

# Guidance of Moon watching

## 1. Background

The Moon is the natural satellite of the Earth. It is the closest celestial body to the Earth. As you know, the shape of the bright part of the Moon that we see from the Earth is changing cyclically. One day the Moon appears as a thin crescent, then grow to a full disk (full moon), then shrink back to a thin crescent again, then vanishes (new moon). We call this changing "lunar phase" or "moon phase". The time between two full moons (a Lunar month) is about 29.53 days.

The half hemisphere of the Moon is always illuminated by the Sun during revolution of the Moon around the Earth. The moon phase is a product from the changing relative positions of the Earth, Moon, and Sun. It depends on the Moon's position in orbit around the Earth. For example, the full moon appears when the Sun and Moon are on opposite sides of the Earth. The new moon happens when the Moon and Sun are on the same side.

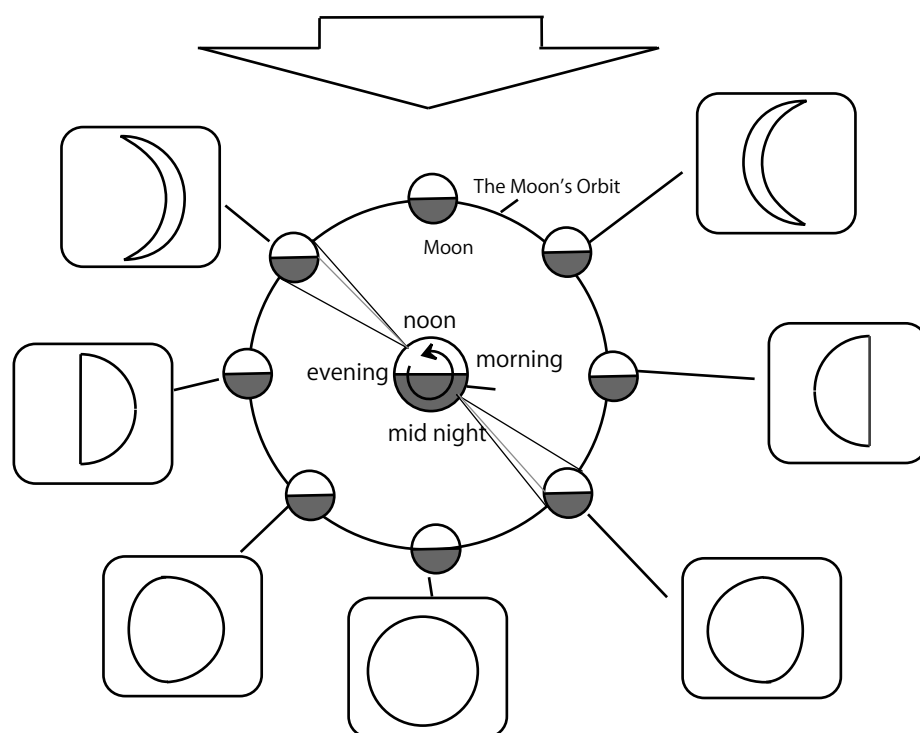


Fig 1: the Earth and the moon

The Moon's surface is not smooth. It is rather rough. Galileo Galilei discovered the moon's surface roughness for the first time by his own telescope in 1609. Galileo frequently observed the moon, and sketched it many times. Using this work-sheet, children execute a similar activity with Galileo Galilei did about 400 years ago. Galileo paid attention to the terminator, then noticed that it is not a straight line and also there are several bright points near the terminator.

He guessed that the bright points are each mountaintop illuminated by the sunlight at sunrise. He thought there are mountains on the Moon just like on the Earth. Since people have believed that the Moon is a completely smoothed globe at that time this Galileo's discovery gave a shock to people. Then it became an important discovery that shook an outlook on the universe at that time. The appearance on the surface of the moon that Galileo discovered can be seen with a 5cm-aperture telescope.

## 2. Purpose

The aim of this activity is that children experience the feeling of wonder that Galileo had when he observed the Moon for the first time. Assembling the telescope and observing the Moon's surface are an exciting experience. Also finding the waxing and waning of the Moon by themselves and then thinking the reason are good experience. It is important for children to understand the reasons behind such phenomena.

## 3. Observation Tips

Comparing with other objects, the observation of the Moon is fairly easy. However, even for the Moon, it is important to use tripod for fixing the telescope. When the Moon enters in the field of view, tighten the tripod to fix the telescope at once. Then, adjust telescope focus. By using the 25x eyepiece, you can see the entire Moon's surface in the field of view, if you use the 50x eyepiece, you can observe the Moon's surface in more detail. 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.

Since the Moon is a bright object, when you observe the Moon, you don't need to wait the sky becomes dark completely.

