



TELESCOPES

Your Window to the Universe



Astronomy Club of Tulsa - <https://www.astrotulsa.com/>

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So, you have a NEW TELESCOPE!! What a wonderful instrument for viewing the wonders of the universe. Most of the members of the Astronomy Club of Tulsa have shared your eagerness to venture forth into the cosmos. The sky is filled with many marvelous wonders but unfortunately there are no flashing signs to tell you where to point your telescope. We would like to share with you some of the lessons we have learned to help you enjoy the magnificence of the night sky. One of the best ways to learn the secrets of the night sky is join an astronomy club and learn from others who have spent years searching out the wonders of the universe.

What to see with your new Telescope

<https://www.skyandtelescope.com/astronomy-news/what-to-see-with-your-new-telescope-4/>

LEARN THE NIGHT SKY The first step is to learn to name and locate the brightest stars and major constellations. Just as you need a road map to set off on a trip to unfamiliar places on earth, so a good star chart can be your guide through the night sky. Today there are smart phone apps that can assist in learning the sky. Some Astronomy Apps *SkyPortal*, *SkySafari* *PUniverse* - a free open source computer program called *Stellarium*. – Many others are available for phones and tablets. There are also good books available which include star charts. I suggest a simple one to start with and then move up to more detailed charts later.

CONSTELLATIONS are official arrangements of stars that have been named for persons, animals or objects. Most of their names have roots in the mythology of the Greeks and Romans. Modern astronomers have selected 88 official constellations. Constellations map out the sky much like the boundaries of nations map out the world. You probably know some constellation names such as Orion, Gemini, Leo. If you want to search for M42 the great Orion nebula, then you must know how to find Orion. One of the best books for learning the Constellations is "The Stars, a New Way to See Them" by H.A. Rey. Rey, the author of the "Curious George" books, presents the constellations in easy to learn stick figure images that resemble the characters for which the constellations are named.

DARK ADAPTATION Our eyes take TIME TO ADJUST to the dark. You must plan to stay in a dark area for AT LEAST 10 MINUTES or more to become dark adapted. Avoid going in and out of lighted areas. Try to find an observing site shielded from direct views of streetlights or other bright lights. Astronomers use a **RED FLASHLIGHT** to preserve their dark adaptation when they need to read at night.

BRIGHTEST STARS The visible stars are divided into SIX groups based on their brightness. The **MAGNITUDE** of a star is a numerical measurement of its brightness. The 20 brightest stars are called 1st magnitude. Magnitudes 2, 3, 4, 5 etc., become increasingly dimmer. On a dark country night, the dimmest stars visible to the human eye are around 6th magnitude. A 6th mag star is 100X dimmer than a 1st mag star. A few objects are much brighter than the stars, so they are given negative magnitudes. The planet VENUS reaches magnitude -4.4, or 144 times brighter than a 1st magnitude star!! Your telescope however will allow you to see many thousands of stars too dim to be seen by the naked eye. A 60 mm telescope will let you see stars 73 times dimmer than the naked eye. While a 6-inch telescope will bring in objects 470 times dimmer than you can see with your eye.

LEARN THE BASIC PARTS AND OPERATION OF YOUR TELESCOPE.

A telescope is an instrument to collect and focus light. The **OBJECTIVE** is the part of a telescope that gathers and focuses light. The objective may be a set of lenses, mirrors or a combination of both. The **SIZE** of a telescope is defined by the diameter of its objective. Astronomers often use the word

APERTURE to describe its diameter. If someone tells you they own a 6-inch telescope, they mean that its lens or mirrors are 6 inches across. Often aperture is given in millimeters. Ex. 6 inches = 150 mm

THREE PERFORMANCE CRITERIA OF A TELESCOPE.

There are three ways to determine how well a telescope performs.

1. LIGHT GRASP 2. RESOLUTION 3. MAGNIFICATION

The **DIAMETER** of the **OBJECTIVE** (Aperture) is the most important factor in judging how well a telescope will perform in each criteria. **THE LARGER THE OBJECTIVE THE BETTER ITS PERFORMANCE.**

LIGHT GRASP is the amount of light that is collected and focused by the telescope. Astronomers often use the slang term "Light Bucket" to refer to their telescopes. You can imagine starlight as a gentle "rain" of photons sprinkling down from the heavens above.

THE LARGER THE OBJECTIVE THE BETTER ITS LIGHT GRASP.

RESOLUTION is the ability to see fine details or to separate images of closely spaced stars. Resolution is measured by the smallest angle between two objects so that they still appear as separate objects. In astronomy we use the **ARCSEC** to measure these angles. One **ARCSEC** (Arc Second) is 1/3600 of a degree. The moon is about 1800 arcsecs in width. Your eye can see objects as close as 60 arcsecs. A 60 mm telescope will resolve 3.2 arcsecs or 20 times more detail. Again, **THE LARGER THE OBJECTIVE THE BETTER ITS RESOLUTION.,**

MAGNIFICATION is the number of times larger or nearer an object appears. Magnification is **MUCH OVERRATED.** The **MAXIMUM USEFUL MAGNIFICATION** of a telescope is limited to 50 power per inch of diameter or 2 power per millimeter. Thus a 60 mm telescope can magnify **ONLY** up to 120 **POWER.** Attempting to push a telescope beyond this limit will result in a fuzzy disappointing image. Many department store telescopes advertise power far beyond what they can deliver. This doesn't mean that they are bad telescopes as long as they are used within their performance limits.

