



EVERY TELESCOPE HAS A SWEET SPOT

UNDERSTANDING TELESCOPE DESIGNS

No telescope design is perfect for every observing goal. Instead, each design offers a different balance between aperture (reach), focal length (image scale), focal ratio (speed), portability, maintenance and cost.

Most telescopes fall into one of three optical families: Refractors, Reflectors and Catadioptric telescopes. In addition, there are two specialised categories that deserve separate consideration, namely Solar telescopes and Smart telescopes.

BUYING GUIDE #2

This buyers guide is designed to help you understand common telescope designs, how their work, their advantages and disadvantages, and which one you should choose given your observing / imaging goals.



THE FIRST CHOICE FOR SHARP, HIGH-CONTRAST VIEWS

REFRACTORS I

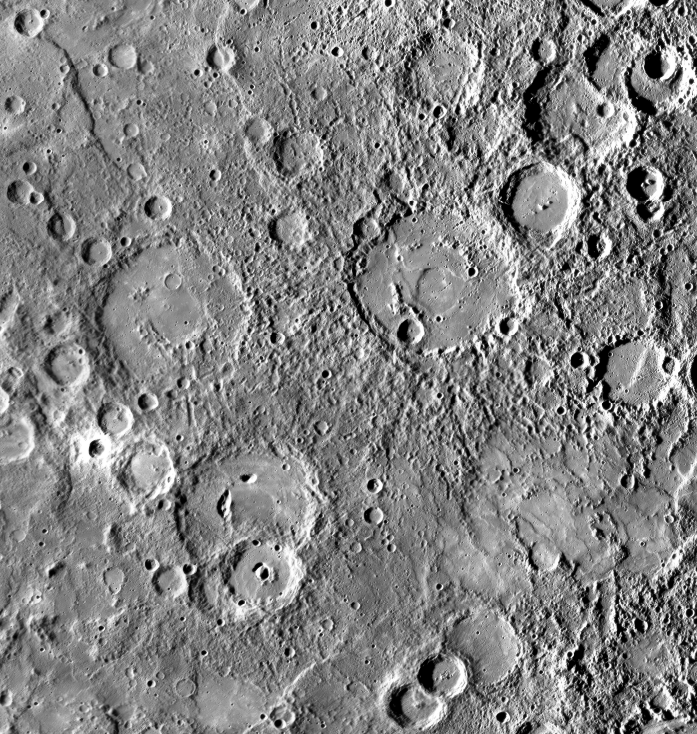
Refractors are the most recognizable telescope design. Light enters through a large objective lens at the front of the telescope which is brought to focus at the eyepiece. Lens bends different wavelengths (colours) of light by slightly different amounts. If not corrected, this can produce a purple or blue halo around bright objects such as the Moon, Venus or bright stars. This effect is known as chromatic aberration. Refractors are broadly divided into two categories based on how well they correct this effect.

- **ACHROMATS**

Achromatic refractors use two lens elements. General they offer excellent value for money and are often recommended as a first telescope. Some colour fringing may be visible around bright objects, particularly in shorter focal length models or at higher magnifications. For visual observing this is usually a minor compromise, but it can become more noticeable in astrophotography.

- **APOCHROMATS (APOs)**

Apochromatic refractors use premium glass and/or multiple lens elements in different configurations. The improved optics make apochromatic refractors significantly more expensive than comparable achromats. Larger models can also become quite heavy.



EASY TO USE, LOW
MAINTENANCE

REFRACTORS II

- **ADVANTAGES**

Superior image quality makes them particularly well suited to observing the Moon, planets and double stars. Refractors are also extremely reliable. The optics remain permanently aligned, require virtually no maintenance and are ready to use as soon as they are set up.

- **DISADVANTAGES**

High-quality lenses are expensive to manufacture. As aperture increases, refractors become significantly heavier, longer and more costly than other telescope designs. Large refractors are popular among enthusiasts willing to invest considerably in premium equipment. However, more affordable, shorter focal length refractors are very popular amongst astrophotographers since they offer a wide field of view that is suitable for large objects such as nebulae.

Which Should You Choose?

If your main interest is visually observing the moon and planets, and you're looking for the good value, an achromatic refractor can be an excellent choice.

However, if you're interested in astrophotography or want to obtain the sharpest possible views with virtually no false colour, an apochromatic refractor is well worth the additional investment.



UNMATCHED LIGHT GATHERING CAPABILITY

REFLECTORS I

Reflectors replace the front lens with a large primary mirror at the back of the telescope. The light is reflected to a smaller secondary mirror before reaching the eyepiece or directly onto a camera sensor. Given that mirrors are easier and therefore less expensive to manufacture than large lenses, reflectors offer the greatest aperture for your money.

