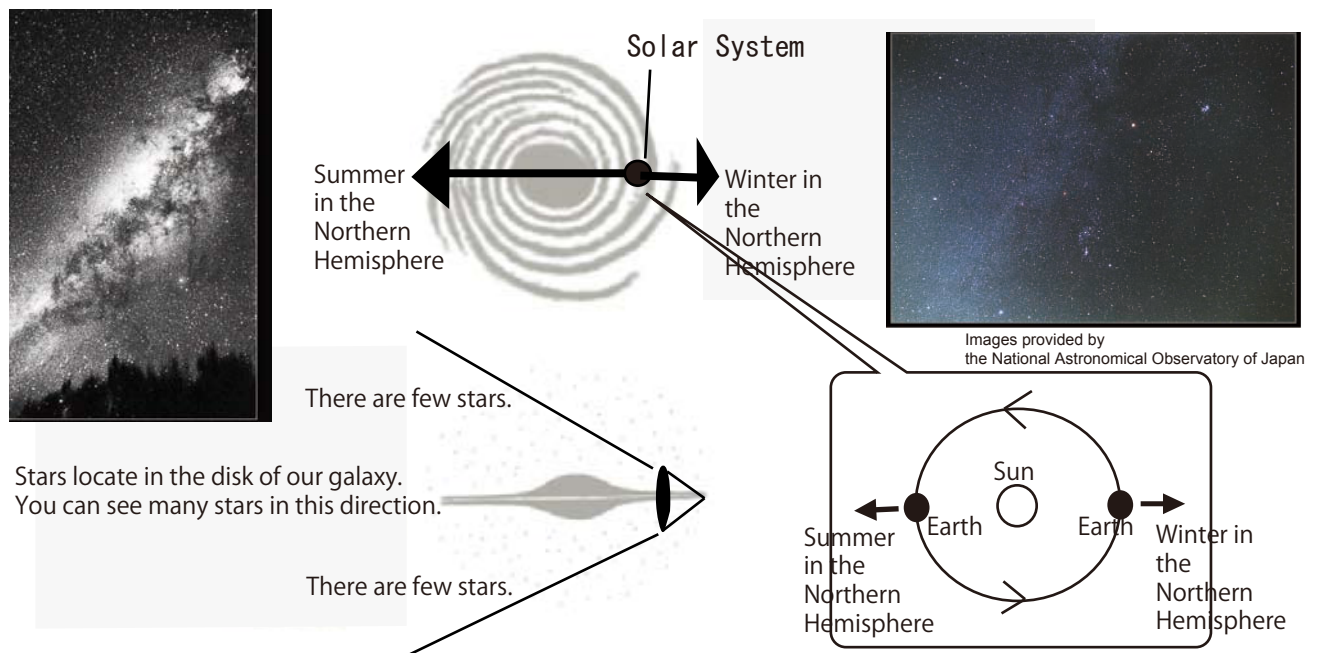
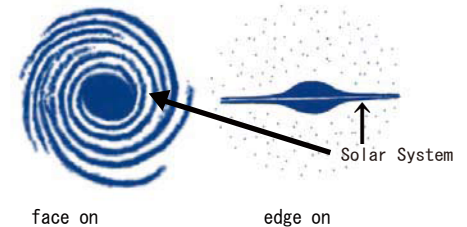


# Guidance of the Milky Way watching

## 1. Background

Stars don't exist alone. They are gravitationally bound, then make a massive group. We call such a massive group of stars a "galaxy". A typical galaxy consists of about 200 billion stars. The Sun of our Solar System is one of stars in the galaxy. For distinguishing from other galaxies, the galaxy in which we are is called "the Milky Way galaxy" or just "the Milky Way" or "Our Galaxy". Historically, galaxies have been categorized according to their apparent shape. The Milky Way galaxy is a spiral galaxy, which is disk-shaped assemblages with dusty, curving arms. The diameter of disk of the Milky Way galaxy is about 100 thousand (100,000) light-years (1 light-year is the distance that the light travels in a vacuum in one year, equal to about 9.5 trillion kilometers). The Solar System is located at a distance of about 28,000 light-years away from the center of disk of the Milky Way galaxy. Beautiful Milky Way in the sky as shown in a below picture is a figure of the Milky Way galaxy with a edge on view (namely seeing the Milky Way galaxy from the side viewing angle).



At the beginning of 17th century, a telescope was developed in the Netherlands. An Italian astronomer Galileo Galilei who understood telescope's structure made a telescope by himself, then observed the night sky with the telescope. He found the facts: the Moon's surface is rugged, 4 satellites are revolving around Jupiter. He also found that Milky Way is a place that stars concentrated.

In 19th century, we finally found the fact that we are in the Milky Way galaxy and that the Milky Way in the sky is a figure seeing the disk of our Galaxy from the side way.