LIGHT GRASP and **RESOLUTION** cannot be changed without buying a different telescope. Magnification, however, can be selected for the type of object you wish to view. Most telescopes come with 2 or 3 different eyepieces to change the magnification. To calculate the magnification of an eyepiece, divide the eyepiece focal length into the telescope focal length. The focal length of eyepieces and telescopes are often labeled on the telescope or in the owner's manual.

Use **LOW POWER** - 30X to 50X to find your target and view star clusters or larger objects. Use **MEDIUM POWER** - 80X to 100X for the moon, planets, star clusters, nebulae and galaxies. Use **HIGH POWER** - 150X or more for specific details of planets and moon craters. However, the motion of the Earth's atmosphere often limits magnification on most nights to about 200 X

Telescopes come in three basic designs.

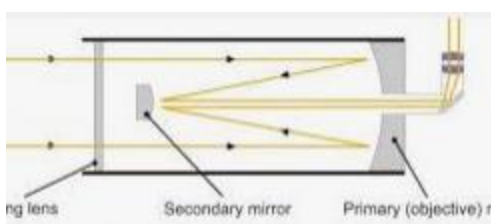
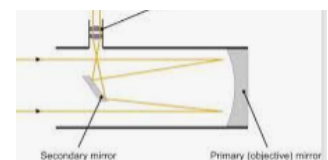


Refractor - which uses a lens to focus the light at the opposite end of a long tube. A good, rugged design for starter scopes for kids Higher end

models are favorites for planet enthusiasts.

Reflector - uses a concave parabolic mirror to collect and focus the light.

Have good light grasp but do require care for keep clean and alignment.



Catadioptric - which use a combination of a primary mirror along with lenses to gather and focus the light along a folded light path. There are a variety of designs. The most common is a Schmidt-Cassegrain or "SCT"

The telescopes mount is important. It needs to be sturdy to keep the scope steady for viewing. It also needs to move smoothly. They may be designed to be moved manually or may have a motor that track the motions of the sky. Designs are also available with computer assisted locating and tracking. Unfortunately, these can take a steep learning curve to master and often frustrate the novice astronomer. I strongly discourage beginners from buying a German equatorial mount that has a counterweight on a long arm with the telescope at opposite end. A recent innovation called "StarSense" uses an intelligent camera to read the sky and figure out where things are in the sky. One even has a cell phone mount on the scope and an app that tells you how to move the scope. It's a new technique that shows promise.

Before you purchase a telescope explore your options and ask questions.

Do Not buy them at "Big Box" stores and use caution when looking at the Internet ads that say things like "Most Popular" Which does not necessarily equate to quality. Many have poor optics and mounts.

BE SURE TO **ASK IF THE TELESCOPE YOU WANT IS IN STOCK.**

If you are completely new to astronomy, start with a simple but quality scope. Spend a year or two learning the sky. By that time, you will know if you want to pursue astronomy at a higher level and what types of telescopes would best fit expanding your interest. Fortunately, today there are many phone apps and Internet sources that can help you identify visible objects in the sky as well as the hidden treasures in the sky accessible with telescopes. Learning the sky is much like becoming familiar with your neighborhood and town. When you look up on a clear night you mind will recognize familiar patterns in the sky. My favorite book for learning constellations "The Stars, A New Way to See Them" by H.A Rey which represents the constellations in simple stick figures.

Join an astronomy club or subscribe to an astronomy magazine or frequent their websites.

<https://skyandtelescope.org/>

<https://astronomy.com/>

An illustrated version of this article is at <https://www.astrotulsa.com/telescopes>

Choosing a First Telescope

<https://skyandtelescope.org/astronomy-equipment/choosing-astronomy-equipment/>

Stargazing Basics <https://skyandtelescope.org/astronomy-resources/stargazing-basics/>

This features a whole collection of resources from beginner basics – meaning of astronomy terms to reading star charts. Family fun projects and more.

How to Use a Star Chart at the Telescope - Great article describing how to use star charts to locate the objects you want to observe.

<https://skyandtelescope.org/astronomy-resources/using-a-map-at-the-telescope/>

A few reputable telescope dealers. **ASK IF THE TELESCOPE YOU WANT IS IN STOCK**

Explore Scientific Springdale, AR <https://explorescientificusa.com/> Has a nice showroom with a variety of telescopes from novice to advanced users. They also manufacture a line of premium telescopes.

Highpoint Scientific <https://www.highpointscientific.com/> has an extensive selection of telescopes, accessories and astronomy cameras.

Ocean Pacific Telescopes in CA <http://www.optcorp.com> Extensive line of astronomy equipment as well knowledgeable staff to assist questions

Land, Sea & Sky <https://www.landseaskyco.com/> a Houston based company that carries many options for optical instruments for astronomy and navigation as well as imaging cameras.

Others **Astronomics** - <https://www.astronomics.com/> **Orion scopes** at <https://www.telescope.com/>

Vixen <https://www.vixenoptics.com/>

Skywatcher <http://www.skywatcherusa.com/>

This is not a comprehensive list of sources but ones I or our members have experience with.

Article by John Land – Astronomy Club of Tulsa