

The background of the slide is a deep space image featuring a dense field of stars of various colors and sizes. Several prominent galaxies are visible, including a bright yellowish-white star in the lower-left quadrant, a blueish-white star in the lower-center, and a bright yellowish-white star in the lower-right. A prominent yellowish-white star is also visible in the upper-left. The overall scene is a rich, multi-colored star field.

Astronomy as a Hobby

Skylight Astronomical Society, Inc. (SAS)

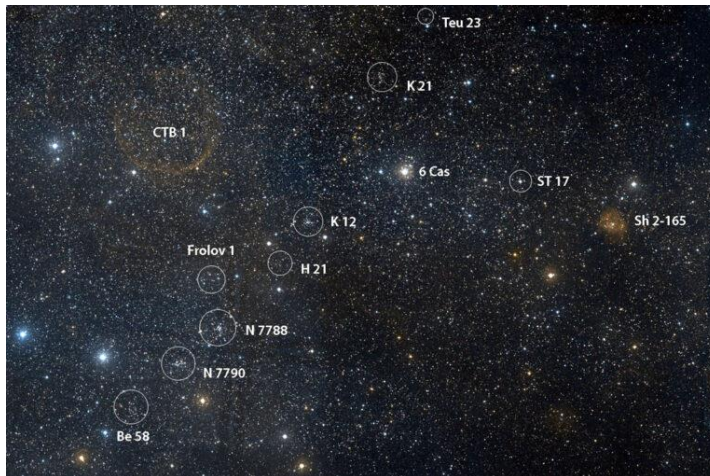
by Terry Riopka / David Murray

January 2, 2025

Enjoying Astronomy



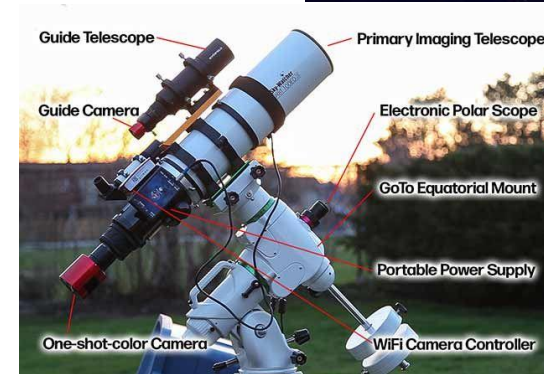
Looking up!



Night sky binocular viewing



Telescope Visual Observing



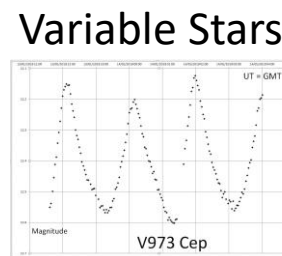
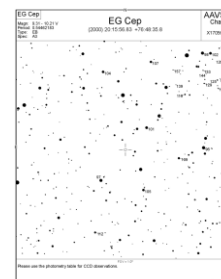
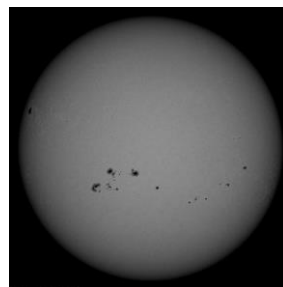
Telescope Imaging

Telescope Science

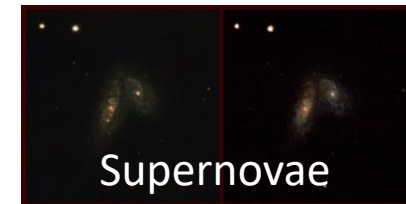


Recognizing constellations

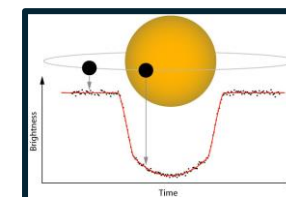
Daytime binocular viewing



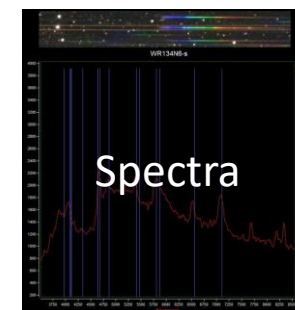
Planetary Discoveries



Supernovae



Exoplanets



Spectra

Overview

Why Buy a Telescope?

