Astronomy is for Everyone

A M.A.R.S. Resource

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for the
Museum Astronomical Resource Society

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Introduction

"Astronomy is for the amateur as well as the professional. The amateur can see for himself the sights that stirred Galileo, the Herschels, and other great astronomers. A high-school boy may be the first to see a comet, a rug salesman my discover a nova, and a homemaker can observe and map meteor showers.. An amateur's faithful observations of a variable star may be just the data an observatory needs." (Adapted from "The Sky Observer's Guide", published by Golden Press, New York.)

Anyone can be an amateur astronomer. If you like to gaze at the night sky, you are qualified. The great thing about amateur astronomy is that it's such a portable hobby. The only basic requirements are you and a moderately dark sky. You may increase your enjoyment by learning more about the sky with the help of books and magazines. Binoculars and telescopes allow you to gaze even more deeply in to the wonders of the heavens. Photography is another way that some amateurs enrich their observing experience.

Here is some information on the tools available to you. Please use it to answer your questions, direct your attention, and enhance your enjoyment.

Getting Started

A Basic Guide: The beginning observer should have a book on general astronomy. Even a little knowledge greatly increases the pleasure of observing, and it prepares the observer to undertake real astronomical projects. Golden Press puts out some very good pocket-size books that are ready companions for the beginner and the experienced amateur. The are entitled *The Sky Observer's Guide*, *Stars* and *Planets*. Peterson Field Guides and the National Audubon Society both publish excellent astronomy field guides.

A Planisphere: A planisphere, or star-finding wheel, is part of the kit of every astronomer, from the child to the old pro. They consist of a wheel illustrated with night time objects, attached at the center to a second piece, and covered with a third piece that allows a portion of the wheel to be seen through a circular or oval window. They are usually made of thick paper or cardboard. By turning the wheel to indicate your time and date, the window allows you to see which constellations are in your sky at that moment and where they are located.

Binoculars

Every observer should own a good pair of binoculars. These gather far more light than the eye, they magnify images and use the capacity of both eyes. Binoculars are the ideal instrument for the beginning observer for the following reasons:

- They are portable.
- They have a wide field of view.
- They are relatively inexpensive.
- They will still be of use even if you later progress to a telescope.

They are ideal for helping the beginner find their way around the night sky. Star colors are more noticeable through binoculars.

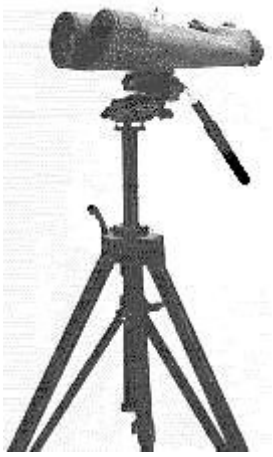
Binoculars are well suited for:

- Scanning star clusters
- Picking out nebulae and galaxies
- Recording light changes in variable stars
- Watching for novae and comets
- Observing Jupiter and its 4 main moons
- Observing Mercury in twilight
- Observing the crescent of Venus
- Searching for dim Uranus and Neptune
- Observing bright asteroids
- Getting to know our closest neighbor, the Moon

Choosing Binoculars: The beginning observer might be tempted to think that bigger is better. However, when choosing binoculars a pair with a magnification of 7 to 10 times is advisable because of the increased weight. Anything larger would be difficult to steady by hand.

Consider this scenario before choosing high magnification binoculars.

1. Higher magnification
2. Heavier binoculars
3. More difficult to steady
4. Bigger images with bigger and more frequent shakes
5. Unhappy observing



High magnification binoculars are used by many experienced observers, but they are normally mounted in order to provide the steadiest images possible.

Binoculars require prisms in order to give the observer a right side up image. Porro prism binoculars are the most common type. Binoculars of the roof prism design are also very good and they also have the added feature of compactness.

Many stores have seasonal sales on binoculars. This makes it possible to own a good pair of binoculars on even a tight budget. Before buying, you should try them out first to make sure that the images appear sharp and clear. Focus on a point of light as far away as possible and check for flaws in the image. If you see any distortion in the light, that will only be intensified when you are gazing at a sky full of pinpoint light sources! Don't let someone else pick out a pair for you because their eyes might not see an image exactly the way yours do. Another important point when examining binoculars is to check for the presence and amount of coatings on the optics. A good pair of binoculars will have anti-reflective coatings on each surface of every lens and prism in the binoculars. This reduces the possibility of glare and reflected images when observing. Beware of manufacturer packaging. While all say they use coated optics, not all use only completely coated optics.

Telescopes

At some point in their observing, every amateur astronomer considers whether a telescope can aide them in their observing. The light-gathering and magnifying power of telescopes brings out details of the Moon's surface. It reveals Jupiter's larger satellites and its banded clouds, as well as markings on Mars and the rings of Saturn.