## 2. Purpose

The aim of this activity is, through observation of the Milky Way with a telescope, to notice the fact that the Milky Way is a place that stars concentrated. In addition, pay attention to the shape of the Milky Way, then imagine that we are in the Milky Way.

## 3. Observation Tips

It is difficult to see the Milky Way with naked-eyes in urban area because of light pollutions. It is better to avoid even the Moonlight. However, if you watch the Milky Way with the telescope, you can understand that many stars are in the Milky Way. For making sure, it is better to observe two points: one is inside of the Milky Way and another one is far away from the Milky Way.

When you decide the observing point in the sky through telescope, 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.

## 4. Steps

### (a) Observation and sketch

For observation and sketch, you use the first sheet.  
There are two sketch columns: for a sketch of inside of the Milky Way and for an away from the Milky Way.  
Mark the observation points in star chart, like the image.

Magnifications of the telescopes are as follows:

For Hoshi-no-Techou Inc. telescope kit,  
the magnification is a 15 power  
(Focal length of the telescope is 273mm  
and focal length of the eye piece is 18.2mm).

For ORBYS Inc. telescopes kit , it is a 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.

### (c) Check your understandings

There are 3 check points in the sheet.

### (d) See the seasonal changes of the Milky Way in summer and winter

You can compare two pictures on the work sheet  
of the post observation study.

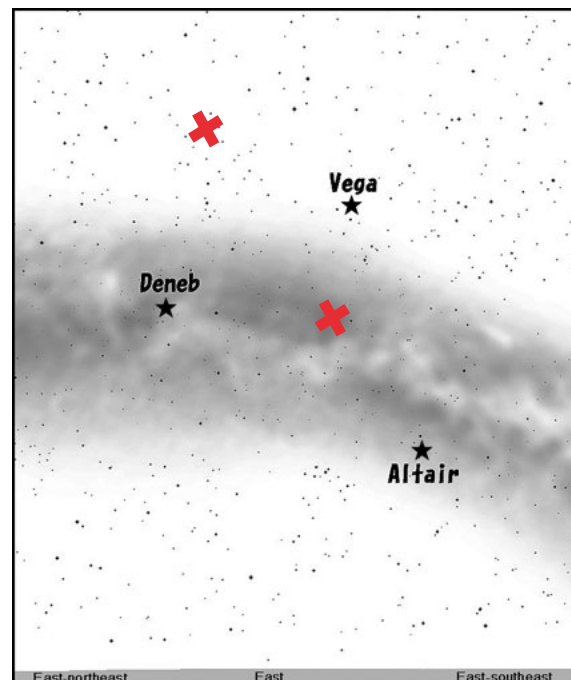
### (e) Estimate the shape of the Milky Way galaxy by investigating the picture on the work sheet

(e-1) Trace the edges of the Milky Way galaxy on the picture.

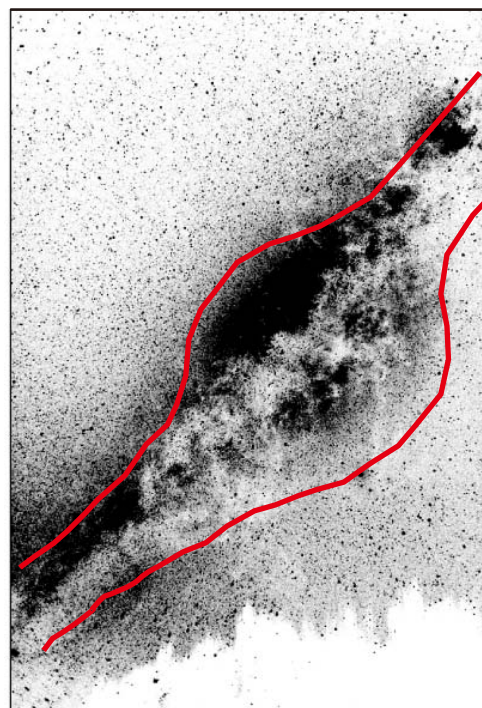
Teacher may help children to notice bulging galactic center.

(e-2) Think why the Milky Way has a seasonal change.

Teacher may explain the location of the Earth in the Milky Way galaxy.



Images provided by Stellanavigator / AstroArts Inc.



Images provided by  
the National Astronomical Observatory of Japan

(f) Use the "Mitaka", which is a software that show celestial objects in the universe, then explain the shape of the Milky Way and where we are in the Galaxy.

Teacher can download the "Mitaka" from the following URL. It is a free software.  
[http://4d2u.nao.ac.jp/html/program/mitaka/index\\_E.html](http://4d2u.nao.ac.jp/html/program/mitaka/index_E.html)

(g) Teachers lecture on the outside of the Milky Way galaxy

Teachers explain there are many galaxies distributed outside of our galaxy. The history how we know the outside of the Milky Way galaxy step by step should be explained.

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

Let's summarize your knowledge of the Milky Way, 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!"