How NOT to Choose a Telescope

How to Choose a Telescope

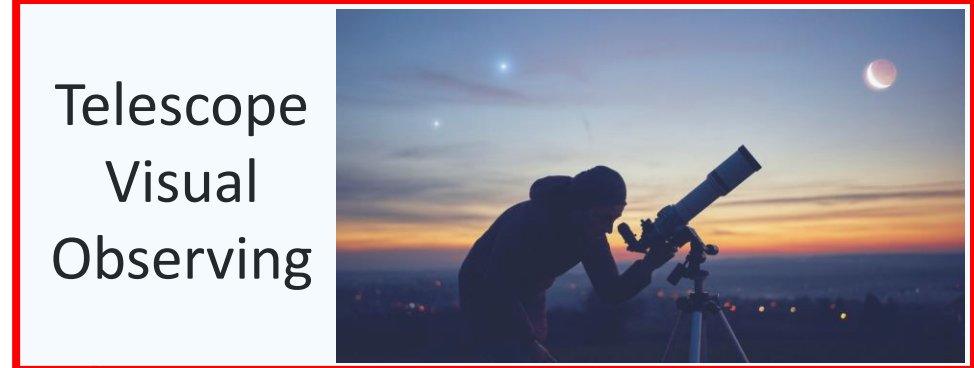
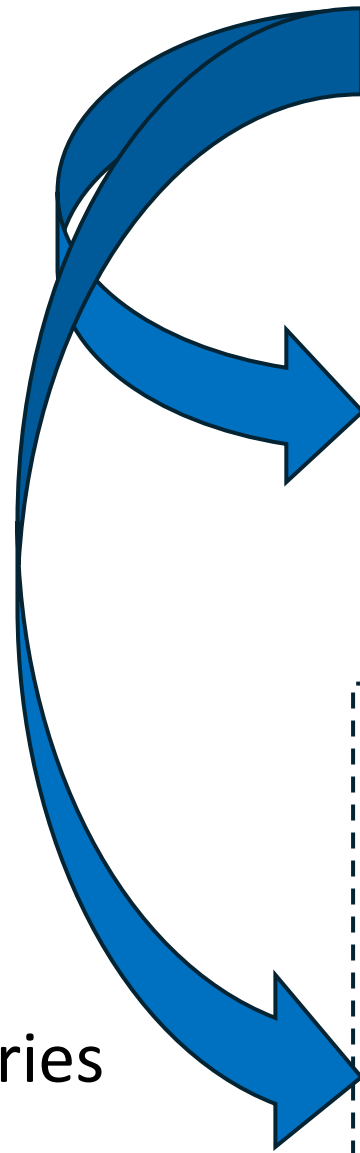
Altazimuth vs. Equatorial Mounts

What a Telescope Does

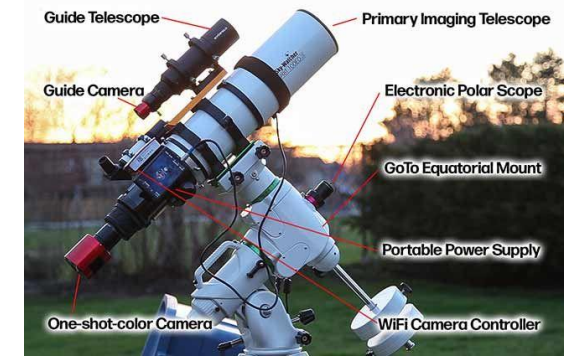
Types of Telescopes

What is the Best Telescope to Buy?

Useful Beginner Telescope Accessories

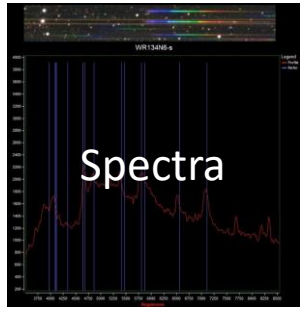
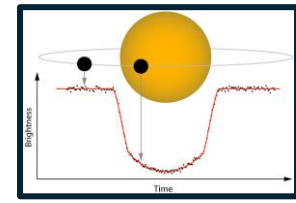
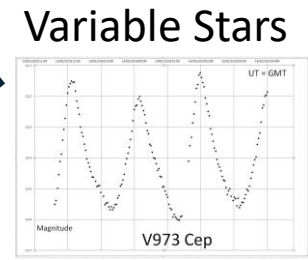
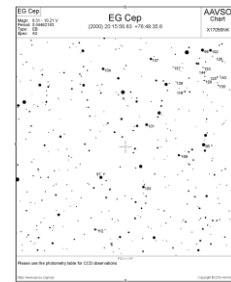


Telescope
Visual
Observing



Telescope
Imaging

Telescope Science



Why Buy a Telescope?

- to encourage a child's interest
 - inspire curiosity
 - use as an educational tool
 - encourage interest in STEM
- to indulge your own interest
 - can be meditative, reduce stress
 - foster a sense of wonder/perspective, deeper connection to the Universe
- to develop a hobby
 - social interaction with people with common interests
 - hobby evolves over time as you discover new objects and enhance your skills
- to contribute to science
 - comet/asteroid/supernova discoveries, planet observations, variable stars (AAVSO), exoplanets
- to take pretty pictures

SEEING IS BELIEVING!

Why Buy a Telescope : Seeing is Believing!

"To be is to do."

"Being in the world"

"The world is not something to be explained, but something to be lived."

- ➔ difference between a picture and reaching out with your own senses to experience reality
- ➔ sense of satisfaction to be able to "discover" objects in the heavens yourself
- ➔ there are some astronomical events to which you can be the only witness in the entire Universe!

Why Buy a Telescope: Taking Pretty Pictures

- If taking pretty pictures is your only goal – no need to buy a telescope!

➔ FREE robotic on-line telescopes!

- <http://www.itelescope.net>
- <https://telescope.live/home>

- free demonstration membership
- approximately 30 free minutes access to iTelescope-T3 – a single shot color telescope in New Mexico



1 min exposure



2 min exposure



2 min exposure

How **NOT** To Choose a Telescope

Worst Thing to do:

- Google-search for “best telescopes for kids”
- red flag #1: magnifications > 200
- red flag #2: price < \$200

➔ sure-fire way to kill a child’s enthusiasm and interest in astronomy



Features:

- Professional Telescope for Beginners: ESSLN'B telescopes offer quality, value, features, and power for first-time telescope users, making them ideal gifts for family and friends.
- Perfect Optical Quality: With a 700mm focal length, 70mm aperture, and fully coated optical glass lens, this telescope delivers clear and bright images. The included eyepieces and 3X Barlow lens provide a wide range of magnifications, making it ideal for exploring the moon and stars.
- Phone Adapter and Tripod: The telescope comes with a full-size stainless steel adjustable tripod for stability and a phone adapter for capturing and sharing your astronomical discoveries.

