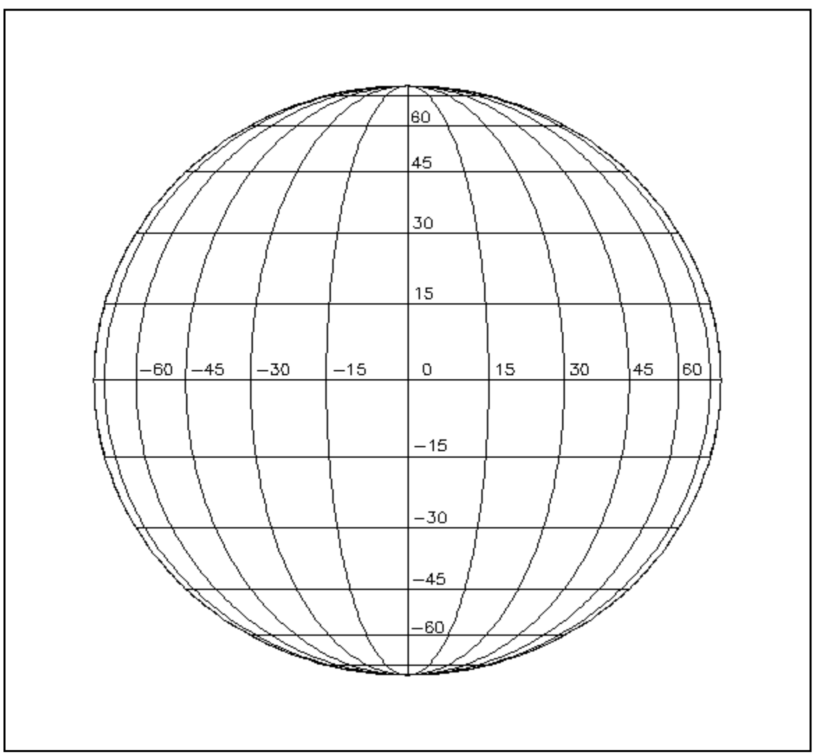
One of the first things that Galileo noticed in 1609 when he started watching sunspots on the sun, is that the spots do not stay in one place. Over the course of days and weeks, they move from west to east. The reason this happens is because the sun rotates, like the Earth and other bodies in the solar system. By carefully watching the positions of sunspots, and by using a device called a Sunspotter, you can determine how many days it takes the sun to spin once around on its axis. Here's what you do, but you can alter these steps once you gain more experience with the equipment and with the calculations!

Step 1: On your Sunspotter, replace the white screen with the pattern below. The diameter of the circle grid should be enlarged or reduced until it is 85 millimeters across.

Step 2: Visit the website at the Mees Solar Observatory (http://www.solar.ifa.hawaii.edu/MWLT/mwlt.html) and check if there are any sunspots to be seen today…or just go outside, set up the Sunspotter and see for yourself!

Step 3: Draw the locations of one or more sunspots on the pattern on Day 1 and note the time. Repeat the sketching in two to three days using a different color pen/pencil.

Step 4: Using the grid marks and the spot location changes, calculate how many days it would take the spot to move completely around the sun.
Hint: The vertical curved lines are lines of longitude on the sun with 15-degree intervals.



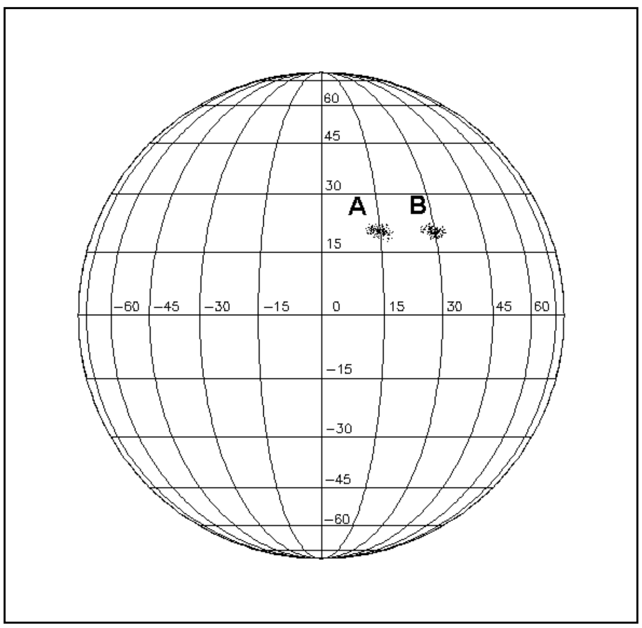
Extra Credit Problem

This activity uses the following math concepts:

1 – Making careful observations to extract quantitative information
2 - Addition and subtraction of time units
3 - Time conversion from hours to days
4 – Working with angular measures
5 - Extrapolation

Additional website: http://solar-center.stanford.edu/spin-sun/spin-sun.html

The challenge in this problem is to find sunspots that are large enough that they persist for at least the duration of the observation, but are small enough that they give an accurate sense of where the spot is located. It is not always best to use the largest spot you find to do this calculation. Suppose the student produced a drawing like the one below:



The spot moved from location A at 10 AM on Day 1 to location B at 2 PM on Day 2 at 1 PM.

The angular distance traveled was 15 degrees.

The elapsed time between the two observations was 24 + 4 = 28 hours.

You calculate the rotation time of the sun as follows:

If it takes 28 hours for the spot to shift 15 degrees, it will take (360/15) = 24 times longer for the spot to shift a full rotation around the sun. That equals 28 hours x 24 = 28 days.

The Extra Credit project is to realize from enough data that the sun takes longer than 28 hours to rotate at the poles when you track sunspots at the higher latitudes, and it takes slightly less than 28 days if you track spots traveling along the equator. In fact, near the poles the time is 30 days and near the equator it is near 25 days. The sun can do this because it is not a solid body. It is made of gas, and this gas rotates 'differentially' because there is no rigidity to keep everything in step.