

Guidance of " Venus-Watch Campaign"

1. Background

Venus is a planet that is often called the morning star or the evening star. It is a brightest star in the evening and the dawn sky. One of characteristic features of Venus is a waxing and waning. Furthermore, Venus's apparent size changes. The Moon waxing and waning is well known. The Moon and Venus are shining only when the Sun illuminates them. Since the relative positions of Earth, the Moon, and the Sun changes, the shape of the shining part of the Moon changes (as shown in Figure 1). Similar to the Moon, the configuration of Earth, Venus, and the Sun changes, the shape of the shining part of Venus changes (as shown in Figure 2). This is the reason for the waxing and waning of them. The apparent size of Venus changes considerably, though that of the Moon changes little. This is because the distance between Venus and Earth changes much more than that changes of Earth and the Moon. When Venus locates between the Sun and Earth, we can see a large Venus, while when Venus locates the behind the Sun, we would see a small Venus (see Figure 2).

Figure 1 Earth and Moon

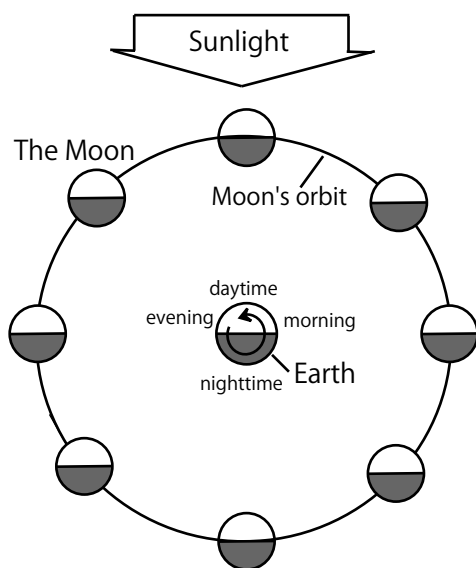
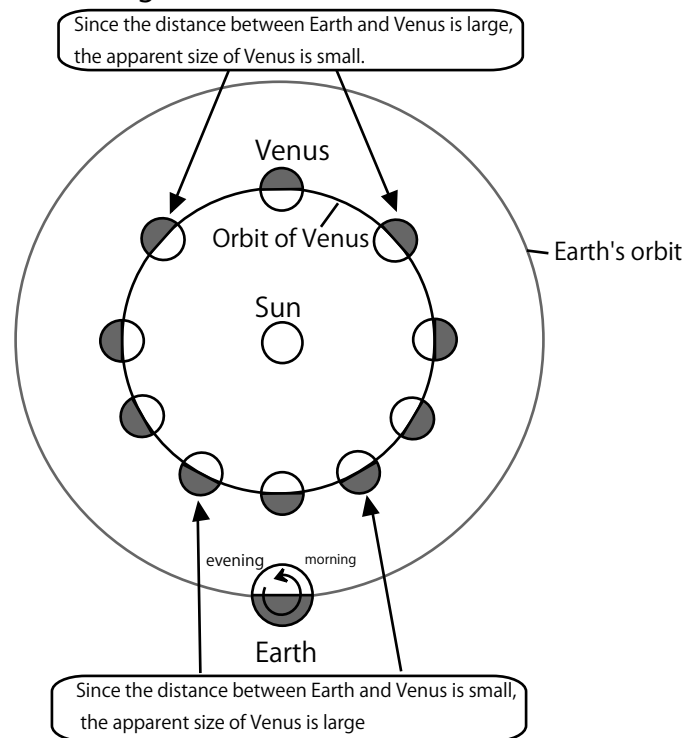


Figure 2 Earth Venus and Sun



Galileo Galilei, first, noticed the waxing and waning of Venus. He looked through his telescope at the celestial bodies in 1609, and in the next year, he discovered the waxing and waning and the apparent size change of Venus. At that time, the Copernican theory or the Ptolemaic theory had been the subject of debates. It was not clear which theory is the correct one. Galileo's discovery apparently supported the Copernican theory. Because the Ptolemaic theory could not explain the waxing and waning of Venus, it caused a significant impact to believers of the Ptolemaic theory.

