

# Investigation Three – Following in Galileo’s Footsteps

<b>Standard 03:</b> Students will understand the relationship and attributes of objects in the solar system.
<b>Objective 2:</b> Describe the use of technology to observe objects in the solar system and relate this to science’s understanding of the solar system.
<b>Intended Learning Outcomes</b> <ol style="list-style-type: none"><li>1. Use science process and thinking skills.</li><li>2. Manifest scientific attitudes and interests.</li></ol>

**Standard  
III**

**Objective  
2**

## Background Information

For centuries the only way the sky could be viewed was with the naked eye. Then in the sixteenth century the telescope was invented. One of the early telescope inventors, Galileo Galilei observed the four large moons of Jupiter. He kept meticulous records of the moon’s changing positions and came to the conclusion that they actually orbited the planet, contradicting the notion that all objects orbited Earth as center of the universe. his observations lead to a whole new way of understanding the Earth and its place in the universe.

## Pre-Assessment/Invitation to Learn

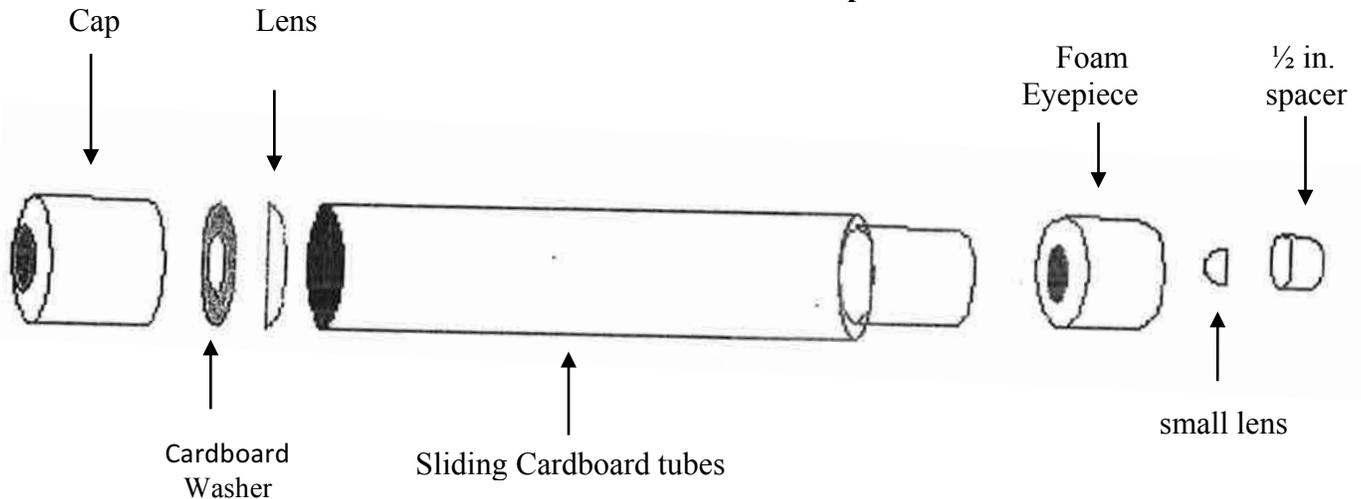
Show a poster or other visuals of one or more of the moons of Jupiter. (Google: Galileo and moons. Click on Satellites of Jupiter.) Tell the story of how Galileo observed the moons of Jupiter. Show a slide of Galileo’s journal page (see “Resources” *Moons of Jupiter*) Ask students to speculate what it is. Explain that it is a journal page from a great scientist, Galileo. Ask: What do you think he was recording? Tell the story of how Galileo observed the moons of Jupiter.

## Instructional Procedure

This activity uses either a simple telescope made with interlocking cardboard tubes and two simple lenses, binoculars or available telescopes. A convenient, inexpensive telescope is available from Learning Technologies (see materials). Or alternately make telescopes using two paper towel tubes in which one fits within the other, an object lens attached to the end opening on the outer tube, and an eyepiece lens, or ocular, attached at opposite ends of the inner tube.

1. Make telescopes with students or arrange for binoculars or assorted telescopes. You may have students draw a plan as shown in the materials section for making the telescope in their journals.

## Cardboard Tube Telescope



2. Allow students opportunities to experiment with the telescopes. Have them record observations in their journals. Challenge students by asking questions. How does the image appear in the telescope? How far can you see? How are objects in the distance changed? What problem do you have with the telescope? Can you solve them? (Images are hard to steady and you may consider how to rest them to help solve this problem.) You may want to go into more depth about refraction of light and consider coordinating activities from Standard VI, Objective 2.
3. The following activities will require using the telescopes at night. They could be checked out, used at a star party, or in an outdoor school setting. you will need to do a little homework to be sure of the visibility of the objects. Have students find the following objects and record a drawing and basic facts in their journals.
  - The moon. The best time to view is near its crescent or quarter phases because shadows make craters more visible than during a full moon.
  - Jupiter. Obviously it must be available to see and you will need to find its location. Students can look for small moons, bands on planet, etc.
  - The Pleiades. This is a cluster of stars found in the shoulder of the constellation Taurus, the Bull. On a clear night it is easy to see with the naked eye, but more distinct stars are visible with the telescope.
  - Double Star Mizar and Alcor. The second star from the end of the handle of the Big Dipper is actually a double star. Mizar is the brighter.
  - Great Nebula in Orion, the Hunter. Locate the belt in Orion and then the three stars that hang as the sword. The end star at the tip of the sword is actually the Great Nebula.

### Materials

- Binoculars or other assorted telescopes. Telescope kits, at least one per four student team, been developed by Project Star, available from Learning Technologies, 40 Cameron Avenue, Somerville, MA 02144, 800-537-8703 (\$4.50 each in sets of 10) or
- Two paper towel tubes or mailing tubes
- One 43 mm (about a 1 3/4") objective lens
- One 17.5 mm (about 3/4") ocular lens,
- Foam rubber cut in a cylinder the size of paper towel tube opening

## Curriculum Extensions

### *Language Arts*

- Do a research paper on the telescope. (Standard VIII, Objective 6)
- Do a research paper on probes that have been sent out into space. (Standard VIII, Objective 6)
- Do a research paper on one of the great scientists of the past who used telescopes. (Standard VIII, Objective 6)

## Assessment Suggestions

1. Students compare Galileo's use of the telescope with their own and compare with today's technology for learning about space.
2. Evaluate student journal entries. Look for organization, clarity and personal reflection.

Reference to Assessment Section:

	Multiple Choice	Constructive Response	Performance Test
Unit Test 1	4, 6	2	Telemetry
Unit Test 2	5, 6, 7, 8	2, 3	Telemetry

## Resources

### *Teacher Guide*

- *Moons of Jupiter*. GEMS, Lawrence Hall of Science. This guide includes engaging activities about the four largest Jovian moons, including a simulation of Galileo's original observations. A set of 20 slides is included. A copy of a page from Galileo's journal is included.

### *Videos*

- *Solar System*, Aims Multimedia, 1998
- *The Sun/The Planets*, Disney, 1995
- *Planets, Wonders of the Night*, Media Guild, 1991