Whether you're a beginner or an experienced stargazer, this telescope offers the tools you need to explore and appreciate the wonders of the night sky.

700mm Professional Astronomical Telescope With Phone Adapter

\$229.99 ~~\$300.00~~ | Save \$70.01 (23% off)

Introducing the **700mm Reflector Telescope** is a remarkable piece of equipment for astronomy enthusiasts. Crafted from solid metal and high-quality optics, it boasts durability and precision. Its lightweight and portable design make it convenient for transportation to your favorite stargazing spots.

For those who have a passion for observing the night sky, this monocular telescope is an excellent option. It offers night vision capabilities and a wide zoom range, enabling you to switch seamlessly between wide-angle and extreme close-up views of your celestial targets.

Specifications:

- Maximum Magnification: 525X
- Model: XD70070
- Country/Region of Manufacture: China
- Finderscope: Red Dot Finderscope
- Aperture: 70mm
- Lens Coating: Coated
- Type: Refractor
- Features: Lens Cover, High Tripod, Mobile Holder
- Mount Type: Altazimuth
- MPN: XD70070
- Brand: ESSLN'B
- Objective Lens Diameter: 70mm
- Focal Length: 700mm
- Eyepieces: K4mm, K10mm, K20mm, 3X Barlow Lens
- Magnification: 35-525X
- UPC: 797439069790

How To Choose a Telescope

Most important feature: stable and adjustable mount!

