



In the Footsteps of Galileo

Your first Discoveries with the Library Telescope

Four hundred years ago, Galileo Galilei was the first person in history who turned a telescope towards the heavens for scientific study. What he saw forever changed our concept of the universe. Before that pivotal moment, all astronomical knowledge had been gained through naked-eye observations. After that, our understanding of the universe grew dramatically, and telescopes became larger and more powerful, eventually giving us the spectacular views that we see today.

This Library Telescope gives a clearer and sharper image than Galileo's equipment ever gave. You will see fascinating sights in our night sky, ones that are just out of reach of unaided eyes. Here are a few tips for getting the most out of this telescope:

- a. Make sure it is properly focused.
- b. Star clusters need only low power, while the planets need high power.
- c. Make sure the supporting table is steady. Some sky objects appear very small and a jiggling image obscures fine detail.
- d. Try to observe at a site away from city lights when viewing star clusters and nebulae. You will find that much more can be seen from a dark area than from a city location. You will quickly come to realize that light pollution degrades your view of the sky.

Presented below are five observing activities suitable for the Library Telescope. We hope you enjoy your experience under the stars. Become your own Galileo!

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The Discoveries of Galileo

Activities using the Library Telescope

1. Moon. November 30 through December 19, 1609.

Regarding the markings on the face of the moon which can be seen with the unaided eye, Galileo wrote:

“Now those spots which are fairly dark and rather large are plain to everyone and have been seen throughout the ages; these I shall call the ‘large’ or ‘ancient’ spots, distinguishing them from others all over the lunar surface, and especially the lighter part. The latter spots have never been seen by anyone before me. From observations of these spots repeated many times I have been led to the opinion and conviction that the surface of the moon is not smooth, uniform, and not precisely spherical as a great number of philosophers believe it (and the other heavenly bodies) to be, but it is uneven, rough, and full of cavities and prominences, being not unlike the face of the earth, relieved by chains of mountains and deep valleys...” (Starry Messenger, Galileo Galilei, 1610)

Objective: Discover that the moon is not a flawless sphere, but has craters of many sizes, and has mountainous regions as well as smooth plains.

Activity: Observe and draw the moon through the telescope when its phase is between a waxing (i.e., growing thicker) crescent and first quarter (“half” or “D” moon). Do this for two consecutive evenings.

How to locate: The thin crescent moon sets about an hour after sunset. As the evenings pass, it appears to grow fatter, i.e., wax, and it sets later. By the time of first quarter, the moon is high in the south at sunset and it sets near midnight.

2. Jupiter and its moons. January 7, 1610.

After viewing Jupiter and its accompanying four “stars,” Galileo wrote, *“And in the first place, since they are sometimes behind, sometimes before Jupiter, at like distances, and withdraw from this planet towards the east and towards the west only within very narrow limits of divergence, and since they accompany this planet alike when its motion is retrograde and direct, it can be a matter*

of doubt to no one that they perform their revolutions about this planet while at the same time they all accomplish together orbits of twelve years' length about the center of the world.” (Starry Messenger, Galileo Galilei, 1610)

Objective: Discover that Jupiter exhibits a small, flattened disk as viewed with this telescope. It has four moons (Io, Europa, Ganymede, and Callisto) which orbit around it, the innermost (Io) taking less than two days to do so and the outermost (Callisto) taking two weeks.

Activity: Observe and draw Jupiter and its four moons at about the same time on at least three evenings over one week. Your drawings should have Jupiter centered with its moons proportionally placed on the planet's correct side. Be sure to write down the dates and times when you made your observations.

How to locate: Please refer to the Planetary Chart in this guide. Jupiter is a very bright object when it is not positioned near the sun and likely the brightest object in its part of the sky.

3. The phases of Venus. December 1610 and January 1611.

Galileo announced his observations of the phases of Venus by using a Latin anagram. Unscrambled, it gave, "*Cynthiae figuras aemulatur mater amorum.*" Translated, it read, "*The mother of love [Venus] emulates the figures of Cynthia [the moon].*" (Starry Messenger, Galileo Galilei, 1610)

Objective: Discover that Venus exhibits phases, similar to the moon's, as it orbits the sun.

Activity: Observe and draw Venus when it is in its crescent phase. Try to view it at least twice, five to seven days apart. View through the "moon port" to decrease the glare from the planet's intense light.

How to locate Venus in its crescent phase: During its crescent phase, bright Venus can be found low either in the west shortly after sunset or in the east shortly before sunrise. See the Planetary Chart for the appropriate dates and sky locations.

