

How to buy your first telescope

By Mark Johnston

So you're interested in buying a telescope. How can you make sense of the myriad of different suppliers, designs, mounts, accessories – and prices? Whether you're looking for a gift for a family member, or starting on your own stargazing journey, this article is for you. The good news is telescopes are higher quality, more affordable, and easier to use than ever before. But buying a telescope is not unlike buying a car. One answer does not suit everyone. You need to consider several factors in your decision:

- What is my budget?
- Will I be observing from the city, suburbs or a rural/dark location?
- What types of objects am I most interested in seeing?
 - Planets and the Moon
 - Galaxies, star clusters
 - Double stars
 - Terrestrial as well as night use
 - The Sun
- How much room do I have for storage?
- Do I need something rugged, or can I manage a more delicate design?
- The best telescope is the one you use. If it's too big, heavy, or complicated, it will gather dust
- Do I know anything about the night sky or am I a complete 'newbie'?
- Do I think I want to get into astrophotography?



Source: Sky & Telescope

Google “astronomy clubs in [my area]”. You will probably find there is at least one club near you with members who gather periodically to show the night sky to the public. There’s no better way to get a feel for what you want, and what value you can get for the dollar, than going to a

'star party' and looking through different designs of telescopes. You'll get a feel for what you can expect to see, costs, necessary accessories like eyepieces, and how interested you really are.

Binoculars

Many people say the best way to get into astronomy is to start with a basic pair of binoculars. This way you can see craters on the moon, the moons of Jupiter, and larger star clusters like the Pleiades and the Beehive at under \$100 for a decent used pair. Plus, they can be used for sporting or vacation activities too.

If you are going to consider binocular as a first step, look for 7 or 10x magnification and 35-50mm lenses. I think a 7 or 10x50 is ideal as they will gather much more light than 35mm binoculars. Certainly, if you can't afford to spend at least \$150 on your first telescope and mount, binoculars are a better investment.

I have 2 very high quality binoculars but I rarely use them for astronomy except to hunt for the first visible stars at dusk. They simply do not provide sufficient magnification to see enough detail in most objects. And you can't hold them up to the sky for too long without arm fatigue, unless you buy a binocular stand which sort of defeats the purpose of a portable optical device.

Some people have found starting with binoculars has led them successfully into astronomy. For me it would not have worked. But for others binoculars have been a great first step. It's something you should consider.

Here are some general DO's and DON'Ts from someone who has used all types of telescopes for over 50 years:

DO:

- Buy a telescope from a specialty astronomy store
- Consider a telescope from a quality used source, like www.cloudynights.com/ or www.astromart.com/ *IF* you have an experienced friend to help you
- Be concerned about aperture rather than magnification
- Set up your new telescope for the first time in the daylight, so you can be sure the mount, finder scope and telescope are all working properly and you can focus on a distant target (mountain, powerline or building) successfully
- Focus on two key criteria: quality optics and a stable mount
- Expect to pay >\$250 for a decent quality first telescope and mount combination
- Get educated before you buy. Good places to learn include the Cloudy Nights forum <https://www.cloudynights.com/index/> and Stargazers Lounge <https://stargazerslounge.com/>

DO NOT:

- Buy a telescope from a department store. In every case I have seen, they are junk.
- Forget to factor in necessary accessories into your budget like eyepieces, a battery, and a mount/tripod (unless these are included)
- Buy anything with a rickety tripod. The scope should be solid and stable on its mount.
- Buy something from craigslist, ebay, or any other non-astronomy-specific online source UNLESS you have an expert friend who can help you avoid junk (and you get a reasonable return policy)
- Be concerned about magnification

Types of telescopes

There are two fundamental classes of telescopes. Those that use lenses (refractors) and those that use mirrors (reflectors). There are sub-types of both classes. The 'reflector or refractor' debate will never end, but here are some generally useful points to consider:

Refractors

- More rugged, do not need collimation [mirror alignment] or adjustments
- Adjust to temperature more quickly than reflectors
- More expensive per inch of aperture, especially for higher end models
- More portable
- Better contrast (blackier blacks) and sharpness
- No central obstruction in the light path
- Images are right side up (though reversed)
- Subject to chromatic aberration in lower cost models (colored fringes around Venus and bright stars)



Reflectors

- More aperture per dollar means for the same price you can see fainter objects
- Higher maintenance (cleaning mirrors, collimation)
- Easier to make 'faster' i.e. with lower focal ratios. This means you can see a brighter, wider field of view (at the expense of magnification)
- Subject to coma aberration and spherical aberration (deformed stars on the edges of the field of view)
- Bulkier and heavier
- Images are upside down (irrelevant for astronomy but problematic for terrestrial use)