There are three popular types of telescopes:

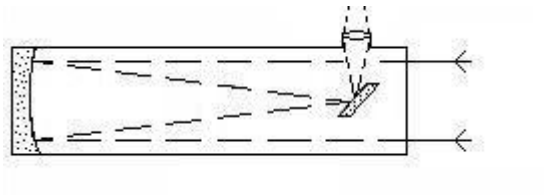
1. Refractors, which use lenses to collect and focus light.
2. Reflectors, which collect light with a large mirror.
3. Catadioptrics, which are a special class of telescope that use lenses as well as mirrors. They are considered by some as modified reflectors.

Refractor Telescopes: The familiar long tube telescope, with the lens in front and the eyepiece in back, is the standard design of the refractor telescope. This design is commonly seen in department stores. While all look generally the same in advertisements, quality varies tremendously.

Beware of advertising claims of extremely high magnification. These are usually achieved by pushing the telescope to its limit, and then the images are not satisfactory.

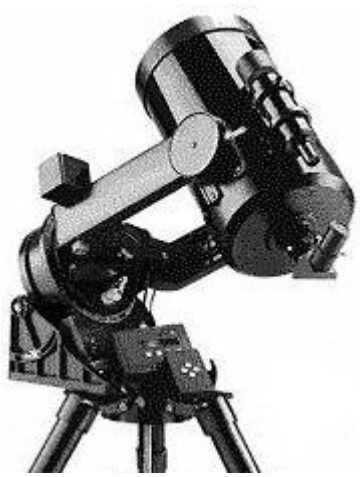
Look for sturdy mechanical construction. A spindly mount will wobble at the slightest touch and ruin the view. Favor models with low to medium power eyepieces of good quality, rather than those with high-power, low quality eyepieces. Fittings for the eyepieces, diagonal prism, and accessories should be of machined metal, not molded plastic.

Newtonian Reflector Telescopes: The Newtonian reflector (invented by Sir Isaac Newton) is a very popular and economical telescope. Its simple high performance design provides tremendous light grasp at the lowest cost per unit of aperture of any type of telescope. Many observatory telescopes are Newtonian designs.



Small Newtonians are very portable because the tube can detach from the mount. Because the light is gathered and bent by mirrors, the image is rotated and usually appears upside-down or sideways.

Their large aperture makes them ideal for deep-space views of galaxies, star clusters, and nebulae. The optical design results in sharp, high-contrast planetary and lunar views.



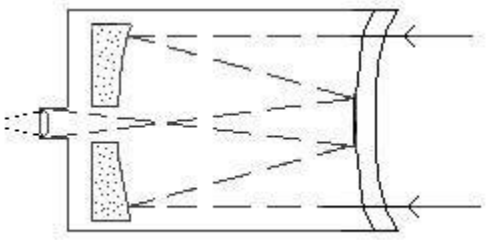
Compound "Catadioptric" Telescopes: Compound telescopes combine the best features of refractors and reflectors into very compact, lightweight instruments. They use both mirrors and lenses, resulting in telescopes only about twice as long as they are wide. Unlike the basic refractor and reflector, these telescopes are distinctly modern 20th century designs, the products of high-technology manufacturing techniques.

The features are many -- the closed tube, lightweight, rugged designs are easily portable, and the superb optical performance is better in nearly every respect than any single telescope. Little if any maintenance or alignment is required. The lightweight optical assembly allows very strong mounts to be made very light in weight. Camera adapters and many varied accessories are

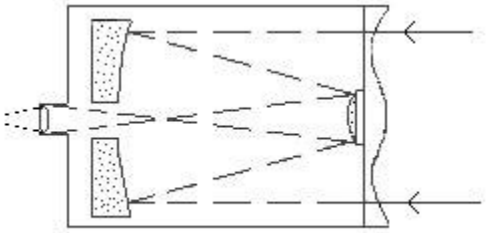
widely available and easily attached.

The one significant disadvantage is just what might be expected: compound telescopes cost more than other telescopes.

Maksutov-Cassegrain Telescopes: The Maksutov-Cassegrain telescope was introduced by D. D. Maksutov in 1944. It uses a deeply curved, thick front corrector lens, with a reflective spot on the corrector acting as a secondary mirror. Large diameter models are very difficult to manufacture and take a long time to reach thermal stability at night.



Schmidt-Cassegrain Telescopes: The Schmidt-Cassegrain design was made commercially economical due to the optical production innovations of Tom Johnson at Celestron International in the late 1960's. His techniques for producing the complex-curved Schmidt corrector plate were the foundation for every major manufacturer in the business.