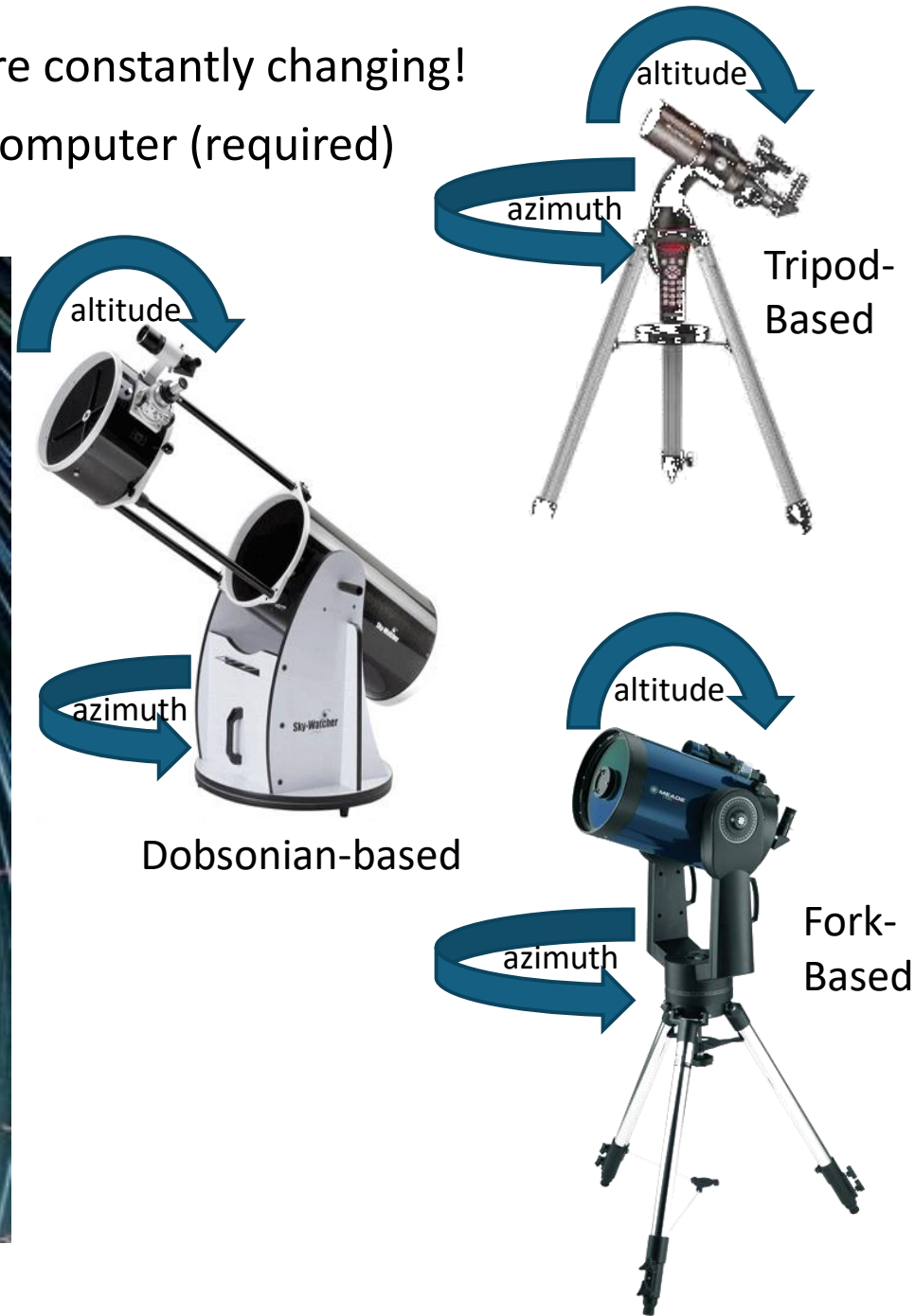
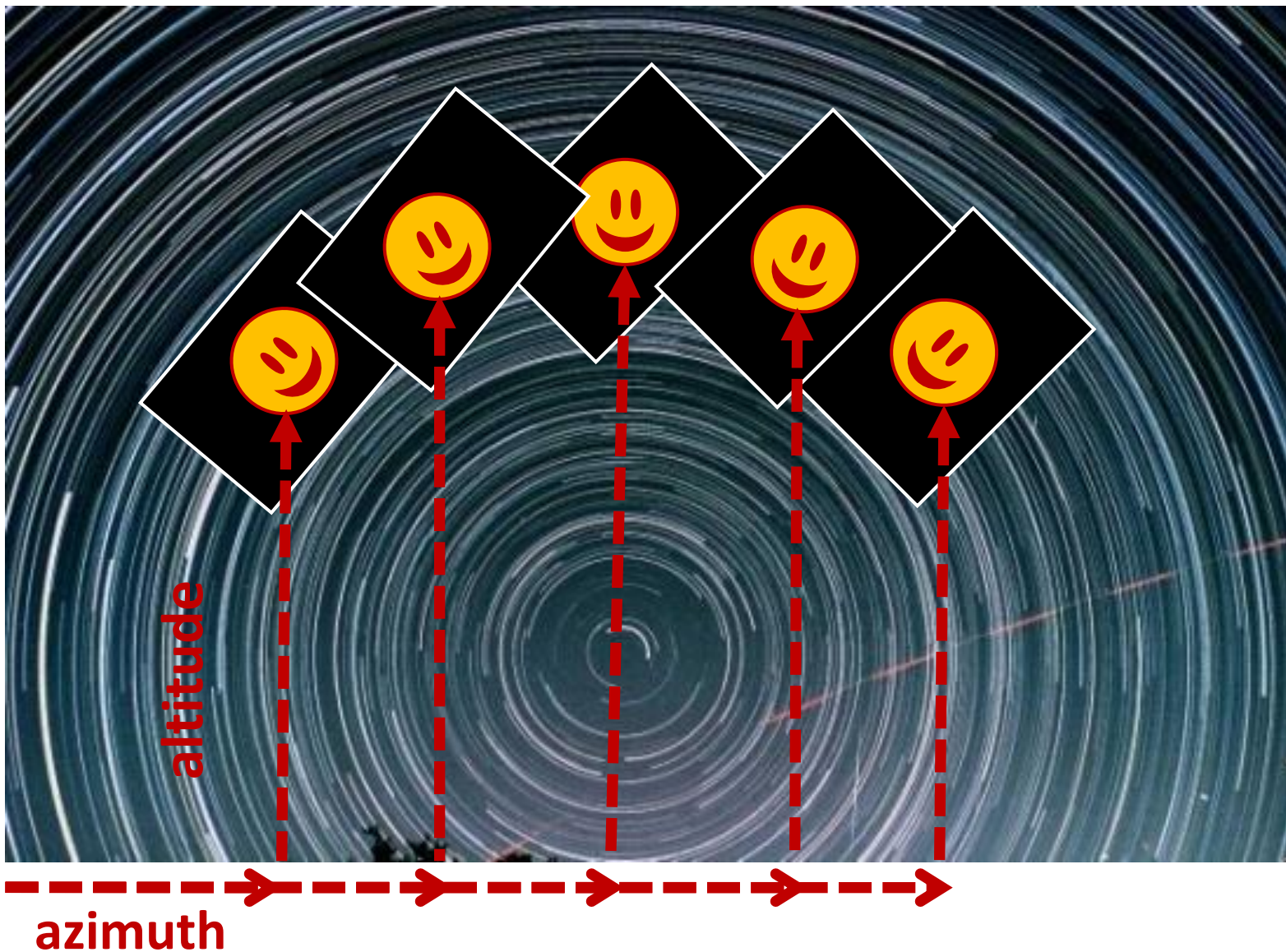
- Stability:
- minimize vibrations and “settling” time
 - prevent accidental damage to optics
 - maintain calibration

- Adjustability:
- need to be able to locate astronomical objects
 - need to be able to fine tune locations
 - need to be able to easily track objects (if not automatically, then manually)

Altazimuth Mounts

Both altitude and azimuth are constantly changing!

➔ Two Tracking Axes + computer (required)



Equatorial Mounts



R.A. and Declination are like an address:
every object has a unique one!

