

Sun-Earth Connection

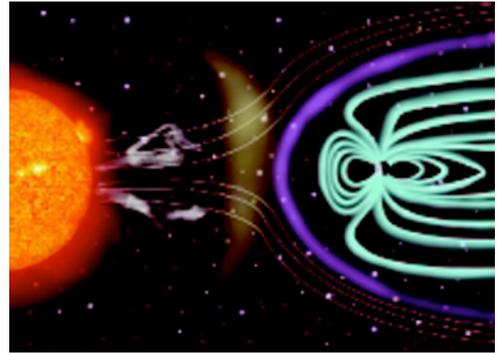
Relative Sizes and Distances

Time:

50 minutes

Objective:

This activity begins to look at the space between the Sun and Earth, or space in the solar system in general. This is where the satellites that measure the solar wind reside. Before we look at the interaction between the solar wind and the Earth's magnetosphere, we want the students to develop an understanding of the relative sizes and distances between planetary bodies.



Content Standards:

- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry
 - Identify questions and concepts that guide scientific investigations
- Communications
 - Recognize and analyze alternative explanations and models
 - Communicate and defend a scientific argument
 - Understandings about scientific inquiry

Equipment, Materials and Tools:

- Graph paper,
- Scissors,
- Ruler,
- String [optional]

Background Information:

For thousands of years inhabitants of the Earth have been gazing out into the Cosmos. Observations and imagination have led to many important milestones in human history. Early star gazers began to identify certain patterns of stars helped them identify times of the year. They saw that the stars moved across the sky during the night but always remained in the same positions, all but four that appeared to move among the others. They called these moving points of light planets, meaning wanderers and named them after their deities. The largest was named after the king of gods, Jupiter. The red colored planet named after the god of war, Mars, the brightest after the goddess of love and beauty, Venus and the last after the god of agriculture, Saturn. They also observed other objects that moved in the night skies but were not permanent: comets with their sparkling tails and meteors shooting through the night skies.

They were not able to observe the other planets, as they did not possess the tools needed to see distant objects. The invention of the telescope changed the astrological world as more star gazers began to see objects never seen before. Uranus was first observed in 1781, Neptune in 1846, and Pluto in 1930. To enhance their ability to observe the skies, they began to find ways to improve the telescope.

Of the nine planets, four are known to have solid rocky surfaces and are located closest to the Sun. Mercury, Venus, Earth and Mars are called the terrestrial planets. Beyond the orbit of Mars

are the gas giants, Jupiter, Saturn, Uranus and Neptune. The ninth and most distant planet, sometimes called a proto-planet, has a solid but icier surface.

Many of the planets have natural satellites (moons) revolving around them. More than 120 have been identified and the number is still growing. The Earth has one satellite. Some of the moons orbiting the other planets are much larger than the Earth's moon while many are just small pieces of debris. The origin of many of these moons is still questioned. Were they left over debris from the formation of the Solar System, parts of the planet that were lodged from the planet by a catastrophic collision, or asteroids captured by the planets gravitational field.

Three planets are now known to have rings: Jupiter, Saturn, and Uranus. Saturn's rings are by far the most known and observed as they lie at an angle easily seen from Earth. These rings are composed of particles ranging in size from dust to house sized boulders and may be rocky or icy.

In early human history, it was believed that the Earth was the center of the Universe and that all celestial bodies revolved around the Earth. This belief was disproved through observations and calculations made by Copernicus. We now know that the Earth is but one of the nine planets that revolve around the Sun and that the Sun is just one star of billions of stars in the Milky Way Galaxy and that it too is moving through space.

Our perceptions of the Solar System and of the Universe are constantly changing as we develop better tools to collect data. The use of new technologies and our own reasoning powers have helped to further our knowledge and understanding of 'heavens.'

The following activity will ask what celestial body appears largest in the sky. Students will develop an understanding of the relative sizes of large and distance objects.

Instructions:

1. Give each student a copy of the 'Relative Size and Distance' worksheet (Figure 1). Have students complete the worksheet.

Body	Distance from Sun	Distance from Earth	Diameter	Number of Satellites
Sun	0	1 AU		
	0.387 AU			0
		.277 AU	12,103 Km	
Earth	1 AU			1
Mars		.524 AU		
Jupiter	5.20 AU		142,984 Km	
				31+
	19.191 AU			
			49,528 Km	
		38.48 AU		1

Discussion Questions for Students

The planet Mars is .524 AU from the Earth while earth is 1 AU from the Sun. How far is Mars from the Sun?

The planet Jupiter is 5.2 AU from the Sun while earth is 1 AU from the Sun. How far is Jupiter from Earth?

2. Relative Sizes

Have students plot, to scale, the information for Earth, Mars and Jupiter on graph paper. Place the Earth to one side and Jupiter on the other with Mars in between. Remember, Jupiter is 5.2 AU away from Earth. What scale will you use to put Jupiter on the other side of the paper from Earth?

FOR THE TEACHER

This activity can be done on one sheet of graph paper or the planets can be cut out.

Now draw a cone from the center of the Earth's surface to one of the other planets. Ask the students which would look bigger from earth?

Put a Sun (2-8' diameter depending on room size) on one wall. Use a small moon cut out and have student close one eye and hold out the moon to the correct distance in order to make an eclipse. Have student reflect on the relative distances between the moon and eye and Sun and eye.

High school students can use arc length and trigonometry to reach their conclusions.

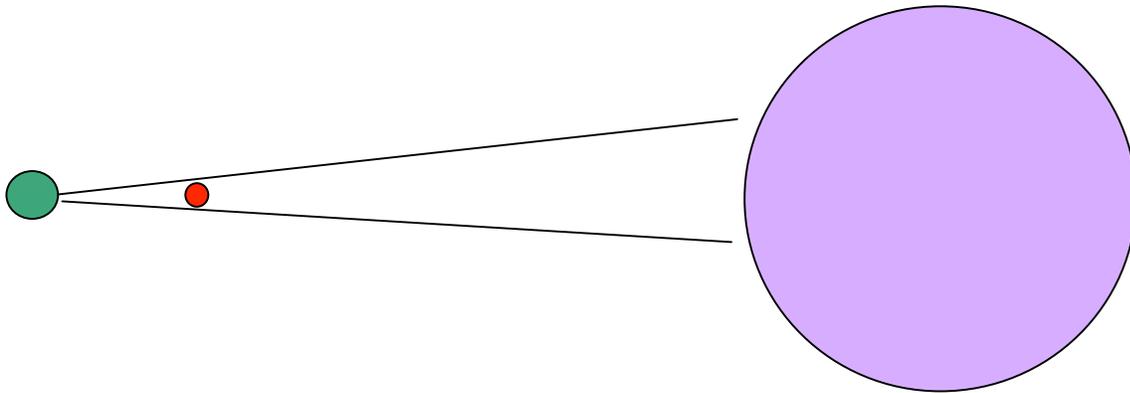


Figure 1. Relative Sizes and Distances of Solar System Bodies

Solar System Body	Distance from Sun	Distance from Earth	Diameter	Number of Satellites
Sun	0	1 AU		
	0.387 AU			0
		.277 AU	12,103 Km	
Earth	1 AU			1
Mars		.524 AU		
Jupiter	5.20 AU		142,984 Km	
				31+
	19.191 AU			
			49,528 Km	
		38.48 AU		1