



LibraryTelescopeProgram

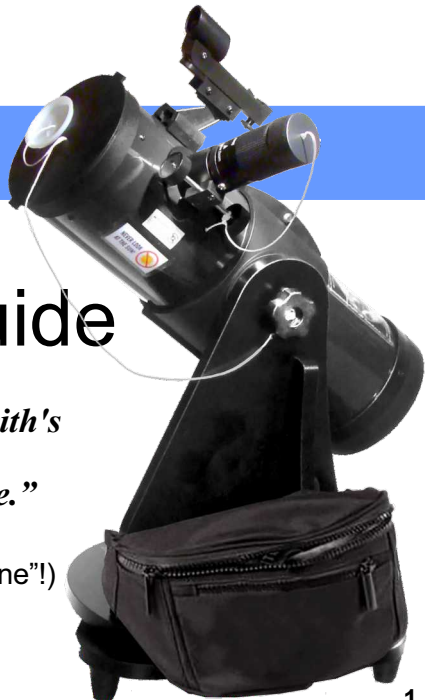
# Telescope User Guide

*“The strongest thing that's given us to see with's  
a telescope. Someone in every town  
seems to me owes it to the town to keep one.”*

From the Robert Frost poem “The Star Splitter”\*

(Please thank your librarian for being that “someone”!)

\*see page 15 to learn about “star splitting”



## Meet the Library Telescope!

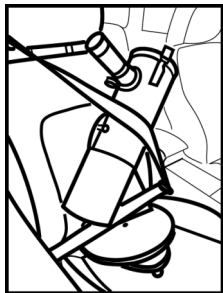
This short focal length 4.5 inch diameter reflecting telescope has good optics and a stable easy-to-use altitude-azimuth mount.

It has a very wide field of view, meaning you get to see a large part of the sky. It has a zoom eyepiece, which gives a range of magnifications from 21 power to 64 power, and shows a field of view spanning from just under 1 degree to almost 2 degrees.

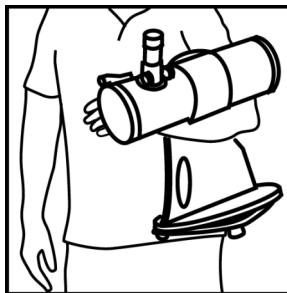
Without having a great deal of expertise, you can obtain clear views of the Moon, planets, and the brighter star clusters and nebulae. Each time you work with the telescope, it will get easier to use, and stellar objects will become easier to find.



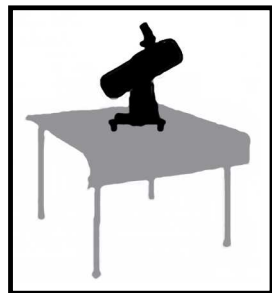
## Transporting, Setup, and Care



The telescope can travel belted in a car



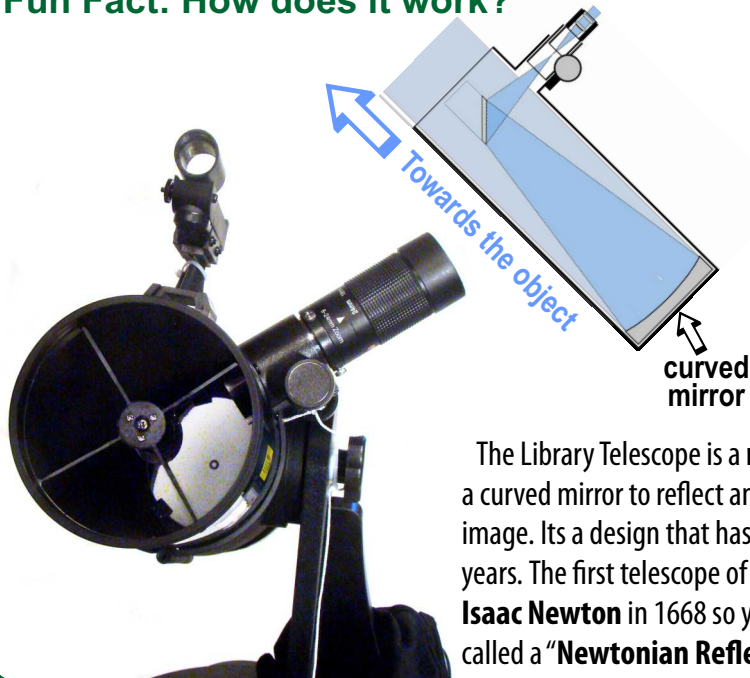
Wrap your arm around the mount to carry it