You can see the waxing and waning of Venus with the 4cm telescope.

2. Purpose

The aim of this activity is that children to experience the feeling of wonder that Galileo had when he observed Venus the first time. Assembling the telescope and finding the waxing and waning and the changes of the apparent size of Venus by themselves are an exciting experience. It is important that children to understand the reasons behind such phenomena.

3. Observation Tips

At first, it may not be easy acquiring Venus in the telescope' s field of view. To help stabilizing the telescope and to make ease of acquisition, use of tripod is recommended. When Venus enters in the field of view, tighten the tripod to fix the telescope at once. Then, adjust telescope focus. It is advisable to have a practice session by using distant scenery in daytime. Children should be informed that the scenery turn upside down through telescope. You can get information about the positions of Venus by the following website.

4. Steps

(a) Observation and sketch

First, print out the work-sheet. Then, observe Venus and make a sketch on the work-sheet. From December 2008 to February 2009, Venus can be seen at the western sky in the evening even before the sunset. During this period, you should observe Venus at least once a month (i.e. in total three times). If it is possible, you may add the sketch column, and recommend children to observe as many as possible.

Magnifications of the telescopes are as follows:

For Hoshi-no-Techou Inc. telescope kit (\$10 one),

the magnification is 15 power

(Focal length of the telescope is 273mm and focal length of the eye piece is 18.2mm).

For ORBYS Inc. telescopes kit (\$20 one),

it is 35 power (Focal length of the telescope is 420mm and focal length of the eye piece is 12mm).

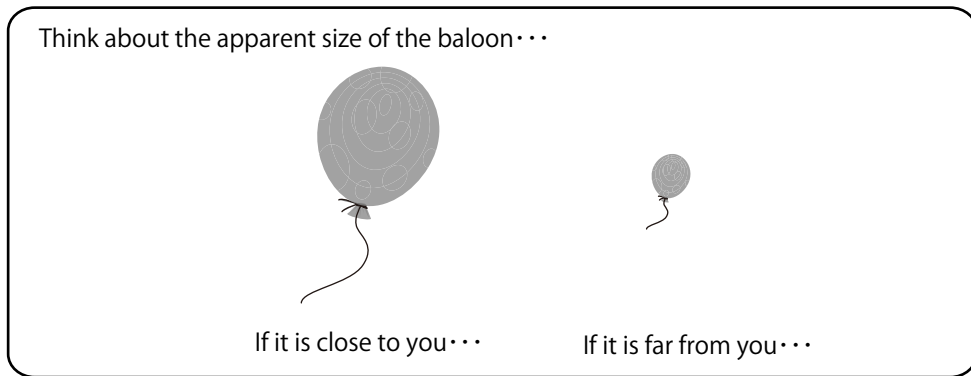
(b) Write any findings and/or questions

Write anything you found out and/or question from your observations in your sketch sheet under the sketch column. It is not easy to recognize the apparent change in size of Venus just from these 3 observations. However, children will learn it by working on the workbook.

(c) Confirm how Venus looked from Earth

Using the after observation workbook, explain children to understand how Venus is seen from Earth. Use the balloon example on the after observation workbook, let children think about a relationship between the apparent size of the balloon and the distance to it. When children understand the relationship well, let them fill the parentheses.