4. Pleiades Star Cluster (aka Seven Sisters or M45). Early 1610.

Galileo described his view of the Pleiades, also known as the "Seven Sisters," "*I have depicted the six stars of Taurus known as the Pleiades (I say six, inasmuch as the seventh is*

hardly ever visible) which lie within very narrow limits in the sky. Near them are more than forty others, invisible, no one of which is much more than half a degree away from the original six.” (Starry Messenger, Galileo Galilei, 1610)

Objective: Discover that many celestial objects that are visible to the unaided eye as “blurry” areas are, in reality, composed of many stars that you can not readily see. This applies to the Pleiades star cluster, a popular stargazing target in the late fall, winter, and early spring skies.

Activity: Observe and draw the Pleiades star cluster using low power. Increase to high power and notice how the clustering effect is lost due to over-magnification.

How to find the Pleiades: The Pleiades resemble a very little dipper. (It is not the well-known “Little Dipper” formation of stars.) It can be found to the far upper right of the constellation Orion. It rises in the east-northeast in mid October about 8:00 p.m. and stands nearly overhead at midnight.

Location of the Pleiades in the early evening hours:

September	10:00 p.m.	Low in the East-Northeast
October	8:00 p.m.	Low in the East-Northeast
November	8:00 p.m.	In the East
December	8:00 p.m.	High in the East
January	8:00 p.m.	Nearly overhead
February	8:00 p.m. EST	Nearly overhead
March	9:00 p.m. EDT	High in the West
April	10:00 p.m.	Low in the Northwest

Between May and August, the Pleiades lie in the sky sometime between 11:00 p.m. and sunrise.

5. Milky Way. Throughout 1610.

The mystery of the nature of the glowing band of the Milky Way was partially solved by Galileo. He wrote that the Milky Way “is nothing but a congeries of innumerable stars grouped together in clusters. Upon whatever part of it the telescope is directed, a vast crowd of stars is immediately presented to view. Many of them are rather large and quite bright, while the number of smaller ones is quite beyond calculation.” (Starry Messenger, Galileo Galilei, 1610)

Objective: Discover that the band of the Milky Way is primarily composed of an uncountable number of very faint stars.

Activity: Pick one of the brighter sections of the Milky Way's band and draw its star field as seen through the telescope. There may be too many stars to draw! Pick another area of the sky far from the Milky Way and draw its star field. Note the dramatic difference in the number of stars. You might wish to draw the areas surrounding Deneb, lying in the middle of the Milky Way and Arcturus, lying far from it.

How to find Deneb and Arcturus: Let's begin with Arcturus. First, locate the Big Dipper. Then draw an imaginary line following the curve of the Dipper's handle. It will land on a very bright star exhibiting a slight yellowish tinge. That is Arcturus, the 2nd brightest star visible from most of the United States. Now, let's find Deneb. First, again locate the Big Dipper. Then draw another imaginary line northeastward, this time beginning at the two stars at the back of the bowl. (A line drawn from the two stars at the front of the bowl intersects the North Star.) That straight line intersects Deneb, one of the stars in the Summer Triangle. In early evening in September and October, Deneb lies nearly directly overhead for most of the observers in the United States.

How to find the Milky Way: The softly glowing band of the Milky Way galaxy cannot be seen from urban locations, although it can be faintly discerned from some of the darker suburban areas. Rural locales, away from lights, are required to truly see this magnificent sight in all its splendor.

The Milky Way is not easily visible in the early evening hours from late April through late June. It lies too close to the western, southern, and eastern horizons for it to be a good stargazing target. During this period, the best time to view it is between 1:00 a.m. and 4:00 a.m.

Location of the Milky Way before 11:00 p.m.:

January	8:00 p.m.	Southeast — overhead — Northwest
February	8:00 p.m.	Southeast — overhead — Northwest
March	9:00 p.m. EDT	South — overhead — Northwest
April	10:00 p.m.	South — West — North
May	11:00 p.m.	Along western horizon. Tough to see
June	11:00 p.m.	Southeast — East — North
July	11:00 p.m.	South — East — Northeast
August	11:00 p.m.	South — overhead — Northeast
September	10:00 p.m.	Southwest — overhead — Northeast
October	9:00 p.m.	Southwest — overhead — Northeast
November	8:00 p.m. EST	West — overhead — Northeast
December	8:00 p.m.	West — overhead — East