## 4. Steps

### (a) Observation and sketch

For observation and sketch, you use the first sheet. Please draw an entire figure of the Moon in the field of view of the telescope. Then choose a place on the moon's surface where you are attracted in, then sketch that in detail in the second sketch column of the sheet.

Observation should be done several times so that children become interested in the Moon phase. Teachers can add the sketch column to the sheet if necessary, and recommend children to observe as many times as possible.

### (b) Write any findings and/or questions

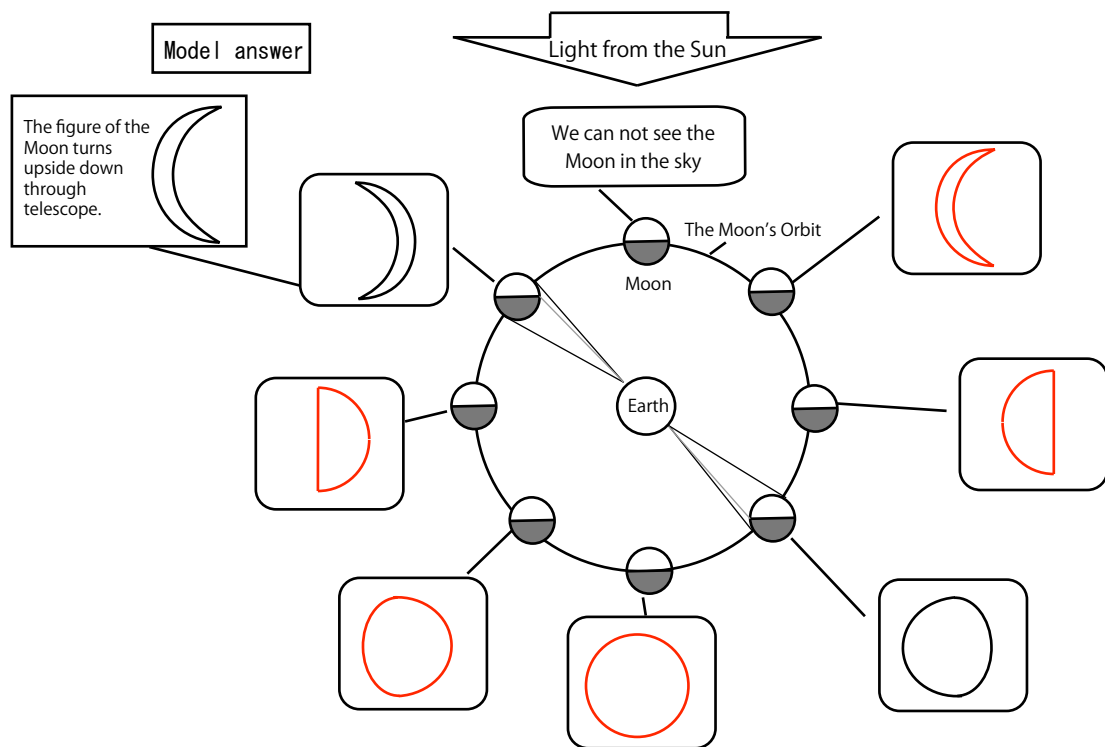
Write anything you found out and/or question from your observations in your sketch sheet under the sketch column. For example, a pattern of the Moon's surface, indented terminator, changing the shape of the bright part of the Moon and so on.

### (c) Confirm the name of the place where you made detail sketch by using the Moon map

If teachers want to show very detail surface of the Moon to children, the "Google Moon" is one choice.  
<http://www.google.com/moon/>

### (d) Confirm what you observed through the telescope.

Are there craters? basins? mountains?



### (e) It is important to understand the reason of the waxing and waning of the Moon

Using the work sheet of the post observation study, think how the shape of the bright part of the Moon in the sky looks from observers being on the Earth. Then draw the shapes into the columns. The drawings with red are a model answer.

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

Let's summarize your knowledge of the Moon, which you learned from observations with the telescope and through a text book or the internet. Also, write down what you want to know more and what you can do further.

## 5. Notes

Caution must be given to children that "Never watch the Sun through the telescope!"

## 6.Memo

There are two kinds of the combination of eyepiece and object lens for a refractor: the Galileo style and Kepler style. The Galileo style uses a convex lens for the object lens and a concave lens for the eyepiece. This combination makes an erect image, however the field of view is very narrow. It has been used for opera glasses with a low magnification today. Meanwhile the Kepler style uses the convex lenses for the object lens and the eyepiece. It was made by Johannes Kepler. With this combination, an inverted image appears, but the field of view is relatively wide. It has been used for observations of celestial objects. Please try to guide the children's interest towards the history of telescope and its optical system through experience obtained with telescopes of the Kepler and Galileo styles.