➡ One Tracking Axis + computer (optional)

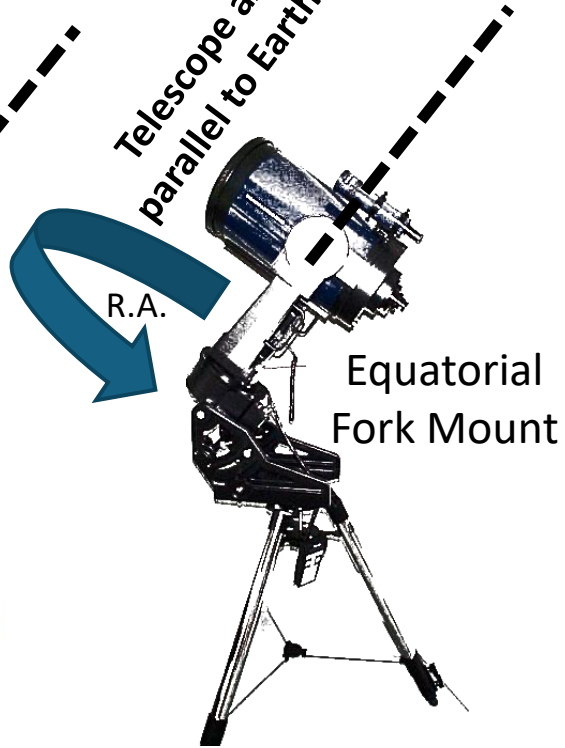
German Equatorial



Telescope axis aligned
parallel to Earth polar axis

R.A.

Equatorial Fork Mount

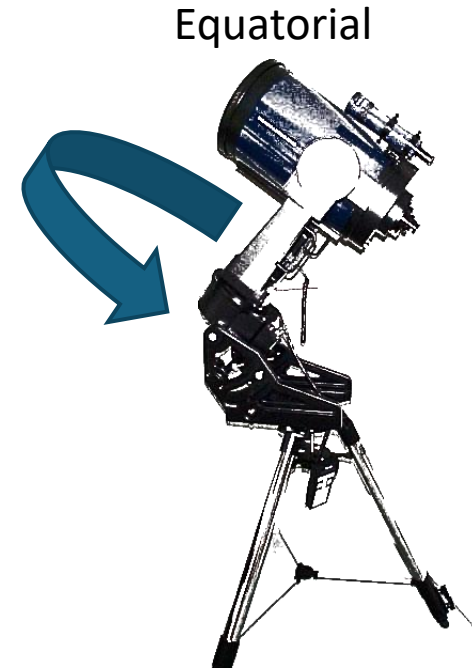


Altazimuth vs. Equatorial Mount



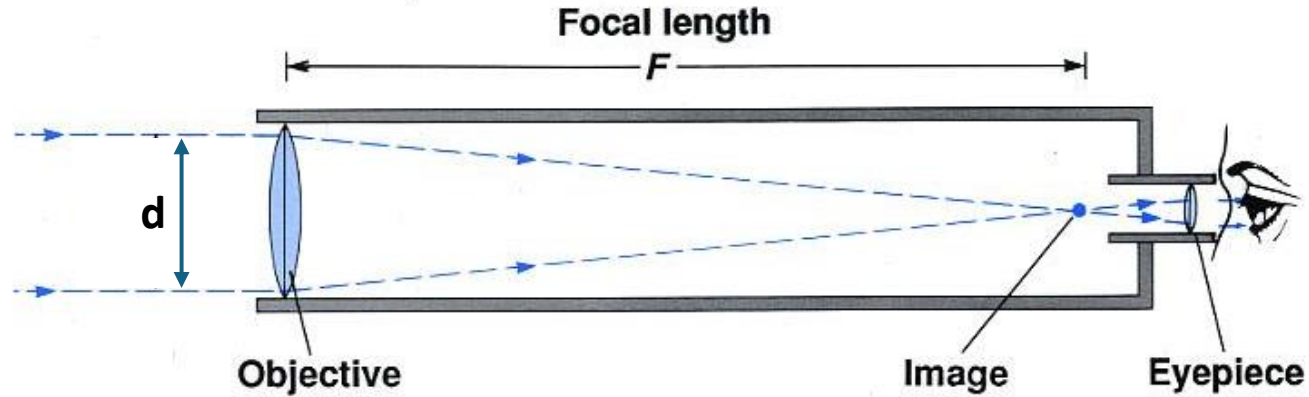
	Altazimuth Mount	Equatorial Mount
Ease of Use	Simple and intuitive.	More complex; requires polar alignment.
Portability	Lightweight and compact.	Bulky and heavy.
Tracking	Two axis tracking; permanently limited in accuracy and duration	Single axis tracking; generally better, and accuracy and duration can be even further enhanced. Objects can also be located manually.
Astrophotography	Limited; Short exposure (<30s) only.	Ideal for long-exposure imaging.
Cost	Affordable.	More expensive.

With built-in computers, not an issue



Difference relevant only for hard-core imagers and highly ambitious beginners

What a Telescope Does



1. Collects Light

- objective in ANY telescope only collects light: it does not magnify it
- light collecting ability depends on the size of the objective
- increases with the square of its diameter (**d**)

