

A Few Thoughts on Your First Telescope

We expect to see images like Hubble Space Telescope photographs, but we want to pay a garage-sale price for a telescope. Obviously, the first thing we need is reasonable expectations! What you see through any telescope will never show detail or color like photographs, especially photographs taken from outside Earth's atmosphere. But a few simple tips will help you get a telescope worth keeping and using for life.

- Don't get a telescope with eyepieces that have **0.965" barrels** (sometimes called 1"). One and one-quarter inch are fine, as are 2" eyepieces (the barrel is the part of the eyepiece that is inserted into the focuser). We're not sure why, but 0.965" eyepieces are nearly always inferior, and are sold with telescopes that are inferior. Some "inferior" can be helped, but not this one.
- Don't get a telescope with a **built-in focal adapter**, i.e., the optical tube is about 2' long but the claimed focal length is maybe 1000mm. This is accomplished with a lens at the bottom of the focuser that bends the focal path, but it is a bad idea in many ways (one acceptable focal length adaptation is the cassegrain style telescope, which is a complex design that may not be in a beginner's price range).
- We are not fond of **computerized, "go-to" scopes** in the beginner price range because (1) they are not the best quality; (2) the user still needs to learn the night sky but probably is not there yet but thinks they can skip that step; and (3) half the budget goes for a device that simply points the telescope, nothing more.

You need glass more than you need electronics. Star hopping is very quickly learned and lets you know the sky, which we find more rewarding than simply learning to use another device. We have a page showing Star Hop Examples and a list of Deb's Star Hops. Get with us for hands-on help, as it is easier to show you how to do this than to try to explain it here.

- A **complicated telescope** will not get as much use as a simpler, grab & go type. We have a page to help with a German Equatorial Mount, and a Dobsonian mount is even simpler. You might notice a first-quarter Moon or Jupiter in the evening sky, and either grab your simple scope for a peek or dismiss the idea of setting up a complex mess. You will still want a smaller, simpler scope after you grind that 18" mirror...
- Don't buy a telescope **advertised on the basis of magnification**. There is nothing mysterious or difficult to understand about magnification, but it is frequently over-rated. One good way to approach the subject is by considering the **exit pupil** of the telescope/eyepiece combination. To see an exit pupil, hold a binocular about 1 foot from your face, aimed toward a bright wall, and notice the small discs of light "floating" behind the eyepieces. The diameter of the exit pupil on a binocular will be the lens diameter divided by the magnification, i.e., 10x50 will be 5mm, 7x50 will be 7.1mm. Since few of us can accommodate a 7.1mm exit pupil, we should not think in terms of ever wanting a 7x50 binocular, as some of the light will be wasted. A binocular of 12x50 or 20x80 would fit our eyes better, especially for night use. That exit pupil enters your eye to form the image on your retina, to be real simple about some very complicated stuff.

If the telescope is used at an exit pupil smaller than around 1mm, the background sky is so dark that some detail may be lost. If the telescope is used at an exit pupil larger than around 4mm, the background sky is so bright that some detail may be lost. Some real smart folk have said that magnification around 0.52 X (diameter of objective in millimeters) will best connect the telescope system to our eyes, and that is real close to a 2mm exit pupil. We find the 2mm exit pupil to be very comfortable, with a properly dark background sky and pretty good magnification for a given scope. So if we can put it this way, 1mm to 4mm exit pupil is a 2mm exit pupil bracketed 1 octave up & 1 octave down. Most people can remove their glasses and refocus and aren't bothered by astigmatism (the exit pupil is narrower than the flaws in the iris).

The exit pupil for a telescope/eyepiece combination is the (eyepiece focal length) / (telescope focal ratio). A 25mm eyepiece on a F/10 scope provides a 2.5mm exit pupil. If you have a F/8 telescope, refractor or reflector, start with eyepieces from around 8mm to maybe 32mm focal length, and your most used may be around 14 to 18mm. It is good to have a range of magnifications available, and sometimes to view an object at several magnifications to see different aspects of its appearance. And yes, it is always time to buy an eyepiece!

Eyepieces are available in a wide range of prices. More \$\$ usually means a wider field of view and better coatings (less light scattered) or a fancy brand name. Many very nice eyepieces can be had for less than \$100 or maybe \$150. Learn before buying the fancy ones. Eyepieces with wider field of view are heavier and might cause balance issues on some telescopes. And some telescope/eyepiece combinations just don't work well together, and it's hard to predict until you try them.

- We like **garage sale telescopes** if they don't have too much dust on the mirror and come with 1.25" eyepieces and don't have focal adapters built in. We like 5 or 6 inch diameter telescopes, refractor or reflector, around F/8, for a beginner telescope. Few of us will ever exhaust the sights available to such an instrument.
- **Dew** is not your friend! Wet glass means it is bedtime. Don't cover wet glass; let the moisture evaporate or crud can be trapped on the wet surface. Heating devices are available or can be easily fabricated to solve this dilemma. Or move to a dry climate!
- **Cleaning** coated optical surfaces is not complicated but is scary. Some people tend to want to clean too frequently, but dust causes little impact to the views. First try using a puff of air from a puff-blower-thingy or from an oil-free sprayer for optics. Next step is a white china bristle brush that has never seen paint. When more must be done, take a gallon of distilled water and pour out 1 quart, add 1 quart isopropyl alcohol, then add a few drops Dawn dish washing liquid. Dispense using pure cotton balls with no wiping, and wipe using a tissue with no additives that is folded so no edges contact the glass. Mirrors can be cleaned by laying in a sink, running tepid water over, then add Dawn dish washing liquid while rubbing with your hand, then end with a distilled water rinse. Tip the mirror so the water runs off, use the puff-blower-thingy to chase off the water, or carefully use the edge of a tissue to absorb the drops that remain. And don't forget to breathe! You are cleaning a protective covering, not the aluminized coatings. We learned of the water-in-the-sink method from a website that re-coats mirrors but we tried it anyway, and it worked very well.
- Dim red light is your friend. **Night vision** is precious, so protect it by avoiding all white light. A one-second glance at you cell phone destroys your night vision, and it takes up to 30 minutes or more to fully develop scotopic eyesight. Thirty minutes! We do not make up the rules, just report them. We frequently encounter people who want to argue this one, but all we can suggest is they have never experienced dark adaptation. It is like adding more glass to your telescope!
- Practice **setup and tear down of your equipment blindfolded** so you can do it easily in the dark. Mark stuff that can be dropped with bright colors, so you can find them when you drop them. Simplify setup where you can. Some tripods have a metal spreader that assembles with several small nuts & bolts that will disappear in grass when dropped. We have replaced the spreader with a small chain that holds the tripod legs at the correct angle with no grief, no lost parts, and less time involved. A small dollar store bubble level lets us setup a tripod accurately enough for most uses other than astrophotography.
- **What are you going to look at tonight?** It's a great question! We have a books and websites that alert us to deep-space goodies we have never seen before, and we track them down to view them. We have two books by Sue French, one older book from Walter Scott Houston, a small collection of hundred year old books on the topic (a bit confusing, as the constellations have changed, but interesting nonetheless). The "[Astronomy Picture of the Day](#)" website teases us, and the "[IAAC Deep-Sky Observing Log](#)" website helps us know what others have seen visually of particular objects.
- And have fun! Learning is always cool, and we are constantly dazzled by the beauty of what God has placed in the night sky. Contact us if we can be of help to you.