Example of answer



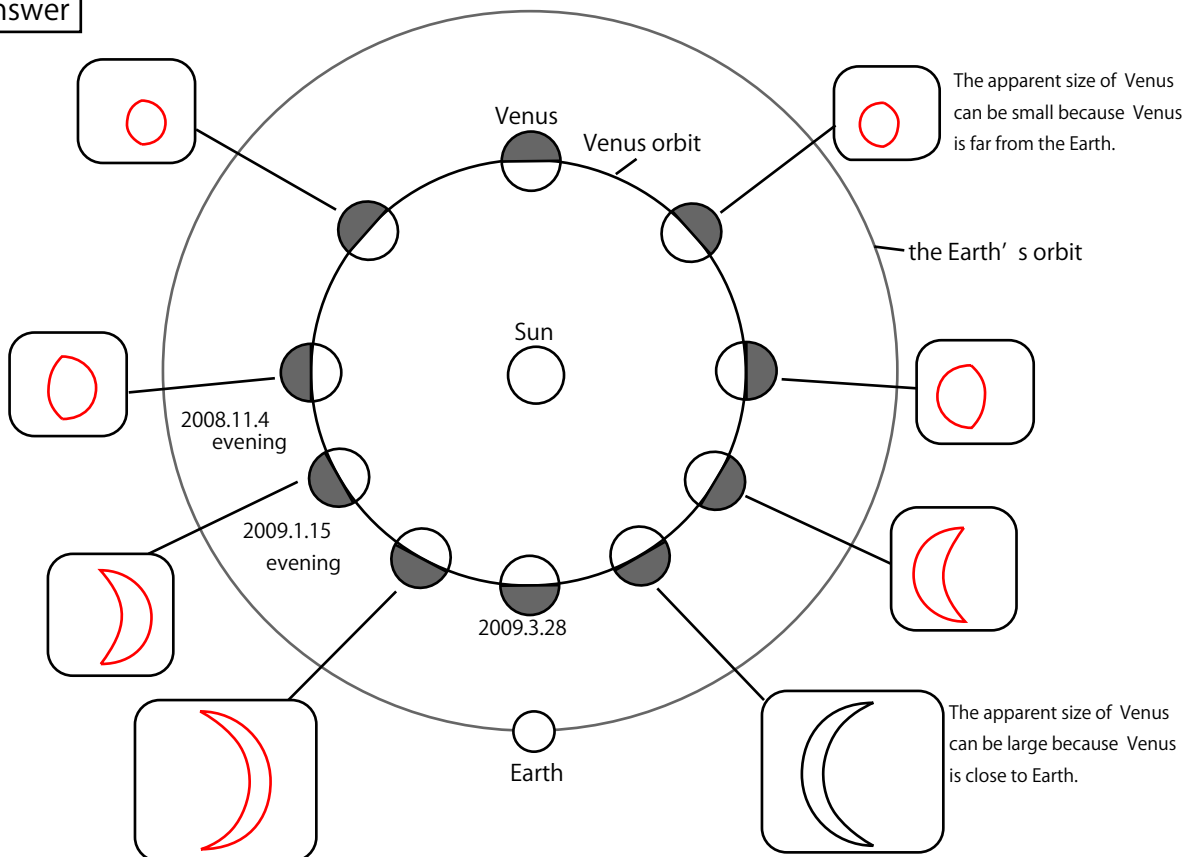
■ How about the Venus size?

When the Venus is large, it is (close to Earth) .

When the Venus is small, it is (far from Earth) .

Then, move on to the second page of the after observation workbook, consider the distance and the apparent size from the relative positions of Earth, Venus and the Sun. Draw the shape and the size of Venus would be seen from the Earth like the example shown in red lines.

Example of answer



(d) Write down what is learned today, and what you want to know more.

A summary should look like: "Venus displays phases like those of the Moon. Venus presents a small "full" image when it is on the opposite side of the Sun. It shows a "quarter phase" when it is at its maximum elongations from the Sun. It presents a "thin crescent" in views as it comes around to the near side between the Earth and the Sun. The apparent size of Venus becomes largest when it is between the Earth and the Sun." Also, write down what you want to know more and what children can do further.

5. Notes

It helps that teaching the change in phases of the Moon before observing Venus.
Caution must be given to children that "Never watch the Sun through the telescope!"