Objective of diameter 3 inches would collect $3^2 = 9$ units of light

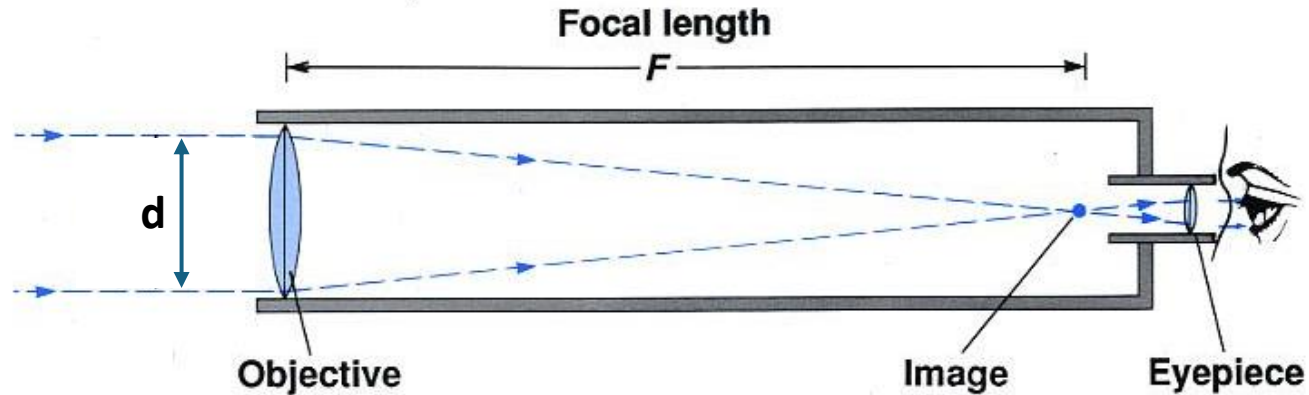
Objective of diameter 6 inches would collect $6^2 = 36$ units of light

So, a 6 inch telescope would collect $36/9 = 4$ times as much light as a 3 inch telescope

An 8 inch telescope would collect $64/9 = 7$ times as much light as a 3 inch telescope

A 10 inch telescope would collect $100/9 = 11$ times as much light as a 3 inch telescope
etc.

What a Telescope Does



$$f = \frac{\text{Telescope focal length (F)}}{d}$$

“focal ratio”

2. Makes Objects Appear Closer

- magnification happens only at the eyepiece for **all** telescopes
- magnification (M) can be computed by dividing the focal length (F) of the telescope by the focal length (E) of the eyepiece

$$M = \frac{\text{Telescope focal length}}{\text{Eyepiece focal length}}$$

e.g. F = 2540mm for a 10 inch LX200 Meade, so, for an eyepiece with E = 28mm:

$$M = \frac{F}{E} = \frac{2540}{28} = 91 \times$$

For a given telescope, the **smaller** the eyepiece focal length, the **higher** the magnification

Why Does This Matter?

A telescope...

Collects Light

- large diameter telescope (a big “light bucket”) means that you can see dimmer objects, or objects will look brighter:



- a large telescope also collects light pollution just as well as light from dim object, resulting in poor contrast:



Typical magnification range for deep sky objects: 40-100 X

Typical magnification range for planets: 100-300 X

Makes Objects Appear Closer

- magnification of a telescope indicates the number of times closer an object will appear
- the closer an object is, the more detail you can see
- most important for objects like the Moon, planets, double stars and star clusters



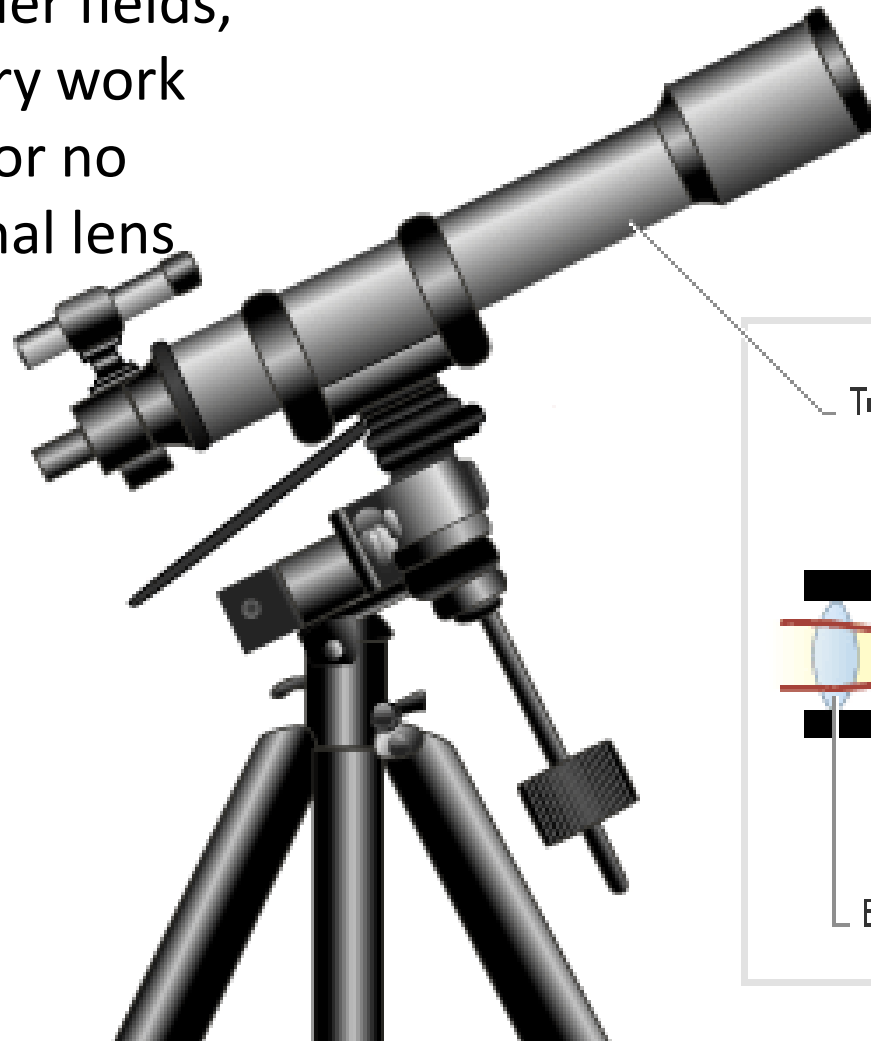
- However, more magnification also increases blur due to telescope vibration and natural atmospheric turbulence