To use, place it on any table, stool, or bench

- Try not to bump the zoom eyepiece or red dot sight.
- Dropping anything into the telescope tube may cause serious damage.
- Avoid touching the mirrors inside the telescope tube or the eyepiece lens glass.
- Contact your librarian if the optics seem cloudy or dirty, please don't attempt to clean them.
- Put on the dust caps when not in use.
- Children should use this telescope only with adult supervision.
- **Never aim the telescope at the Sun, it will melt parts and damage eyesight.**

## Fun Fact: How does it work?



Isaac Newton's 1668 reflecting telescope, look familiar?

The Library Telescope is a **reflecting telescope**. It uses a curved mirror to reflect and focus light to create an image. Its a design that has been around for hundreds of years. The first telescope of this type was created by **Isaac Newton** in 1668 so you will also see this design called a "**Newtonian Reflector**."

## Getting Started

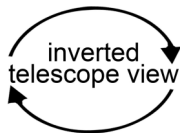


It's a good idea to read the instructions and practice with the telescope inside before you take it out in the dark.



This is a **“Push-to”** telescope on what's called an **“altitude-azimuth mount”** (it goes up / down and left / right). Because the Earth is turning, objects in the night sky will look in the telescope like they are moving in the opposite direction. You will have to reposition the telescope to keep objects in the center of the eyepiece. Depending on the bearing tension, you may need to grasp the front and back of the telescope to move it smoothly.

Like many telescopes, **the image in the eyepiece is upside-down**. When looking at star charts and moving the telescope you will have to keep this in mind. The Moon map on the telescope is inverted or **“flipped”** to match what you see in the eyepiece.



Do you wear eyeglasses? If you are nearsighted or farsighted, you will probably be able to observe with your glasses off. If your eyes are astigmatic, images will probably appear best with glasses on.



# Aiming the Telescope

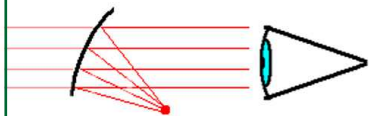


This telescope has a **Red Dot Sight** to help you aim it at objects.

- To it turn on, rotate the power knob until you hear a “click”.
- From behind, look through the sight to see the red dot.
- Center the dot on the object you wish to observe.
- Intensity of the dot can be adjusted by turning the power knob.
- Turn down brightness to the lowest possible setting.



## Fun Fact: Its (mostly) mirrors again!



The Red Dot Sight uses a curved window, acting as a mirror, focusing the light from a small red LED light bulb back at you. This causes all the light to travel in one direction, making the red dot appear to float in space out in front of you.

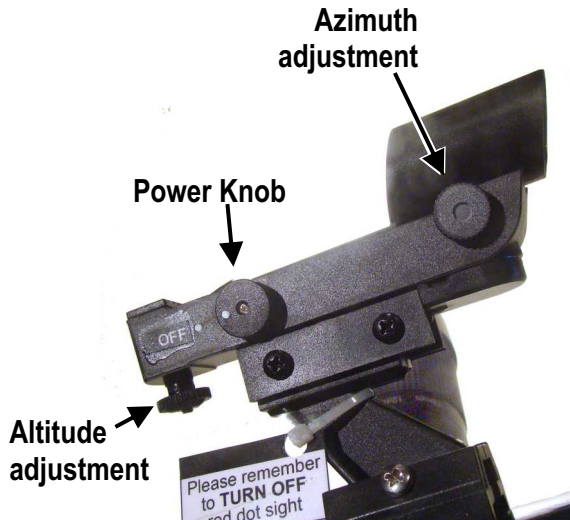
## Adjusting the Sight (if needed)



The Red Dot Sight should be in alignment when you receive the telescope.