- **NEWTONIANS**

Reflectors can be divided into many different categories; however, the most common design is the Newtonian reflector. Originally designed by Sir Isaac Newton, the secondary mirror is mounted near the front of the telescope at a 45° angle which directs the light into the focuser and eyepiece on the side of the telescope.

- **DOBSONIANS**

One of the most common points of confusion for newcomers is the difference between Newtonian and Dobsonian telescopes. In short, a Newtonian reflector is an optical design. A Dobsonian is not a different optical design - it is a Newtonian reflector mounted on a simple, sturdy alt-azimuth base. Dobsonians have transformed amateur astronomy by making very large aperture telescopes affordable.



INEXPENSIVE DEEP-SKY EXPLORATION

REFLECTORS II

- **ADVANTAGES**

If your goal is observing faint objects such as galaxies, nebulae and globular clusters, aperture becomes increasingly important. Reflectors provide excellent light gathering capability without the high cost associated with large refractors. For visual astronomy, they often represent the best value available.

- **DISADVANTAGES**

Like large refractors, as the aperture increases so does the weight. Larger models (>300mm) may require assistance to move and set them up. Reflectors require occasional maintenance. The mirrors may need to be realigned (collimation) to maintain peak performance, particularly after transport. The exposed mirrors in open-tube designs also require occasional cleaning.

Which Should You Choose?

For visual astronomy, no telescope offers better value-for-money than a Dobsonian. Large Dobsonians gather enormous amounts of light, revealing detail in galaxies, nebulae and star clusters that smaller telescopes simply cannot match. The simple mount is intuitive to use and remarkably stable. Celestron's StarSense push-to navigation system and the motorized GoTo system from Sky-Watcher help newcomers find objects easily. Some Newtonians are optimized for astrophotography, and like refractors, a high-quality equatorial mount and stable tripod or pier is required. With



BIG PERFORMANCE, COMPACT VERSATILITY

CATADIOPTRICS

Catadioptric telescopes use a combination of lenses and mirrors to correct optical aberrations while folding the light path in a compact optical tube. Schmidt-Cassegrains (SCTs) are the 'Swiss Army knife' of telescopes, while Maksukov-Cassegrains (MCTs) are well-suited for high-contrast, high-magnification observing. Specialist designs such as RASAs solely for astrophotography.

- **ADVANTAGES**

Catadioptric telescopes are compact, portable and versatile. Their long focal lengths naturally suit the Moon, planets, globular clusters and smaller deep-sky objects, while their folded optical path keeps the tube relatively short. With the appropriate accessories, they can also perform well for many types of astrophotography.

- **DISADVANTAGES**

Their longer focal lengths also produce narrower fields of view, making very large nebulae and open clusters more difficult to observe - focal reducers and ultra-wide eyepieces can help manage this.

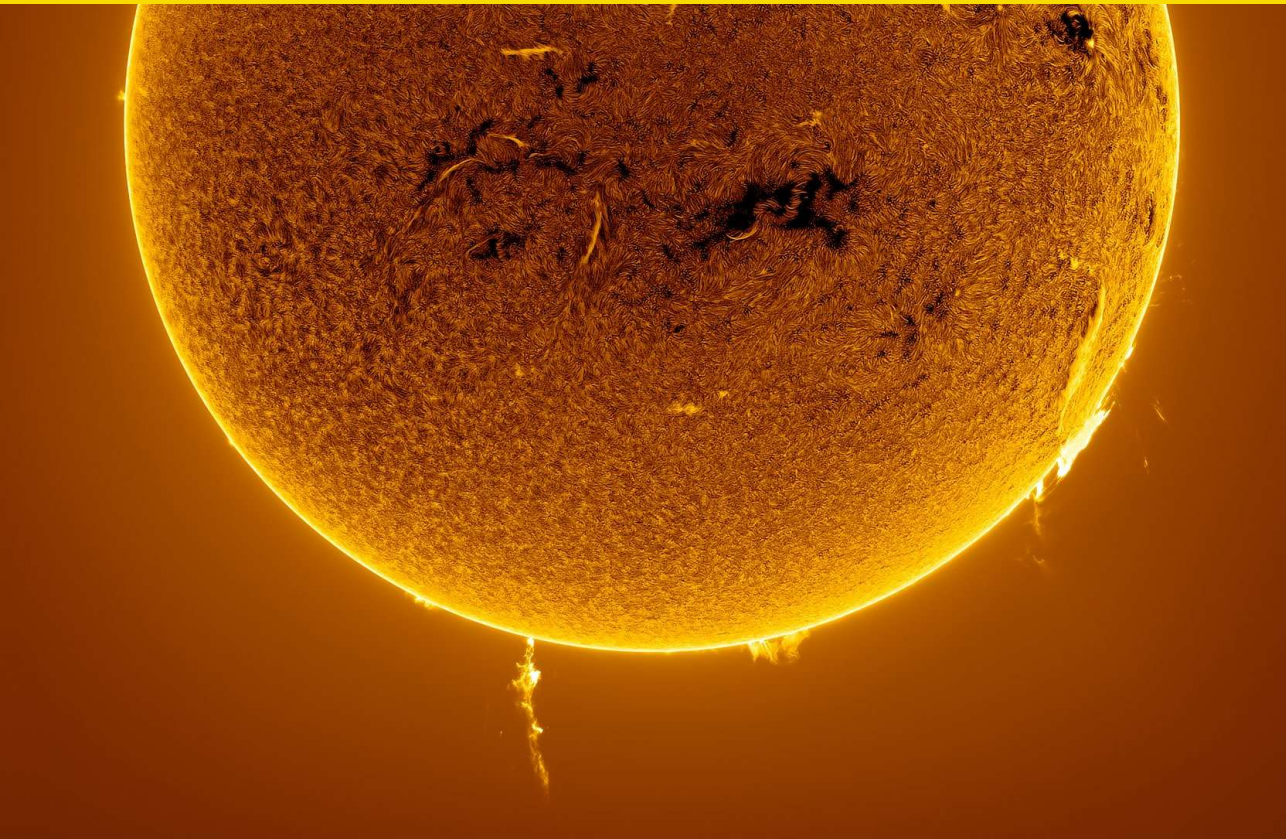
Which Should You Choose?