Types of Telescopes – Refractor

Objective lens + eyepiece lens

- typically used for wider fields, excellent for planetary work
- usually require little or no adjustment, occasional lens cleaning



Refracting Telescope

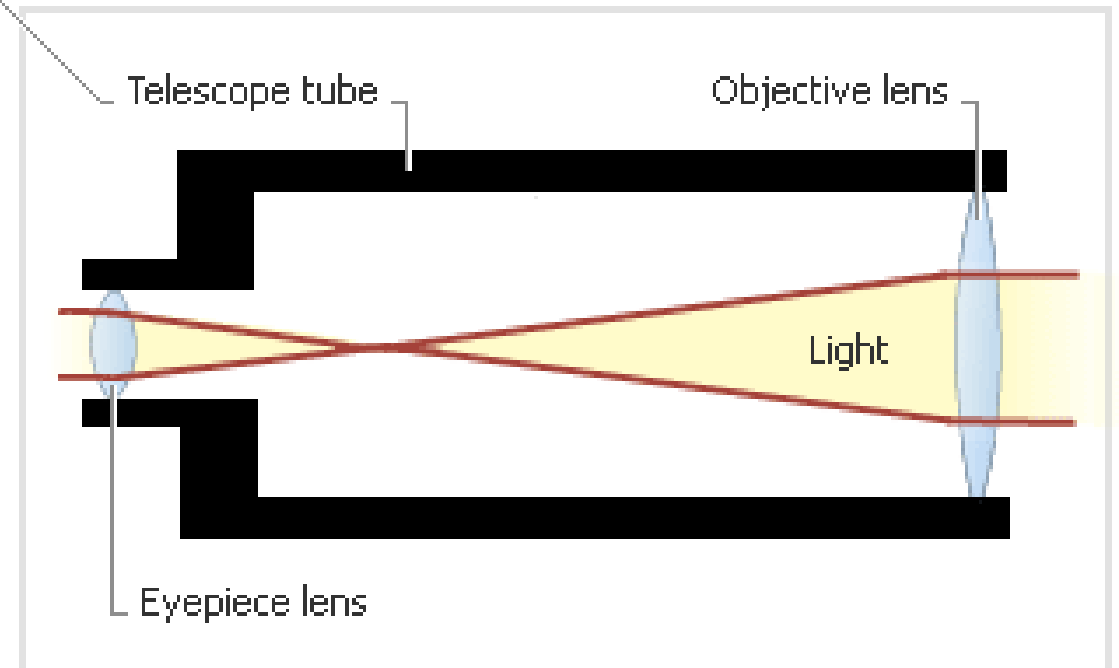


Diagram from Encarta
Encyclopedia 2004

Types of Telescopes – Newtonian Reflector

Curved Mirror + flat mirror + eyepiece lens

- typically used for deep sky
- require periodic collimation
- may require mirror cleaning