**To check**, (best done in the daytime) with the eyepiece at low magnification (21mm), aim the telescope at a distant object and center it in the telescope's eyepiece. Turn the Red Dot Sight on and look to see if the object is near or under the red dot.

**If not:** Use the Red Dot Sight's left/right (azimuth) and up/down (altitude) adjustment knobs to position the red dot on the object. When the object is centered in the telescope and the red dot is centered on the object, you're done!



Red Dot Sight details

## Magnification and Focusing

This telescope has a **Zoom eyepiece** (operated by turning the **Zoom Ring**) to give you a range of magnification. The eyepiece is a variable power magnifying glass: the short focal length (7mm) produces a high magnification and a long focal length (21mm) produces a low magnification. This makes the telescope easier to operate in general. For example, turning the Zoom Ring to 21mm will give you a low magnification, wide field of view, making finding and centering an object easier. You can then zoom in to higher magnifications as needed.

To focus, slowly rotate the **Focus Knobs**. When its "in-focus," rotate the knob to either side of your "in-focus point" just to make sure you've hit the sharpest image for your eyes. When focusing on stars, bring them to as small a point as possible. Each user may have to re-focus to match their eyesight.



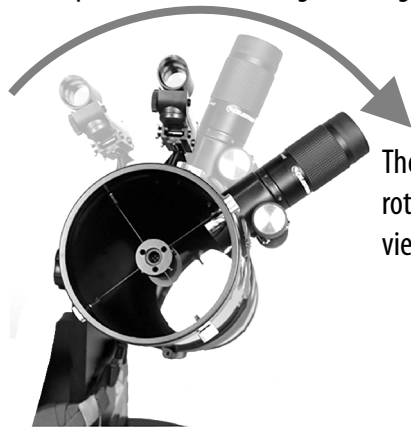
When you change magnification you will have to refocus the telescope.





If the telescope tube is hard to move up-down or does not stay in place, use the **Altitude Clamp** knob to set the right level of tension.

If you find that it's awkward for you (or a child) to look through the eyepiece, you can loosen the **knob** on the **Tube Clamp** and rotate the telescope tube until the eyepiece is in a more convenient position. Be sure to tighten it again!



The tube can be rotated to change the viewing position



The accessories pack strapped to the telescope mount contains a *User Guide*, a night sky navigation chart or booklet, and a **red flashlight**.

When observing at night (especially when trying to viewing detail in dim objects) **it can take 20 minutes or more for your eyes to become adapted to the dark.** Red light doesn't affect this so you can use the supplied flashlight to read the Guide, navigation chart, or to make adjustments to the telescope.



When in a group of people, other observers will appreciate it if you use the red light.



## Observing Hint:

You will find when star gazing that dew forms on pretty much everything (and everyone). The big mirror is tucked safely down at the bottom of the telescope and generally it stays dry. The eyepiece, however, can get covered in dew, making it useless until it warms up and dries out. One way to dry it is to wrap your hands around it for a few moments. As it warms up, the fog should disappear. The telescope can also be taken inside to warm up. Please don't wipe the lens with a tissue or cloth as it has special coatings on it that could be damaged if you do.



**We mentioned this before, but its worth repeating**

**WARNING:** Never look directly at the Sun through your telescope — even for an instant — as permanent eye damage could result. Do not point the telescope at the Sun, as parts will melt!



**NEVER LOOK AT THE SUN!**

## Observing the Moon

**The Moon** is one of the easiest and most interesting targets to view with your telescope. Lunar craters, “seas”, and even mountain ranges can all be clearly seen from a distance of 238,000 miles away! With its ever-changing phases, you’ll get a new view of the Moon every night it’s up. The best time to observe is during a partial phase, that is, when the Moon is not full. During Full Moon the surface looks flat. During partial phases, shadows are cast on the surface which reveals more detail, especially right along the border between the dark and light portions of the disk (called the “terminator”). Use the Map on the telescope tube to help find the major craters and features.

### Observing Hint:

If the Moon is too bright, or you want a bit more contrast, put the dust cover on the telescope and remove the small plastic plug to open what's called the **Moon Port**. This is called “stopping down” and reduces the light hitting your eye.

