In groups at each table, you will investigate how the angular diameter of a spherical body (a ball) depends on its distance from you.

-1.0.1 Data and Graph

1. At your table, discuss and agree on a plan for how to make measurements of the sphere to explore the relationship between its angular size and distance. Consider:
   a. What distances will you make measurements from?
   b. How will you measure the distances?
   c. Will you repeat the measurement with different people? (This is called replication.)
   d. What will you do if points disagree?
2. Make sure each person makes **at least one** measurement of the ball's angular size and distance. Record your measurement below.
   (a) Angular diameter of ball (to nearest half-degree): _____
   (b) Distance from ball: _____

   Record all your measurements on the table worksheet. Mark the the position of your measurements at your table to **graph all the points in the table worksheet.**
3. Select someone at your table to **graph all the points in the table worksheet.**

-1.0.2 Interpreting the Graph

Look over the points plotted by your group and discuss the following:

1. Do the points exhibit a pattern? How would you describe that pattern in words?
2. How might you describe the relationship mathematically?
3. Do all the points agree with each other? What factors might explain the differences we see?

-1.0.3 Angular Size of Astronomical Objects

1. Let's consider the Sun.
   a. Does the Sun's angular size changes during the year?
   b. What month is it the smallest? _____
2. Now let's look at the Moon.
   a. Is the Moon larger when it's full?
   b. What is a supermoon?

c. Is the Moon larger when it's near the horizon?

The planet Mars shows the greatest variation in size of all the planets, which we will explore here.

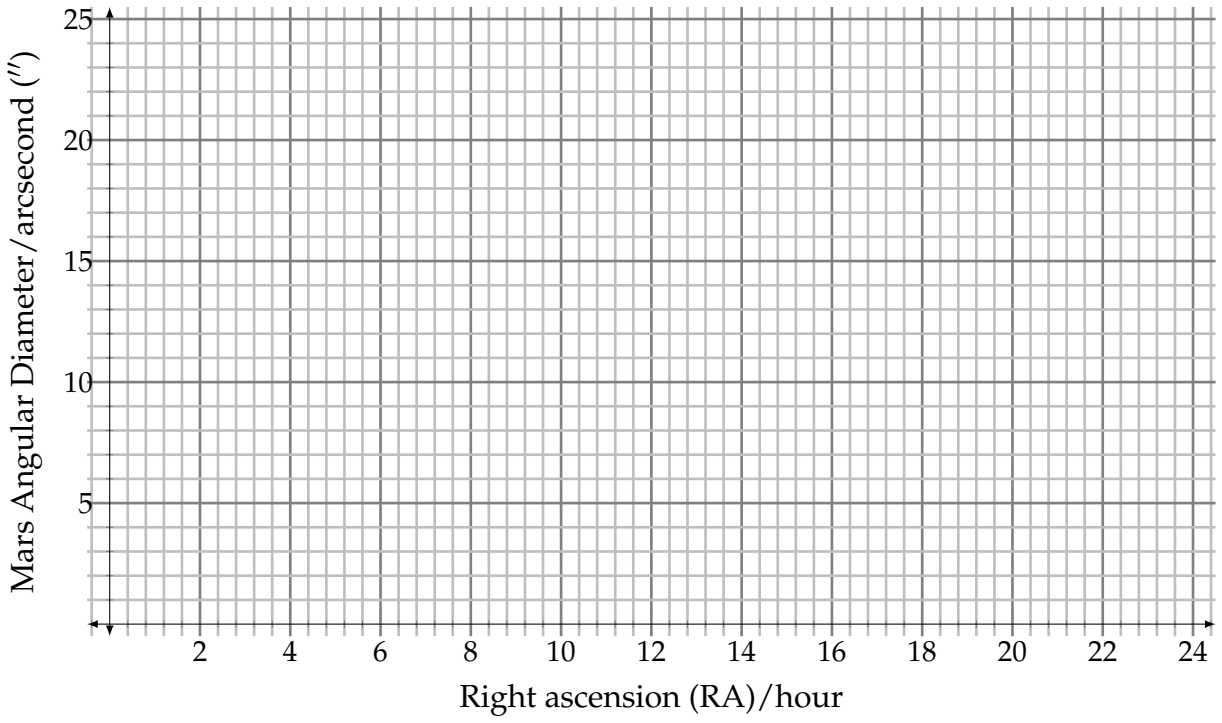
1. In groups of 2-3, start up Stellarium. Find where Mars is today. You can turn off the atmosphere (hit A) and ground (hit G) to help.

2. Once you have found Mars, you can click on it and center the view (by pressing the space key). Take note of Mars's angular diameter (given as "Apparent diameter" in the left-hand side info panel.

3. Zoom in until Stellarium renders some surface features.

4. You are going to look at how Mars's **angular diameter** and **right ascension ("RA")** values each change over time. To do this, open the Date/Time window and vary the date from October 2021 to October 2023, one month at a time. At each date, take note of Mars's **angular diameter** and **right ascension ("RA")**. These are the values you will plot (**NOT** the date!).

5. Plot Mars's angular diameter vs. right ascension in the grid below and answer the following questions.



a. How big is Mars in October 2021? _____ arcseconds

b. Where is it in its orbit in October 2021?

c. In what month is Mars largest? _____

d. How big is it that month? _____ arcseconds

e. What explains the pattern of sizes you find in your graph?

-1.0.4 Lab Quiz on Moodle

Go to the section for this lab on the Moodle page and complete the End-of-Lab Quiz. Write your name on the Table Worksheet and hand it in.