Catadioptric telescopes are also an excellent choice for astronomers who expect their interests to grow. With the right accessories, they can be used for both visual observing and astrophotography, making them one of the most flexible telescope designs available. While they are generally more expensive than a reflector of the same aperture and do not offer the wide field of view of a short-focus refractor, they provide an excellent balance between performance, portability and versatility.

SOLAR TELESCOPES

Unlike conventional telescopes fitted with solar filters, dedicated solar telescopes are designed to reveal features that are normally invisible. Dedicated white-light solar telescopes and certified white-light solar filters allow safe observation of the Sun's photosphere, revealing sunspots and solar granulation. While Hydrogen-alpha solar telescopes reveal an entirely different target. Rather than looking at the Sun's surface, Hydrogen-alpha telescopes show activity within the Sun's chromosphere such that prominences, filaments, solar flares and surface texture can be observed. Because of the specialised filters required, Hydrogen-alpha telescopes are considerably more expensive than standard telescopes. Observing the Sun is one of the most rewarding branches of amateur astronomy, but it also requires the greatest attention to safety.

Never observe the Sun without equipment specifically designed for solar observation. Permanent eye damage can occur almost instantly.



THE SUN ...

A 4.5-BILLION-YEAR-OLD
NUCLEAR FUSION REACTOR

Carl Sagan



THE EASIEST WAY TO EXPLORE THE NIGHT SKY

SMART TELESCOPES

Smart telescopes are a new generation of computerized telescopes that automatically align themselves by recognizing the stars overhead, allowing you to begin observing with little or no setup experience. Instead of looking through an eyepiece, smart telescopes use a built-in digital camera to capture and continuously process images, revealing celestial objects in far greater detail than is possible with the naked eye. Designed with convenience in mind, smart telescopes can locate and track thousands of celestial objects at the touch of a button, with images displayed on a smartphone or tablet. As the telescope collects more light, the software stacks multiple exposures in real time, gradually improving brightness, color, and detail.

• **ADVANTAGES**

Entry-level smart telescopes are a relatively inexpensive, easy-to-use and require very little astronomical knowledge to begin producing satisfying results.

• **DISADVANTAGES**

Offering a very different astronomy experience. Less flexibility than traditional telescope systems with fewer opportunities to upgrade individual components over time.

Which Should You Choose?

While they cannot replace the experience of visual observing through an eyepiece, smart telescopes offer an accessible and highly portable way to explore galaxies, nebulae, and star clusters—even from light-polluted locations—making them an excellent choice for beginners, families, and anyone interested in electronically assisted astronomy (EAA).

ABOUT NSO

Our Vision

We envision a world where anyone with an interest in astronomy can begin their journey with confidence and enjoy rewarding first light experiences. Where choosing equipment is exciting rather than overwhelming, expert guidance is always within reach, and every astronomer has a trusted partner throughout their journey under the stars.

Our Commitment

We believe our responsibility doesn't end with a sale. We are committed to supporting our customers throughout their astronomy journey.

- Expert Guidance
- Carefully Selected Stock
- Accessible Value
- Long-Term Partnership