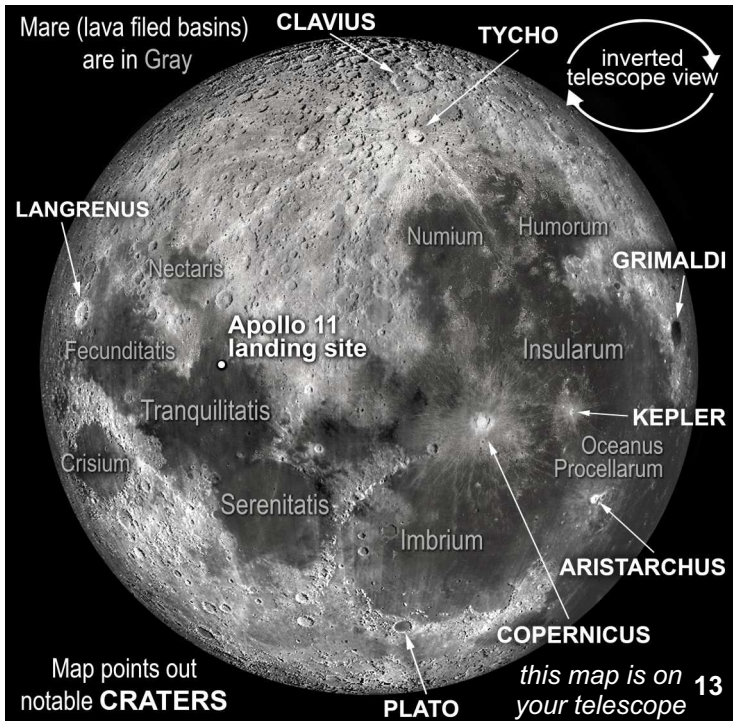




Full Moon looks flat!



In a partial phase, shadows show more detail



# Observing Planets

The Planets do not stay at “fixed” locations so to find them you should refer to print or online publications such as *Astronomy* or *Sky & Telescope*, other astronomy websites, or planetarium apps. **Venus**, **Jupiter**, and **Saturn** are the brightest objects in the night sky after the Moon. **Mars** and **Mercury** are also bright but are usually small telescope targets. You do not need to be at a dark location, or even away from outdoor lights, to see Planets.

**Venus** changes phase and size as it orbits around the Sun

**Jupiter and its moons**



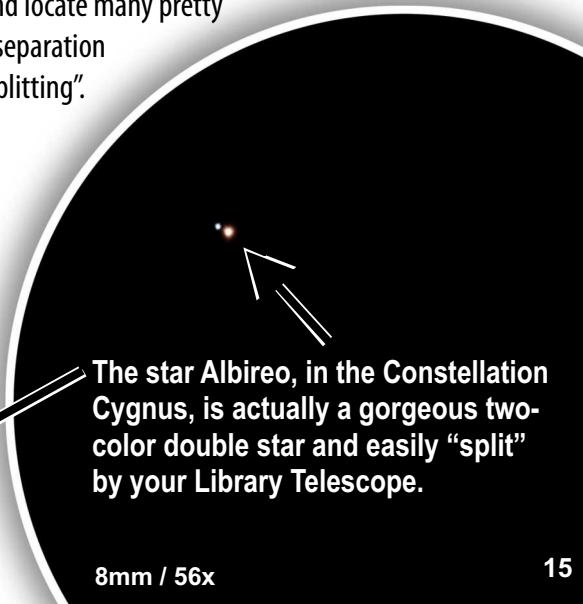
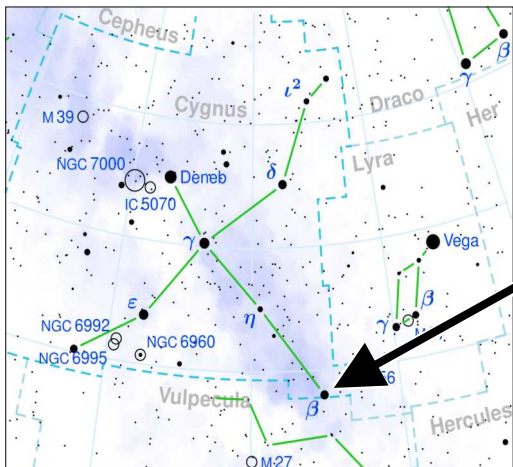
The screenshot shows the Astronomy.com website interface. At the top, there's a navigation bar with 'News', 'Science', 'Observing', 'Space Exploration', and 'The Mag'. Below this is a night sky chart for January 14, 1 hour after sunset, looking southwest. The chart shows several constellations: CETUS, PISCES, AQUARIUS, PEGASUS, DELPHINUS, PISCIS AUSTRINUS, and CAPRICORNUS. Planets and other objects are marked: Diphda, Neptune, Moon, Skat, Saturn, Enif, Fomalhaut, and Deneb Algedi. A scale bar indicates 10 degrees. The bottom of the chart area says 'Jan. 14, 1 hour after sunset Looking southwest'.