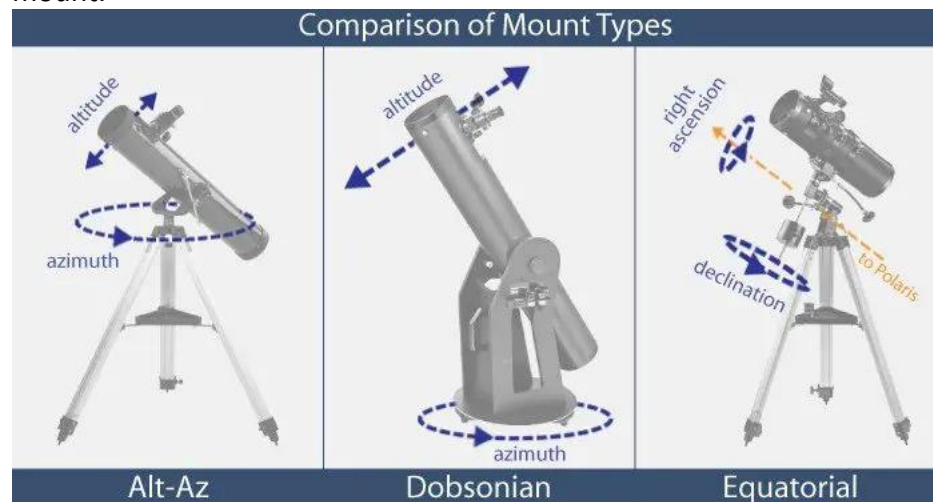


A common type of compound reflector is Schmidt Cassegrain design, which is essentially a folded reflector making the instrument more portable. Celestron makes a very popular 8" model. I happen to have the 9.25" version. But these scopes have 33% central obstruction, which reduces effective aperture and decreases image contrast. I routinely outperform 8" SCTs with my 5.5" refractor. So you can't directly compare a 5" reflector to a 5" refractor. You need to factor in optical quality, size of central obstruction, cost, the nature of your target, and other factors.

Mounts

There are two basic types of mounts, Alt-AZ and Equatorial. The Alt-AZ is simple, you simply move the telescope up and down or left and right. This is an easy way to look at bright targets like the Moon, planets, and bright stars and star clusters. One nice thing about an alt-az mount is the eyepiece is always pointing vertically (it turns with the telescope on an equatorial mount).

Equatorial mounts can compensate for the Earth's rotation and help you track your targets. This becomes more important with high magnifications, because the object will otherwise drift quickly out of the field of view. Equatorial mounts are generally more sophisticated and expensive. If you stay with astronomy for long, it's very likely you'll end up with an equatorial mount.



Source: Starry Hills Observatory

GoTo mounts are computerized mounts (can be Alt-AZ but are usually equatorial) that once aligned, can go to your desired target with the press of a button. This is very helpful if you don't know the night sky or do not have very dark skies.

Dobsonian mounts are a low cost, simple version of a Alt-AZ mount specifically for larger reflector telescopes.

Eyepieces

Eyepieces, along with the focal length of your telescope, determine the magnification of your object. For example if your telescope's focal length is 800mm and you have a 25mm eyepiece, your magnification will be $800/25$ or 32x. Getting started, it's good to have one quality wide field eyepiece (25-40mm) and one medium power eyepiece (10-15mm). You will rarely use high power eyepieces because they are really only effective when the sky conditions are exceptionally steady (excellent 'seeing'). You can also get a 2x 'barlow' lens which can double the power of any eyepiece, turning your two eyepieces effectively into four. I've collected a dozen eyepieces over the years and find I rarely use more than 2 or 3 in a night of observing. Most starter telescopes will come with at least one eyepiece.

Recommendations

A good starting refractor is an achromat in the 2.4-4" (60-100mm) aperture range. For reflectors, a good starter scope has a 6-8" mirror (150-200mm) on a simple Dobsonian mount.

Remember that you usually get what you pay for. Cheap department store telescopes are almost always a waste of money. You can usually trust the experts at specialized telescope stores. They will want you to embrace the hobby and come back again for your next telescope upgrade! A list of trusted distributors is provided at the end of this article.

Spend some time at the eyepiece before looking to upgrade your telescope. I have done hundreds of star parties where the public looks through my telescope. I routinely spot fine details like festoons in Jupiter's belts, or a galaxy's dust lane, or the propeller in M13, that beginners miss who have better eyesight than mine. The more comfortable you get behind the eyepiece the more you will see.

Once you own a telescope, try to get an experienced friend to help you on your first night out. Otherwise, initially start with bright, easy to find targets like the Moon, Venus, Jupiter and Saturn. Smartphone apps provide lists of "tonight's best objects" that will help you choose targets.

What else do you need?

For a comfortable observing session, you might want to bring a chair to sit on, binoculars, a beverage, warm clothes, bug repellent, a red flashlight so you don't ruin your night vision, and a star chart or smartphone app to help you find constellations and targets.

Final thoughts

Connect with your local astronomy club. We recommend the [Phoenix Astronomical Society](#). Members are excited to share their love of the night sky and can be a great free resource to learn. At their events you may have the opportunity to see through several different types of telescopes. Do your research, then dive in!

Trusted Online Suppliers

This is a partial list of telescope distributors who I trust to give you good, honest advice:

[Agena Astro](#)

[Highpoint Scientific](#)

[Starizona](#)