

A Buying Guide for a First Telescope

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If the astronomy course you are taking whets your appetite for exploring the sky further, you may be thinking about buying your own telescope. Many excellent amateur telescopes are available, but some research is required to find the best model for your needs. I like to compare buying a telescope to buying a car – which one you get will depend on how you plan to use the car and what your budget is.

The same is true for buying a telescope. Here are some of the factors that might determine which telescope is right for you:

- Will you be setting up the telescope in one location, or do you want an instrument that is easily portable and can come with you on outdoor excursions? How portable should it be, in terms of size and weight? Larger telescopes offer better views, but can be difficult to move.
- How well do you know the night sky? If you can't identify most of the constellations visible from your location, you might want a computerized telescope that can find objects for you
- Do you want to observe the sky with your eyes only, or do you want to take photographs? (Long-exposure photography, for example, requires a good *clock drive* to turn your telescope to compensate for Earth's rotation.)
- What types of objects will you be observing? Are you interested primarily in the Moon and the planets, or do you want to see fainter star clusters and galaxies?
- How large is your budget? Telescopes range in price, from a few hundred to thousands of dollars. The guides in Appendix 1 will help you see what different price points offer.
- Will just one or two people be using the telescope, or will you have larger groups with you, such as a scout or youth group or a club of some kind?

You may not know the answers to some of these questions yet. For this reason, you may want to “test-drive” some telescopes first. Most larger communities have *amateur astronomy* clubs that sponsor star parties open to the public. The members of those clubs often know a lot about telescopes and can share their ideas with you. See Appendix 2 of this document for websites that can help you figure out if there is such a club near you.

Furthermore, you may already have an instrument like a telescope at home (or have access to one through a relative or friend). Many amateur astronomers recommend starting your survey of the sky with a good pair of *binoculars*. These are easily carried around and can show you many objects not visible (or clear) to the unaided eye.

Once you have a better idea of what kind of instrument you want to buy, you can consult the buyer's guides in Appendix 1.

One major development in telescopes for beginners is the recent addition of *smartscopes*, telescopes with computers inside that can “stack” or add together images to show you longer-exposure views that using your eyes with a regular telescope cannot match. Here is an article about these: <https://skyandtelescope.org/astronomy-news/visual-observing-vs-smart-telescopes-finding-harmony/> For people who are financially comfortable and seriously interested, you might check out the Odyssey line from Unistellar, one of the companies that started the smartscope revolution: <https://www.unistellar.com/discovery/> (A smaller, more budget-conscious version of such a telescope is the ZWO Seestar S50.)

Some Things to Keep in Mind

When you are ready to purchase a telescope, you might find the following ideas useful:

- The key characteristic of a telescope is the *aperture* of the main mirror or lens; when someone says they have a 6-inch or 8-inch telescope, they mean the aperture or the diameter of the collecting surface. The larger the aperture, the more light you can gather, and the fainter the objects you can see or photograph.
- Telescopes of a given aperture that use lenses (refractors) are typically more expensive than those using mirrors (reflectors) because both sides of a lens must be polished to great accuracy. And, because the light passes through it, the lens must be made of high-quality glass throughout. In contrast, only the front surface of a mirror must be accurately polished.
- Magnification is not one of the criteria on which to base your choice of a telescope. The magnification of the image is done by a smaller eyepiece, so the magnification can be adjusted by changing eyepieces. However, a telescope will magnify not only the astronomical object you are viewing but also the turbulence of Earth's atmosphere. If the magnification is too high, your image will shimmer and shake and be difficult to view. A good telescope comes with several eyepieces – all within the range of useful magnification. (Many telescopes come with a *viewfinder* that shows you the fuller scene in the sky.)
- The mount of a telescope (the structure on which it rests) is one of its most critical elements. Because a telescope shows a tiny field of view, which is magnified significantly, even the smallest vibration or jarring of the telescope can move the object you are viewing around or out of your field of view. A sturdy and stable mount is essential for serious viewing or photography (although it clearly affects how portable your telescope can be).
- A telescope requires some practice to set up and use effectively. Don't expect everything to go perfectly on your first try. Take some time to read the instructions. If a local amateur astronomy club is nearby, use it as a resource.

Some text above adapted from Astronomy by Fraknoi, Morrison, & Wolff: <http://bit.ly/astronomytextbook>

Appendix 1: Some Web Resources with Advice about Telescope Buying

Best Telescopes for Beginners: *Wirecutter* Consumer Evaluation in the *NY Times* (Nov 2024):
<https://www.nytimes.com/wirecutter/reviews/best-telescopes-for-beginners/>

How to Choose A Telescope (from *Sky & Telescope* magazine, 2021):
<https://skyandtelescope.org/astronomy-equipment/how-to-choose-a-telescope/>

A Simple Guide to Buying Your First Telescope (from the Our Planet website, Jan. 2021):
<https://ourplnt.com/guide-buying-first-telescope/>

Articles from *Astronomy* Magazine:

- 15 Essential Things about Telescopes: <https://www.astronomy.com/observing/telescopes-101-15-essential-things-to-know/>
- Best Telescopes for Kids, Picked by Experts: <https://www.astronomy.com/astronomy-for-beginners/the-best-telescopes-for-kids-picked-by-experts/>
- Best Telescopes for Under \$1000: <https://www.astronomy.com/astronomy-for-beginners/the-best-telescopes-under-1000-picked-by-experts/>

Binoculars Buying Guides:

10 Best Astronomical Binoculars: <https://www.travelandleisure.com/style/shopping/best-binoculars-for-stargazing>

Best Binoculars 2025: <https://www.space.com/26021-best-binoculars.html>

Stargazing with Binoculars: <https://www.skyatnightmagazine.com/advice/skills/stargazing-with-binoculars-a-guide>

Appendix 2: Web Directories that Help you Find an Amateur Astronomy Club Near You

- Night Sky Network club finder: <https://nightsky.jpl.nasa.gov/clubs/>
- *Sky & Telescope* Magazine astronomy clubs and organizations: <https://skyandtelescope.org/astronomy-clubs-organizations/>
- Astronomical League astronomy clubs and societies: <https://www.astroleague.org/astronomy-clubs-usa-state/>
- *Go-Astronomy* club search: <http://www.go-astronomy.com/astro-club-search.htm>