

Venus phasing

Before the invention of the telescope, it was thought that the Earth was the center of the universe and that all other things—the Sun, Moon, stars, and other planets—revolved around our planet. This was known as the geocentric theory. The problem with the geocentric view of the universe was that early astronomers had to develop very complicated models to explain why the other planets appeared to move the way they do across the skies. These models were especially complex for the inner planets, Venus and Mercury. Astronomers theorized that these planets moved about in a circle or *epicycle*, and that the center of the epicycle simultaneously followed a circular path around the Earth (see diagram at right).

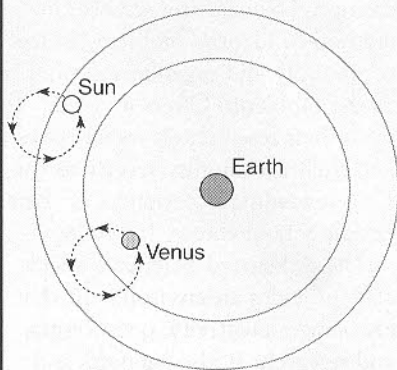
Until the invention of the telescope, the geocentric theory held up. However, Galileo's telescopic observations indicated that the inner planets also underwent phase changes similar to our moon's phase changes, which could not be explained by the geocentric model.

This discovery led to the development of the heliocentric model of the universe, in which the planets revolve around the Sun.

The following activity will introduce your students to the geocentric and heliocentric models of the universe and help them discover why phase changes on Venus knocked the Earth out of the center of the universe.

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Phases of Venus



Purpose

To explore the geocentric and heliocentric models of the universe to discover if each can explain the phases of Venus.

Materials

- light source (unshaded lamp with 100-Watt bulb)
- a tennis ball or foam ball on a stick
- worksheet
- pencil
- masking tape

Setup

Clear a large area in your classroom so students can move about freely. Mark the center of the area with a piece of masking tape. Approximately one meter from the center, place a piece of tape at the six positions indicated in Figure 1. This area will be used to simulate the orbit of Venus in both the geocentric and heliocentric models.

Procedure

(for modeling the geocentric solar system)

1. One student, representing the Earth, takes a position about 3 meters from "the Sun" (a light that has been placed at eye level).
2. A second student holds a ball on a stick, representing Venus, directly between the Earth and Sun. At this

position, Venus will not be visible from Earth because its dark side will be facing our planet.

3. The student then moves Venus to position 1 of the orbital model. The student representing the Earth should sketch that part of Venus that is illuminated (and, consequently, visible from Earth) on the worksheet.

4. Venus should cycle through each of the remaining five positions and a sketch should be made at each stop.

(for modeling the heliocentric solar system)

1. Place "the Sun" (light source) at the center of the modeling area as shown in Figure 1.

2. One student, representing the Earth, takes a position about 2 meters from the Sun.

3. A second student holds up a ball, representing Venus, directly between the Earth and Sun. At this position, Venus will not be visible from Earth because its dark side will be facing our planet.

4. The student then moves Venus to position 1. The student representing the Earth should sketch that part of Venus that is illuminated (and, consequently, visible from Earth) on the worksheet.

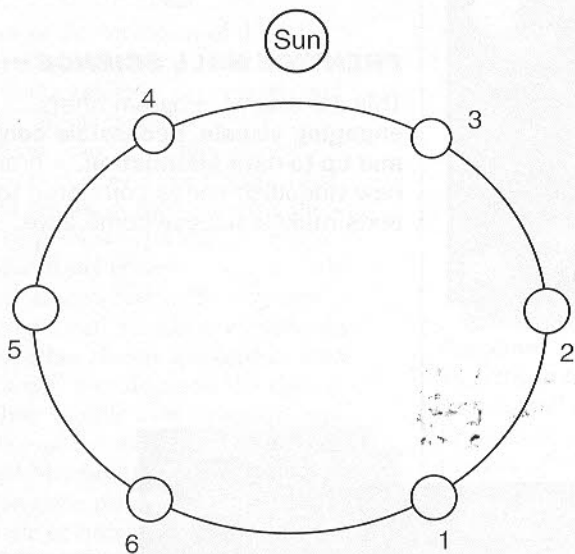
5. Venus should cycle through each of the remaining five positions and a sketch should be made at each stop.

Conclusion

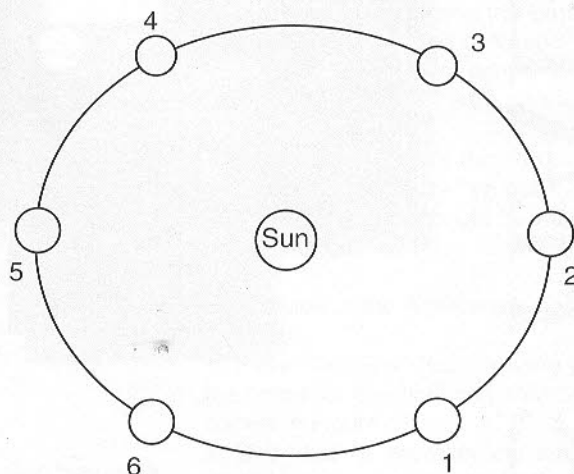
Compare your phase sketches to actual photographs of the phases of Venus. Do both models allow you to duplicate the phases of Venus that we can observe with a telescope? How do these phases compare with our moon's phases? Explain how telescopic observations of Venus influenced ancient models of the universe.

Figure 1. Phases of Venus activity sheet

Name _____



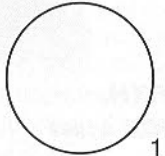
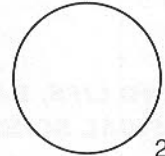
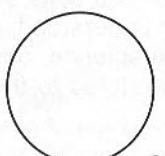
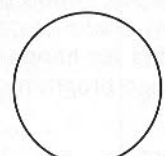
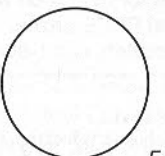
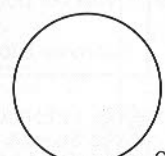
The orbit of Venus in the Geocentric Model



The orbit of Venus in the Heliocentric Model

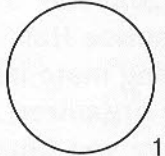
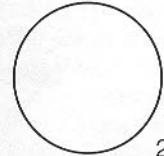

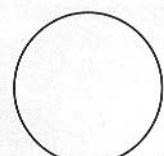
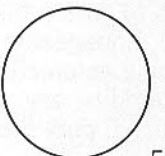
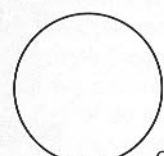
Earth

Sketches

 1	 2
 3	 4
 5	 6

Earth

Sketches

 1	 2
 3	 4
 5	 6