Telescopes Compared

All astronomical telescopes, large or small, share a common goal to brighten and magnify your views of celestial bodies. Refractors, reflectors, and compound (catadioptric) telescopes do their jobs in different ways each with its own benefits and drawbacks. Yet many fundamentals apply to any telescope. Of primary importance is a telescope's aperture: the diameter of its light-gathering lens or mirror. (That lens or mirror is often referred to as a telescope's objective.) Aperture makes a big difference in the level of detail you can see.

A telescope that can only be pushed as high as 50x (50 times magnification) will reveal Jupiter's moons, Saturn's rings, and some degree of detail in the brightest star clusters, nebulae, and galaxies. But to discern Martian surface features or to see both members of a tight double star, you really would like to be able to use at least 150x. Depending on optical quality and observing conditions, you can expect to get anywhere from 20x (mediocre) to 50x (excellent) per inch of telescope aperture. Aperture also enables you to see fainter objects. For example, several dozen galaxies beyond our own Milky Way can be discerned through my 4½-inch (105-mm) reflector. Some are more than 50 million light-years away. Not bad for a telescope I can tuck under my arm and carry on a plane! But with my 12½-inch Dobsonian, hundreds of galaxies are within reach.

If a telescope's aperture is arguably its most important "spec," its focal length comes in as a close second. Say you have two telescopes with the same aperture but different focal lengths. The one with the longer focus (and hence, a higher f/ratio) will generally lend itself better to high-magnification viewing. (The f/ratio is the focal length divided by the telescope aperture in the same units.) One reason: you can stick with longer-focus eyepieces, which are easier to use, especially for eyeglass wearers.

Another reason: "fast" objectives (those with small f/ratios) tend to make fuzzier images, unless you've paid a premium for high-quality optics.

"So it seems clear, I should go after the largest, longest telescope if targets are the Moon, the planets, or double stars. And a large objective is a necessity if you dream of viewing numerous distant galaxies. But if you want to take in large swaths of the Milky Way or sparkling showpieces like the Pleiades, a short, small scope is called for.

"Why's that?" Because a long focal length only lets you see a small patch of sky at one time. With standard eyepieces (those that have 1¼-inch-wide barrels), a focal length of 20 inches (500 mm) can provide a 3° field of view enough to take in all of Orion's Sword. A focal length of 80 inches (2000 mm), by contrast, barely lets you encircle M42, the famous Orion Nebula in the Sword's center.

"What if I want to do a bit of everything?" Don't worry. There are plenty of acceptable compromises. Many astronomers take the 6-inch (152-mm) reflector to be an ideal "do-it-all" instrument. But keep in mind that even with that aperture, you still face a trade off between a wide field of view (f/5 or thereabouts) and high-power performance (optimal at f/8 and up). The long-focus unit will also be heavier and require a beefier mount.

The Image on the Left (Smaller image) is a 1 Degree Field of View. The Large Image is a 3 Degree Field of View.

Altazimuth mounts are generally lighter than their equatorial counterparts, in part because they don't require counterweights to balance the telescope. (I hasten to note, however, that the equatorial "fork" mounts supplied with many compound telescopes are relatively lightweight, too; the photo above shows one example.) Dobsonian mounts, in particular, can be extremely stable and economical. But alt azimuth's do not readily lend themselves to motorized operation, and you have to move the telescope in two directions simultaneously to track celestial targets. While this becomes second nature to many observers, others find it maddening. (See the section below on "smart" telescopes for a novel, high-tech way around this problem.)

Your own personality should play a part in choosing a mount. Are you comfortable with instruments that require tools and a head for numbers to set up and use? Or are you looking for the astronomical equivalent of a point-and-shoot camera? Equatorial mounts generally require several minutes of assembly, careful balancing, and polar alignment, while some Dobsonian's can be set up in the time it took to read this paragraph, and some "smart scopes" on "alt-az" mounts can be deployed nearly as rapidly.

Type: Reflector

Advantage: Least expensive per inch of aperture. Optical Tube Assembly (OTA) can be mounted on an Altazimuth, Dobsonian or Equatorial Mount.

Disadvantage: Longer cool down time

Type: Compound Telescope Catadioptric or Schmidt-Cassegrain. or Maksutov.

Advantage: Long focal length, short tube, can be placed on an English Fork or German Equatorial mount, ideal scope for Astro photography.

Disadvantage: Narrow field of view, long cool down time.

Type: Refractor

Advantage: Very sharp images possible. shortest cool down time.

Disadvantage: Most expensive per inch of aperture.

Type: Dobsonian mount, the tube is *still* a reflecting telescope.

Advantages: Ideal visual companion. The base itself operates on a Altazimuth principle and allows you swing round to anywhere in the sky with ease, **The Optical tube Assembly (OTA) is detached from the mount base for transportation.**

Disadvantage: The OTA is a Reflector (See Reflector). Mount is not designed for Astrophotography.