Selecting a Telescope

advice for the beginning amateur astronomer

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PLANNING YOUR ASTRONOMICAL HOBBY

a series of progressive steps

1) **GET YOUR BEARINGS**

A. **GOOD STARTER'S SKY ATLAS** - *NORTON 2000.0* or a **PLANISPHERE** (for a real-time view of what's up)

B. **GOOD GUIDE BOOK** - THE STAR GUIDE : helps locate stars, especially in the city! - THE SKY OBSERVER'S GUIDE (GOLDEN) An excellent introduction to the science, without insulting your intelligence.

C. **LOGBOOK** - RIGHT FROM THE START, RECORD YOUR OBSERVATIONS!!

2) **FIRST PROBES**

A. **BINOCULARS** -(estimated cost - $50 to 300+) ***note that exit pupil!!*** For night use, the **exit pupil** (the cone of light that exits the eyepiece and enters the eye) ***must be 7 mm in diameter***, to match the iris of the night-adapted eye.To determine the exit pupil, divide the diameter of the objective in millimeters by the magnification

B. **SKY ATLAS 2000.0** (SKY PUBLISHING) (about $40) - THE best sky atlasavailable for the amateur's general use.

C. **SKYGUIDE** (GOLDEN) ($7.95) - An excellent text, with some in-depth study of all 88 constellations, as well as excellent drawings to describe the terms used in the

science.

D. **FIELD GUIDE TO THE STARS AND PLANETS** (PETERSEN)($14.95) THE classic work, recently updated from Menzel's text by his student Pasachoff. Heartily recommended.

FIRST VOYAGES

Are you ready for a telescope???

a fast quiz -

A. Name ten constellations you have found in the sky.

B. Name 10 double stars, clusters, nebulae or galaxies you have seen in binoculars or can point to in the sky.

C. It is 3 a.m. September 30th. Is Orion up?

D. A 5 inch f/10 telescope is used with a 6 mm eyepiece what magnification are you viewing with?

E. Find Theta Cephei and Rho Draconis on a star chart. Can you find about how many degrees they are apart?

F. Most importantly - if you didn't know the correct answers, do you look forward to going out and

finding out what they were?????!!????

IF THE ANSWER IS YES, WITHOUT HESITATION, THEN DO IT!!

SELECTING A TELESCOPE

REFRACTORS - ($350+)

- ❖ good alignment retention
- ❖ portable in smaller sizes

- solid investment in contrast
- color correction never 100%
- WARNING - EXPENSIVE BEYOND 3 INCH APERTURE

REFLECTORS - ($300+)

- more aperture per dollar
- more portable in larger sizes
- easier to maintain.
- coatings deteriorate in 7 - 10 years; can be renewed easily & cheaply.
- WARNING - misaligns easier.

CATADIOPTRICS - ($550+)

- most portable instruments available
- mirror-lens combination
- good value per dollar
- optically the best of all worlds
- warning - are usually expensive in larger (>8 inches) sizes!!
- only go for big name brands!!!

OTHER ADVANCED STUFF

Royal Astronomical Society of Canada (R.A.S.C.) HANDBOOK - for each year, this is the most compact source of information available.

SKY CATALOG 2000.0 VOLUMES 1 & 2 - good reference texts,

backing up SKY ATLAS 2000.0.

ASTROPHOTOGRAPHY FOR THE AMATEUR - THE best guide to the subject in print today.Helps the beginner as well as the advanced amateur.

Cameras, film, power inverter, drives, a clear sky, a mountaintop observatory, coffee....

Don't forget to join your local Astronomical Society!!

Selecting a Telescope

Observer Alert!!!! If you do not know the sky, even the basic constellations, don't buy a telescope!!

Get a good pair of 7x50 or 10x50 binoculars, either Touring the Universe with Binoculars by Phil Harrington (J. Wiley, $24.95), or Binocular Astronomy by Craig Crossen and Wil Tirion (Willmann-Bell, $24.95) and a planisphere, and learn the night sky before you buy!!!.

Click here to see "L" brackets for mounting your binoculars to your tripod

If you insist, however...