Unlike the Maksutov, the Schmidt-Cassegrain has a separate, adjustable secondary mirror mechanically attached to the glass corrector plate. The most popular sizes are 8" to 11" diameter models on fork mounts. As with Maksutovs, large diameter models take a long time to reach thermal stability at night.

Telescope Mounts

The mount of a telescope is just as important as the telescope itself. A telescope is of little use if it cannot be kept steadily aimed at the object of interest. There are two main types of telescope mountings: altazimuth and equatorial.

Equatorial: The equatorial mounting is designed to be set up in a certain way in a specially prepared location. In its simplest form, the equatorial has two axes at right angles to each other. It is an all-purpose mounting, generally used for serious work. Some equatorials have setting circles, which make it possible to aim the instrument automatically at the right point in the heavens.

Altazimuth: The altazimuth mounting is simpler to operate than the equatorial mounting. It allows two motions of the telescope - up and down, an "altitude" motion; and horizontal, an "azimuth" motion. This is a good general-purpose mounting. It can be made light, portable, and easy to take down and set up.

Here are some helpful mounting terms:

- Altazimuth - A mount in which the telescope is allowed to pan around in the horizontal plane (azimuth) and pivot up and down in the vertical plane (altitude).
- Dobsonian Altazimuth - A modified form of altazimuth mounting that has become popular in recent years for short-focus reflecting telescopes. It is named after John Dobson, an American amateur astronomer. The Dobsonian mount is noted for its low cost and portability.
- Equatorial - A mounting which directly counteracts the Earth's axial spin and makes it easier to track objects while you are observing. One axis (called the polar axis) is aligned so that it points directly at the north celestial pole. The other axis of the mounting is called the declination axis. It allows the telescope to move up and down in declination (north and south of the celestial equator).
- Fork-type Equatorial - a design which has become widely used for catadioptric telescopes.
- German Equatorial - the most popular type of equatorial mount design.

Cameras / CCDs

Many amateurs make use of the camera. The eye is sensitive only to the light it is receiving in the present instant, but photographic film is sensitive to light received over a long period of exposure. An amateur's camera can detect faint objects which the eye, even with the aid of a telescope, could never see. Even a simple camera gives exciting and useful results.

In recent years, amateurs have begun using charged coupled devices (CCDs) to collect the light, and store the images on computer disks rather than film. As the popularity of this photographic method has increased, the related costs have lessened. Several periodicals have even been developed to assist the amateur in this endeavor. However, this form of astrophotography is still considered very pricey for the amateur on a shoe-string budget.

Star Charts

Star charts are the astronomer's maps. With them he locates stars and other objects whose positions on the celestial sphere change little from year to year. On them he plots courses of the Sun, planets, and other objects whose positions change more noticeably. Like maps of Earth's surface, star charts are prepared according to different scales to show varying amounts of detail.

Books

There are many books available on astronomy. By reading them and collecting a modest library, the amateur astronomer can build up their knowledge and be better able to observe the heavens. If you are on a budget, your local public library should have a reasonable collection of basic books on the subject of astronomy. These should allow you to increase your knowledge while you save your pennies for that next special book to add to your personal collection.

Periodicals

There are several monthly and quarterly magazines available for the amateur astronomer. Two of the most commonly known are *Sky & Telescope* and *Astronomy* magazines. Using magazines such as these the amateur astronomer has access to the most accurate information on soon coming events. They can prepare themselves, month by month, for upcoming eclipses, conjunctions, occultations, comets, passing asteroids, or any other occurrence. Magazines such as these make the amateur astronomer's hobby more enjoyable and help to keep the experience always fresh and exciting.

Organizations for Amateurs

Astronomy clubs provide amateurs the opportunity to share their experiences while learning from other more experienced members. Many amateur observers belong to national organizations. These give members information on equipment, observing techniques, and standard methods of reporting their work. They set up observing programs and receive observational data from members. Data are sent to observatories for use in programs of research. Some organizations publish news of developments that interest amateurs. Local groups observe together, compare equipment, and promote public interest in astronomy.

Some national and international amateur organizations are:

- Amateur Satellite Observers of Southeast Virginia (ASOSV), URL: www.seva.net/reg/satellite/
- American Association of Variable Star Observers, URL: www.aavso.org
- American Lunar Society, URL: otterdad.dynip.com/als/
- American Meteor Society, URL: www.amsmeteors.org
- Association of Lunar and Planetary Observers (ALPO), URL: www.lpl.arizona.edu/alpo
- Astronomical League, URL: www.astroleague.org
- Visual Satellite Observers (VSO), URL: www.satobs.org

For more astronomy information and astronomy activities, check out www.marsastro.org, the website of the Museum Astronomical Resource Society (MARS Astronomy Club), Tampa, Florida.