Choosing a Telescope - Part 2

Typical 90mm (3.5”) achromatic telescope Telescope Types Achromatic Refractors

Achromatic refractors are those with two lens elements at the front of a tube. They offer crisp, high contrast views due to their clear aperture; i.e. they have no central obstruction that reduces contrast. They also have a high transmission of > 90%. The light travels down the sealed tube only once so the impact of tube currents, which can degrade the image, is minimal. Refractors are durable, essentially maintenance free, and difficult to knock out of alignment. Small refractors, those with an aperture of less than 4 inches, often perform better than larger telescopes when the seeing is poor. It is worth saying that a 4-inch refractor is often said to offer comparable performance to an 8 inch reflector for the moon, planets and double stars. Good refractors with an aperture of 3-4 inches make excellent beginner's telescopes. Achromatic refractors do suffer from chromatic aberration, bright objects like the moon and planets have a halo of false purple colour around them. The impact of this problem is, I believe, often overstated. Personally, I do not find this effect objectionable, however, some people do and it is worth looking at the moon through a few refractors before parting with your cash. These telescopes can be bulky and difficult to mount well and the eyepiece position can be very low if you are viewing near the zenith, requiring the use of a star diagonal to relieve pressure on your neck. A star diagonal unfortunately flips the image left to right making it difficult to compare with star charts. Finally, a decent refractor can be expensive. Manufacturers: Vixen, D and G, Meade, Celestron. Apochromatic Refractors

Typical 152mm (6”) apochromatic refractor These are a modification of the standard achromatic refractors which use 3 or more lens elements, often using advanced optical materials, in order to reduce false colour from chromatic aberration and to minimise other aberrations also. These telescopes can also be made with very short focal lengths of c. f/5, meaning that the tube is very compact and highly portable. The images produced by this type of telescope are essentially perfect.

Unfortunately, this perfection comes at a very high price, this variety of telescope is the most expensive per inch of aperture, typically costing up to €5000 (several thousand Dollars) for a 4-inch refractor. Often, an artificially grown crystal called fluorite is used as one of the glass elements on account of its excellent optical characteristics. Some concern has been expressed in the past regarding the durability of this material, however it is generally accepted nowadays that, with modern coatings, fluorite will last indefinitely. Manufacturers: Astro Physics, Takahashi, Vixen, TeleVue, Borg , APM, TMB, Williams Optics and Meade(semi-apo). 200mm (8”) Newtonian reflector Newtonian Reflectors

These telescopes have been a best-seller for over 300 hundred years, until the arrival of mass-market catadioptrics. Newtonians offer the most aperture per Euro/Dollar since they consist of only one precisely shaped mirror plus a flat. An 8-inch reflector costs less than half the price of a 4-inch refractor and images are 4 times as bright. The large aperture means that this telescope is ideal for deep sky work where aperture is at a premium. Since this type of telescope is all reflective, there is no chromatic aberration, apart from a residual amount generated within the eyepiece. On the down side, these telescopes do need regular collimation since they can go out of alignment, particularly if transported. However, collimation is a simple, 2-minute procedure at the start of the evening's viewing and should not be seen as a huge drawback. Newtonian reflectors are large and heavy traditionally but, in recent years, the Dobsonian revolution has allowed the construction of enormous, 30-inch plus(!!!) telescopes while still retaining some portability.

This is achieved using very thin mirrors and a simple alt-az wooden mount. Newtonian reflectors are particularly susceptible to an optical aberration called coma, which stretches stars at the field edge into tiny comets. Curing this problem means ether using expensive eyepieces or lengthening the f/ratio which compromises portability. Manufacturers: Orion Optics, Parks, Beacon Hill, TAL. Catadloptric Telescopes

Catadioptric telescopes, those using a combination of lenses and mirrors, combine many of the best features of refractors and reflectors into one package, with few of their drawbacks. They allow the performance of a large aperture, long focal length telescope to be folded into a reasonably lightweight and transportable package - very helpful if the telescope must be taken to dark sky sites. Because of their optical design, catadioptrics are almost completely free of the coma found in reflectors and the chromatic aberration found in refractors.

Stars are essentially point-like and coma-free across the visual field of a catadioptric scope, and there's no trace of coloured halos around bright stars and planets to mask faint details and colours. Some curvature of the field is often visible in catadioptrics - particularly in fast focal ratio models - but it usually shows more at the edges of wide field photos than in visual observing.

The typical catadioptric fork mount cradles the telescope's short optical tube securely on two sides, reducing image-degrading vibration to a minimum. Its power-driven right ascension setting circle keeps pace with the motion of the stars, allowing the observer to find faint deep space objects by their celestial co-ordinates alone, without the constant manual readjusting needed with the right ascension circle of most refractor and reflector mounts.

A catadioptric's slow motion controls, often not available on reflectors, makes the "fine tuning" of the telescope's position easy. And a catadioptric's set-up and takedown time is short, due to its folding tripod, lighter weight, and more compact size per inch of aperture. There are loads of electronic/optical gizmos available for this type of telescope. Since they have a sealed tube, there are no tube currents and recoating is not required. Dew can be a problem since the thin corrector plate can lose heat very quickly.

About the Author

I've been interested in astronomy for many years now and have acquired a couple of telescopes (refractors) that I use regularly to patrol the skies.

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