First things first

The selection of a telescope for astronomical purposes is a serious matter. It is *very easy* to spend a lot of cash on a large telescope, only to find that it is too unwieldy to move about, or too complex to assemble in a reasonable time. This article is geared to try to keep the costs of astronomy from *becoming* astronomical!

Second

Realize that *there is no one perfect design of telescope to cover all areas of interests*. Some compromise must be made in the decision.

Third, do not fall into the "power trap"

Most department stores make a great deal of noise over how their 60 mm aperture "Astro-Warp Mark 17" refractor "can magnify up to 400 power!" ***Sure*** it can, but *this is pointless when the optic is a mass-produced cheap lens that is better suited for low magnifications* - as most are - *and the mount the 'scope is on can barely support itself, let alone withstand a slight breeze.* Also, can it *track* what is being magnified? If the mount isn't an equatorial, or doesn't have a motor drive, high magnification is useless! Be more concerned about **light grasp,** i.e., the size of the mirror or lens, and the quality of the optics. These directly determine, respectively, how

faint an object you will see, as well as its ***resolving power*** (how much detail you may see on, say the moon or a planet). Optics at ***1/8 wave quality or better peak-to-valley*** are worth the extra cash than cheaper, eyeglass-class lenses or mirrors. Inquire as to the correction factor - use this 1/8 wave standard in your decision. A drive is necessary if you wish to perform long-duration photography (and have the dark skies to make it possible). This will require the aforementioned *equatorial mounting*, which will add to the cost.

Basic Designs

Refractor

A telescope that uses lenses (usually a doublet of crown and flint glass) to collect and focus light. This yields a high-contrast image, with the drawback of some false color in the image. Good for planets, the Moon and (with a filter) the Sun. Needs little care or maintenance. Unwieldy in the larger (4" or more) apertures. Moderate to high initial costs.

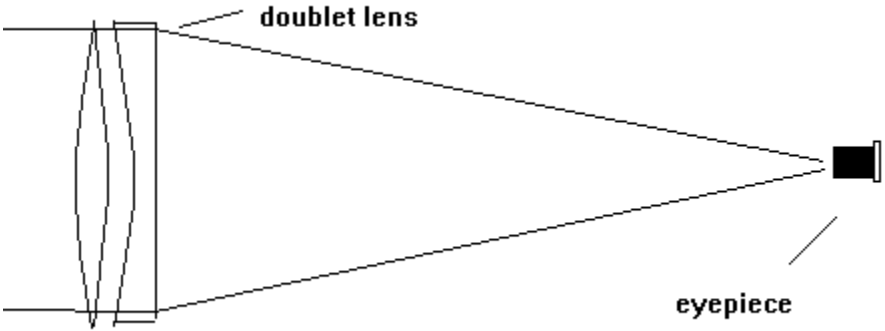

Figure 1 principle of the refractor telescope

Reflector

A telescope that uses a system of mirrors to collect and focus light. Good

color rendition, and aperture-for-aperture, excellent value (for the cost of a good 4-inch refractor, you can buy a 10 or 12.5 inch reflector!). Low to moderate in initial costs in the ***Newtonian*** design.

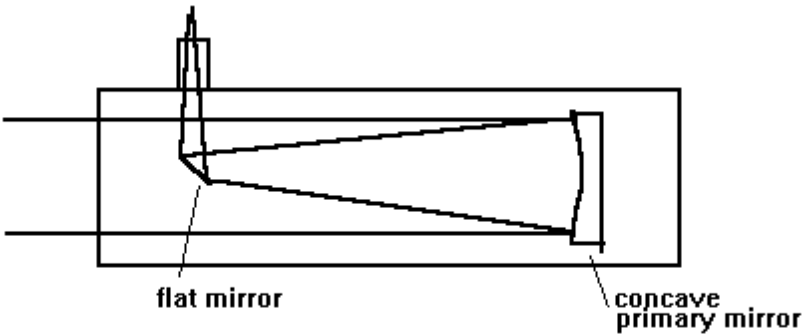

Figure 2 - the Newtonian reflector telescope

Try to get a secondary mirror no larger than 15% of the clear aperture of the primary, to keep the images contrasty. Since the Newtonian is open to the sky, it may need cleaning of the primary once a year, and recoating of the primary every 7 to 10 years. One disadvantage of the Newtonian reflector is that they can become unwieldy over 10 inch aperture.

