-1.0.1 Actual Scale of the Earth and the Moon (Class demo)

1. Suppose the Moon is the size of a golf ball. On this scale, how big is the Earth? **Lower** your hand when you think the demo balloon is at the right size.

2. On this scale, how far would the golf ball Moon be from Earth? **Lower** your hand when you think the demo balloon is at the right distance.

   Relative to the size of the golf ball, this distance is the same as the as the distance from the Earth to the Moon, relative to the size of the real Moon. Hence, **the angular sizes are the same.** If you take a zoomed-in picture of the golf-ball at this distance and compare it to your zoomed-in calibration grid, you will find the golf ball has the same angular size as the real Moon.

3. As part of the extra credit project, take a picture of the golf-ball Moon from the to-scale distance.

-1.0.2 Modelling the Moon's Phases

You will each get a golf ball with a hole in it so you can put it on a pen or pencil and hold it up. Each table will have a light source that will represent the Sun.

1. To first understand Earth's rotation in relation to the Sun, begin by picturing your head as the Earth. Imagine the top of your head is the North Pole, with Boston at your left eye, and San Francisco your right eye. Take the light bulb on the table to be the Sun.

   a. Which way does your head face when it is noon in Boston?

   b. Which way does your head face when it is noon in San Francisco?

   c. Which way does your head turn to go from noontime in Boston to noontime in San Francisco?

2. Let's examine the Moon's phases as it orbits the Earth. Make sure that you can see the portion of the Moon lit by the "Sun" in your table.

   a. Look for the **crescent** phase, and estimate the angle between the Sun and the Moon (with the Earth at the vertex) when the Moon is a crescent.

   b. Can you ever see a crescent Moon at midnight?

   c. Where is the Moon when it is **new**?

   d. Where is the Moon when it is **full**?

   e. Where is the Moon when it is **gibbous**?

3. Suppose the Moon is at **first quarter**.

   a. When should it cross your **meridian**?

   b. When does it rise, and when does it set?

-1.0.3 Observing the Moon's Phases

1. In groups of 2-3, start up Stellarium.
2. Set up Stellarium for Amherst Center (F6) on 23 February 2022 (F5). Look toward the **east** and adjust the time until you see the Moon rising.
    a. What time does the Moon rise?
    b. Press the semicolon ";" key to turn on the meridian line. What time does the Moon cross the meridian?
    c. What time does it set?
3. If you were taking a picture of the Moon in the daytime, what is the range of times you could take a picture on 23 February 2022?
4. Zoom in on the Moon and look at its shape.
    a. What is its phase on 23 February 2022?
    b. Turn off the ground and center the view on the Moon. Advance the day by opening the Date/Time window, and then clicking the up-arrow (↑) above the day's date, until the Moon is next at first quarter. What is the date?
    c. How can you tell whether a "half-lit" Moon is in the first or third quarter?
5. On this new date,
    a. What time does the Moon rise?
    b. What time does the Moon cross the meridian?
    c. What time does it set?
6. Advance the date by 1 day. What time does the Moon rise? Cross the meridian? Set on this date?
    a. What is the Moon's phase?
    b. What time does the Moon rise?
    c. What time does the Moon cross the meridian?
    d. What time does it set?
    e. What are the differences from Part (6)?
7. Keeping the same time, change your location to Australia (hit **F6** and click on Australia in the location window). What phase is the Moon in?
8. Now, change your location to the Moon and look back at the Earth (search for and select "Moon" in the Location window). What phase is the Earth in?

-1.0.4 Lab Quiz on Moodle

Go to the Lab 4 section on the Moodle page and complete the End-of-Lab Quiz.