ASTR 100/1 Lab 5: Motions of the Sun

1. The Sun's Position at Noon

In groups of 2-3, follow along the steps demonstrated by the instructor.

a. Set up Stellarium

   i. Open the Location window and set the location to Amherst Center.

   ii. Open the Sky and Viewing Options window.

      a) Under the "Sky" tab,

         1) Set "Stars Absolute Scale" to 0.0 (or the lowest it will go)

         2) Uncheck "Show Atmosphere"

         3) Under "Projection", select "Cylinder"

      b) Under the "Markings" tab,

         1) Check "Azimuthal Grid"

         2) Check "Meridian"

   iii. Zoom all the way out while staying centered on the South horizon point.

   iv. Open Date/Time window and change the date to 21 September.

   v. Find the time (to within a few minutes) when the Sun is crossing the meridian (azimuth $0°00'$ or $180°00'$, running from due north to due south). What time is it? What might cause it to **not** be 12:00 noon?

b. Plot the **altitude** of the Sun as it **crosses the meridian** on the 21st of each month throughout the year.

2. The Sun's Path during the Day

Watch the Sun's path across the sky on 21 June and 21 December (the summer and winter solstices) over the whole day. On these dates, the Sun reaches its extreme north and south positions respectively. You can advance time faster or slower (or reverse it) using the and buttons in the bottom menu bar, or by **pressing the L and J keys**. Discuss what you see in your groups and answer the following questions:

a. The Sun does not always set due west! What azimuth range do you see it setting over?

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b. The Sun doesn't approach the horizon going straight down! Sketch what you see in Stellarium. Is the angle the same at both solstices?

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c. What is the Sun's azimuth at sunset on the equinoxes (22 September and 20 March)? (If there is "landscape" in the way, look for when the Sun's altitude is near zero.)

d. Suppose there are mountains rising to an altitude of 10° to the west. How would that affect the azimuth of sunset (when the Sun passes behind the landscape, including mountains) on the equinox?

3. The Sun's Position at Different Latitudes

Work in pairs and have one person do each part. Then, plot the Sun's noontime altitude throughout the year for both parts in the grid. (Make sure to record the values for the quiz.)

Note: when seen from the southern hemisphere, the Sun crosses the meridian in the **northern** sky!

City	Latitude	Sun max. altitude	Month
Pick a city between S 24°–60°:			
Pick a city in the tropics (between N 23° and S 23°):			

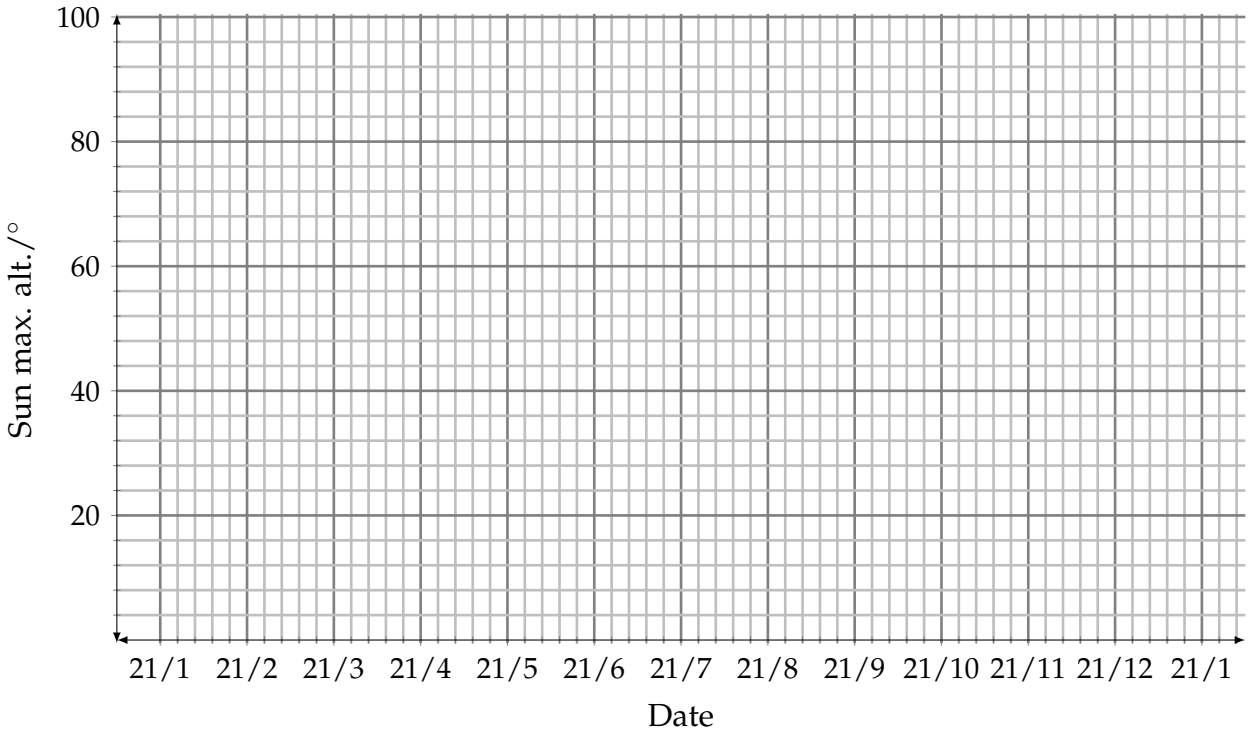
4. The Sun's Path at Different Latitudes

Now, let's look at how the Sun moves across the sky from different locations on Earth. Follow along with your instructor as below:

Open the Location window and type into the "Latitude" entry "N 66d 30m" (note where the spaces are). You should see the red arrow on the map jump to a location north of Amherst Center. (Leave the longitude unchanged from Amherst Center (W 72°) so the time zone stays the same.)

a. At the Arctic Circle (N 66° 30′) and northward, you can sometimes get 24 hours of daylight, and vice versa. Note how the Sun's path becomes more horizontal closer to the North Pole.

b. At the Equator (N 0°), notice how the Sun moves straight up and down as it approaches the horizon. Why would this make twilight shorter in the tropics?



c. From locations at mid latitudes in the Southern Hemisphere, the Sun approaches the horizon at an opposite angle from what we see, and the Sun spends most of the day in the **northern** sky. Note: Does this mean that the Sun is travelling in the opposite **direction** (east or west)?

5. Lab Quiz on Moodle

Go to the Lab 5 section on the Moodle page and complete the End-of-Lab Quiz. Note that some of the questions will depend on what city your team picked for part (3), so be sure to enter the correct latitude of that city.