Schmidt-Cassegrain

This is another reflector design that uses a large thin plate of glass to seal the mirrors from the elements and dust, while it "corrects" the aberrations of the mirrors within. The design is quite compact and portable, at the expense of moderate to high initial costs.

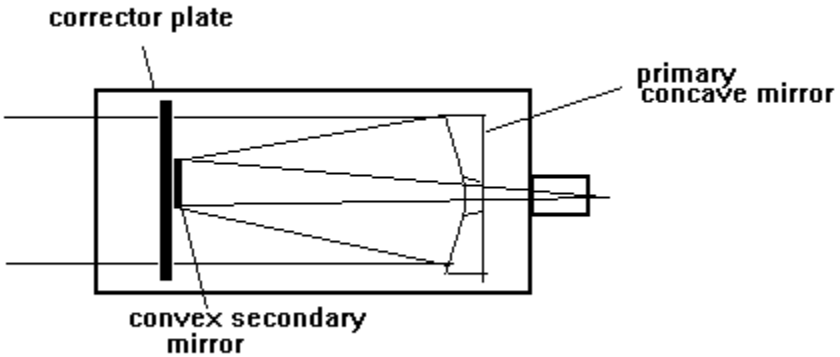

Figure 3 - the Schmidt-Cassegrain telescope

Most manufacturers offer accessories geared specifically for their instruments. An 8-inch S-C should take care of the needs of any given

amateur for many years to come.

Supports for the telescope

Alt-azimuth mounting

A telescope mount that has two axes of movement. One axis permits travel in the vertical axis (altitude), the other in horizontal (azimuth) travel, much in the manner of a gun turret or camera tripod.

Dobsonian mount

A variant of the alt-azimuth mount is Dobsonian mount. It is usually associated with large aperture (10 inch or more) Newtonian reflectors, where they are extremely portable and stable supports. The major drawback to the alt-azimuth mounting is that without a driven platform on which the entire mount is placed, or computer assist, there is no way that the 'scope can track the sky with ease; it must be repositioned constantly throughout the night.

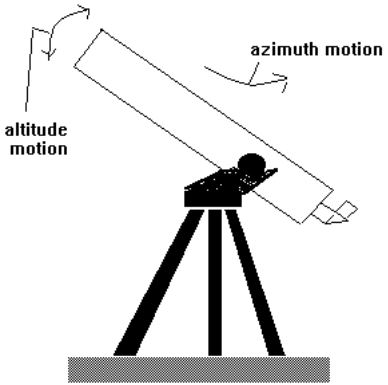

Figure 4 - The alt-azimuth mounting

Equatorial Mount

A telescope mount that has two axes of movement. One axis is pointed at

the North or South Celestial Pole, depending on the latitude of the observer, and permits east-to-west travel. This axis is called the *Polar or Right Ascension Axis*. The other axis permits north-south motion and is called the *Declination Axis*. By attaching a set of gears and a motor to the R.A. axis, we can follow the sky with ease. Although rather pricey, it does permit ease of operation (no constant resetting of the 'scope for groups of viewers), and it allows long-duration photography. It is found as an integral part of most Schmidt-Cassegrain telescopes, and with other designs.

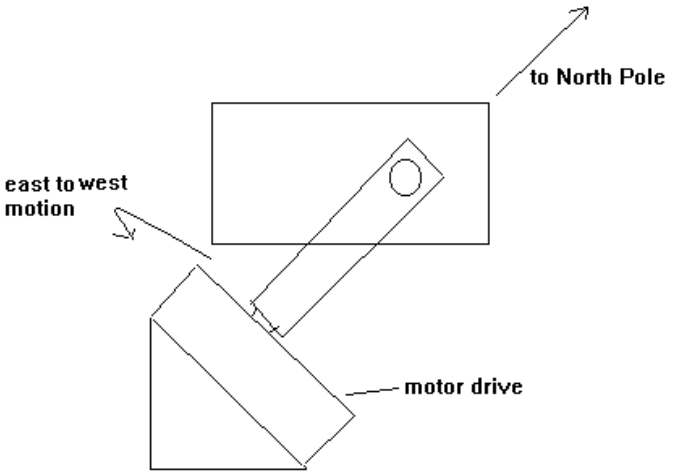

Figure 5 - the equatorial mounting - fork design

Finder telescope

Essentially a "rifle-scope", this auxiliary telescope's wide field of view allows you to locate objects at the limit of vision and thence into the main 'scope. It's an important part of the telescope.