**Websites like Astronomy.com have up to date night sky charts.**

**Saturn**

# Observing Stars

Even powerful telescopes cannot magnify a star to appear as more than a point of light. You can, however, enjoy the different colors of the stars and locate many pretty double and multiple stars. Being able to see the separation between two stars in a telescope is called "Star Splitting".



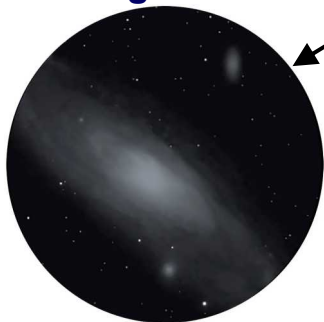
The star Albireo, in the Constellation Cygnus, is actually a gorgeous two-color double star and easily "split" by your Library Telescope.

8mm / 56x

# Observing Deep-Sky Objects

Most **“Deep-Sky Objects”** (the name star-gazers give to nebulae, star clusters, and galaxies) are very faint, so observe them well away from light pollution (travel to a dark sky location if possible) and pick a time when there is no Moonlight (what astronomers call **“Dark Time”**). Take time to let your eyes adjust to the darkness. Often called **“dim-fuzzes”**, do not expect **“Hubble images”**; many will look like dim gray smudges. As you become more experienced you will be able to see more subtle details.

## Observing Hints:



Andromeda Galaxy (M31)

**Deep-Sky Objects** can be big and dim. Use low magnification (21mm - wide field) to find and view them. Your eye is not as light sensitive at its center so instead of looking right at objects, try to look off to one side. This is called **“Averted Vision”** and works well when looking at dim objects.