All about Eyepieces

A good selection of eyepieces is essential for any telescope to operate properly. The magnification can be determined by dividing the focal length of the objective by that of the eyepiece. The Plossl eyepiece design is a highly corrected and strongly recommended eyepiece for general use. Two achromatic lenses are matched together to act as a precision magnifier of what the telescope brings into view. A good selection would

be: one of 26 mm focal length, one of 17 mm focal length, and a Barlow lens (this is an auxiliary lens that amplifies the effective focal length of the telescope) of 2 times power. This will give us the equivalent of a 26, 17, 13, and 8.5 mm set of eyepieces! A little shopping will keep this investment under $150. Other designs of eyepieces are available (*Orthoscopics, Kellners* and *Erfles*), but the Plossls give best results per dollar for a beginner.

At this point....

Again, ***If you do not know the sky, even the basic constellations, don't buy a telescope!!*** Get a good pair of 7x50 binoculars, either ***Touring the Universe with Binoculars*** by Phil Harrington (J. Wiley, $24.95), or

Binocular Astronomy by Craig Crossen and Wil Tirion (Willmann-Bell, $24.95) and a ***planisphere*** (a type of star map that can be customized for any night during the year), and **learn the night sky**. Sound familiar? This is what was said at the start of this pamphlet. Should you lose interest in astronomy (perish the thought!), the binocs are great for all sorts of outdoor activities.

If you have learned the sky pretty well, and will just go into **general observation**, with no photography save for quick shots of the Moon or (with a filter) the Sun, the best bet will be for ***a Dobsonian (alt-azimuth mounted) Newtonian reflector of 8 to 10 inch clear aperture. Bought new, this will run between 300 and 500 dollars.*** It will be ready to use, and easy to move to the observing site.

If you "need" to perform photography (putting a camera "piggy-back" onto a driven 'scope, and then tracking a bright star in the camera's field of view is a great way to get spectacular Milky Way shots!), then ***any equatorially mounted refractor of 2.4 to 4 inch aperture, or a Schmidt-Cassegrain reflector of 4 to 8 inch aperture is needed***. But, here's where the price tag goes up: the refractor will run between ***300 and 800 dollars***, and the S-C reflector will range from ***700 to 2300 bucks***. The saving grace about the S-C 's is that it is highly portable (the 8 inch will pack a focal length of 80 inches in a tube length less than 16 inches, and weigh less than 30 pounds!).

If you have access to a woodshop and/or machine shop, then you can economize by purchasing finished 4 to 10 inch Newtonian reflector optics (cost of $90 to $200 dollars), two Kellner eyepieces and a 2X Barlow lens

(cost of $140 more), and use the detailed plans and instructions in Richard Berry's excellent text, ***Build Your Own Telescope (Willmann-Bell),*** to complete a working instrument.

A magazine, ***The Starry Messenger***, ***(P.O. Box 4823-P, Ithaca, N.Y. 14852)*** has recently come into existence which acts as a clearing house for used telescopes and components at pretty good prices. You can subscribe to it for $18/ year. They offer to subscribers their free ***TSM Buyers and Sellers Guide to Used Equipment Prices***, which may keep you from being cheated on poor or damaged equipment.

Until recently, it was cheaper to make the optics for a reflector telescope of 8 inch aperture or less (it still makes for a good project !). The "Dobsonian revolution" and the higher costs of glass blanks have

conspired to make the kits more expensive than the finished mirrors!

So, there it is - a fast guide to the selection of a telescope. Don't forget to join your local, astronomy society! It's a great way to sample alot of expensive equipment, ask a lot of questions without fear of ridicule, and benefit from the experiences of your fellow amateurs.