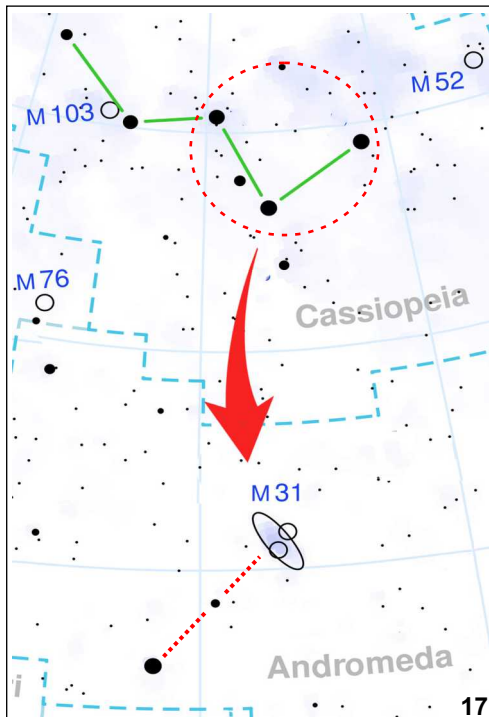




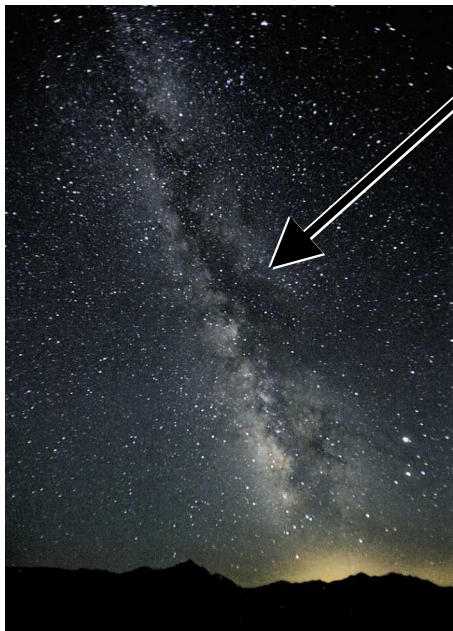
To find deep-sky objects, look through the sky chart provided with the telescope and/or use one of the smart phone planetarium apps. Constellations have many objects hidden within them that are only visible with a telescope or binoculars. Objects with a “**Messier Number**”, for example M11, M45, (cataloged by **Charles Messier** in 1774) are some of the brightest deep sky objects.

To locate objects, look for a pattern of stars on a star chart that can act as landmarks to find them (a technique called “**Star Hopping**”).

For example: to find the **Andromeda Galaxy (M31)**, three stars on one side of Cassiopeia form a triangle “pointing” --> to a brighter star and two dimmer “stars”, all in a row. The end one is the Andromeda Galaxy.

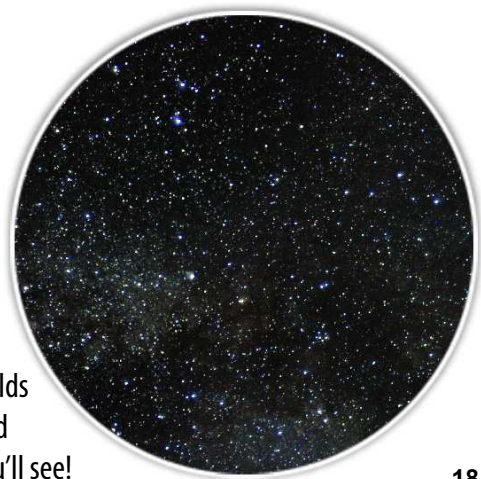


## The Milky Way



The Milky Way at a dark sky location

The Milky Way is our galaxy. It shows up as a fuzzy band across the sky because we live within it. If you are somewhere where you can make out the Milky Way (even faintly), try low-power (21mm) scanning along its length: just cruise through the “star clouds” of our galaxy.

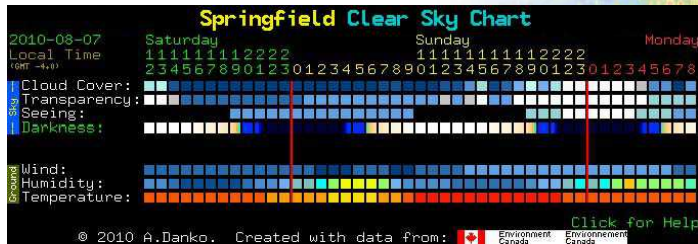


You'll be amazed at the rich fields of stars and objects you'll see!

# Best Skies for Observing

For the **Moon, Planets, Double Stars**, light pollution such as local porch lights, street lights, general sky brightening, or a few clouds does not severely affect observing.

**Deep-Sky Objects** need the night sky to be as clear and dark as possible. Here are some online tools.



The “**Clear Sky Chart**” (<https://www.cleardarksky.com/csk/>) is a weather forecast for astronomers. Pick the city or town closest to you. When reading it, the first 4 bars are the most important, the deeper blue the squares are on each line, the better.

A web search for “dark sky map” will bring up several interactive maps that show you where you can find less light pollution.

This **Library Telescope** is brought to you by the local librarians, amateur astronomers and organizations who help to purchase, modify and maintain the telescope.

The **Library Telescope Program** was originally conceived by the New Hampshire Astronomical society ([nhastro.com/ltp.php](http://nhastro.com/ltp.php)). Further information on the program can be found at [librarytelescope.org](http://librarytelescope.org).

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Guide layout, text, and select images  
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## More help Online



Need more information on your Library Telescope and Astronomy? Helpful videos, apps, star charts, and more are available, just scan the QR code above.