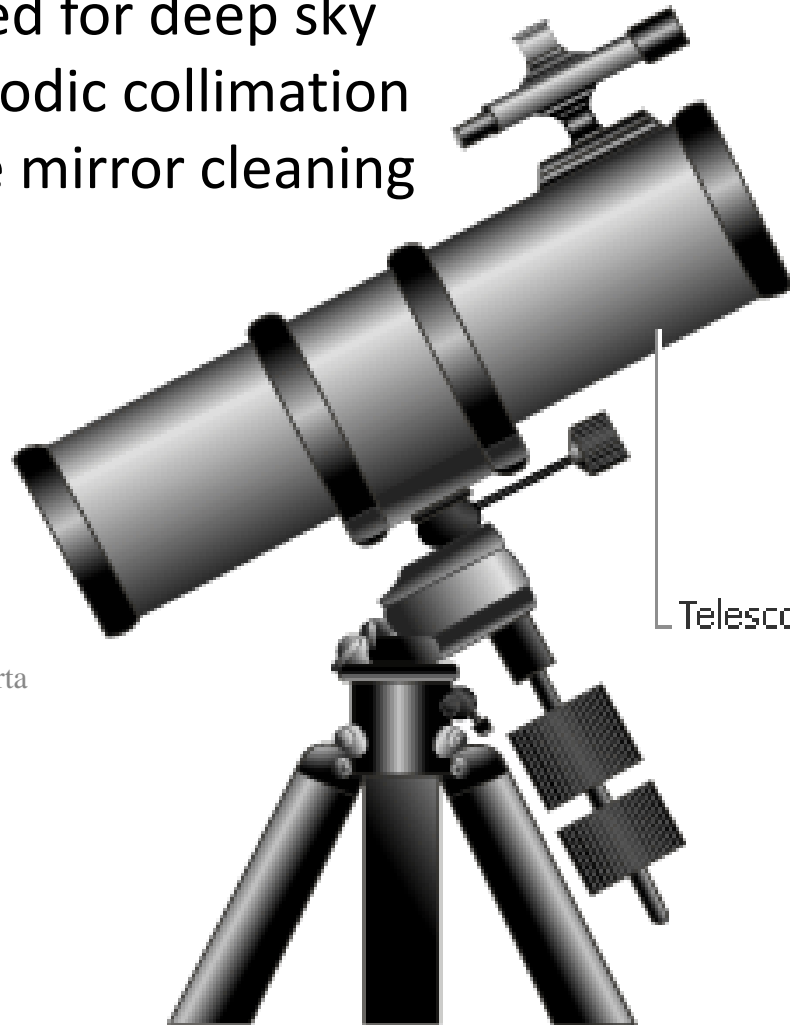
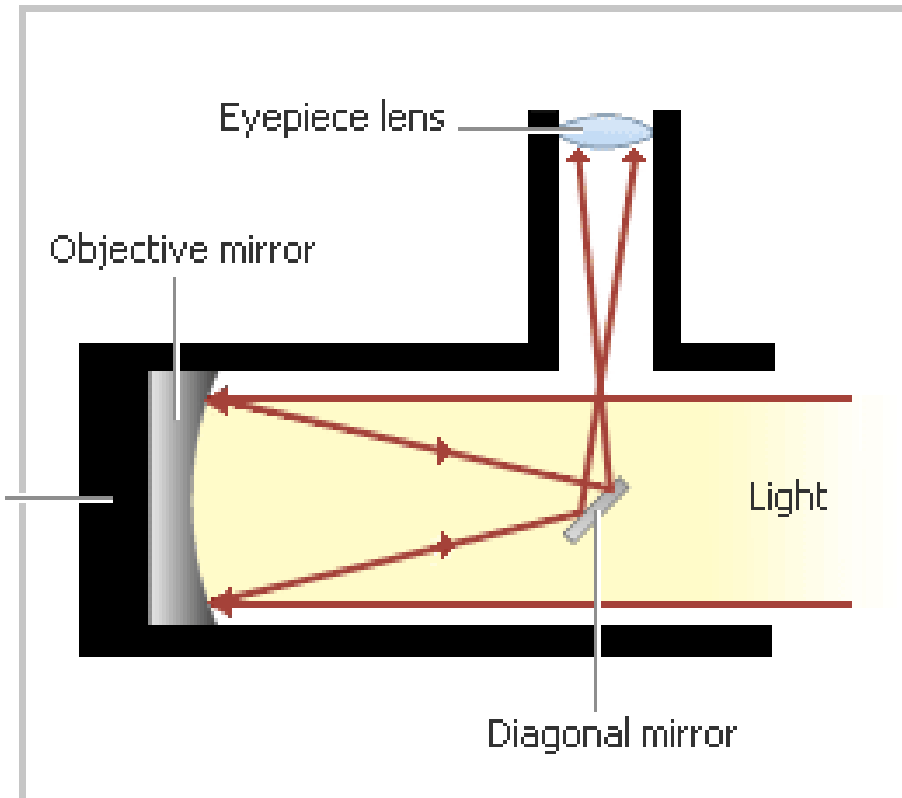


Diagram from Encarta
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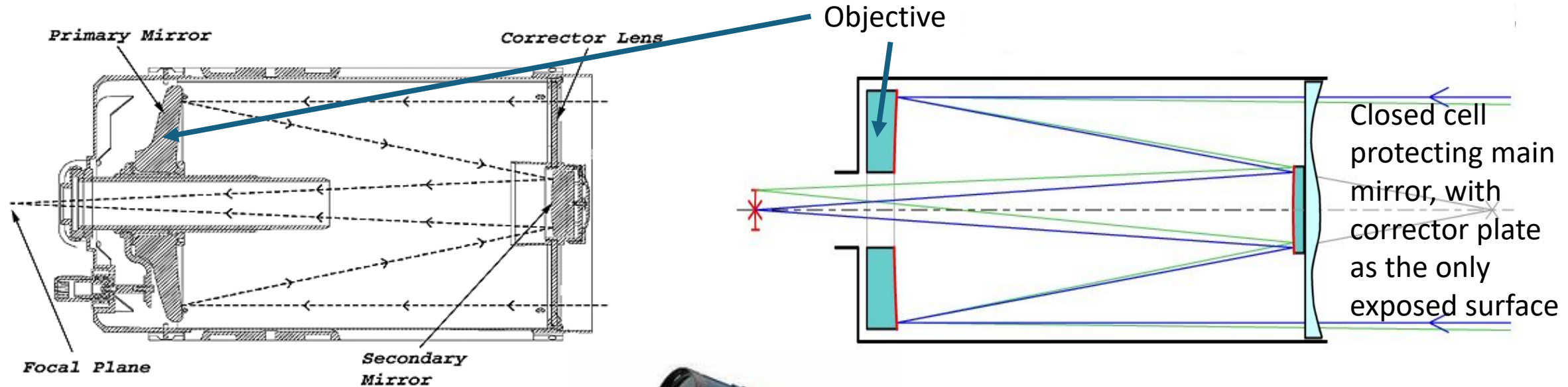
Newtonian Reflecting Telescope



Open cell,
exposing
main mirror
to the sky

Types of Telescopes – Schmidt Cassegrain (SCT)

Curved mirror + curved mirror + eyepiece lens



Images from: A-level Physics Tutor
www.a-levelphysicstutor.com/optics-telescopes.php

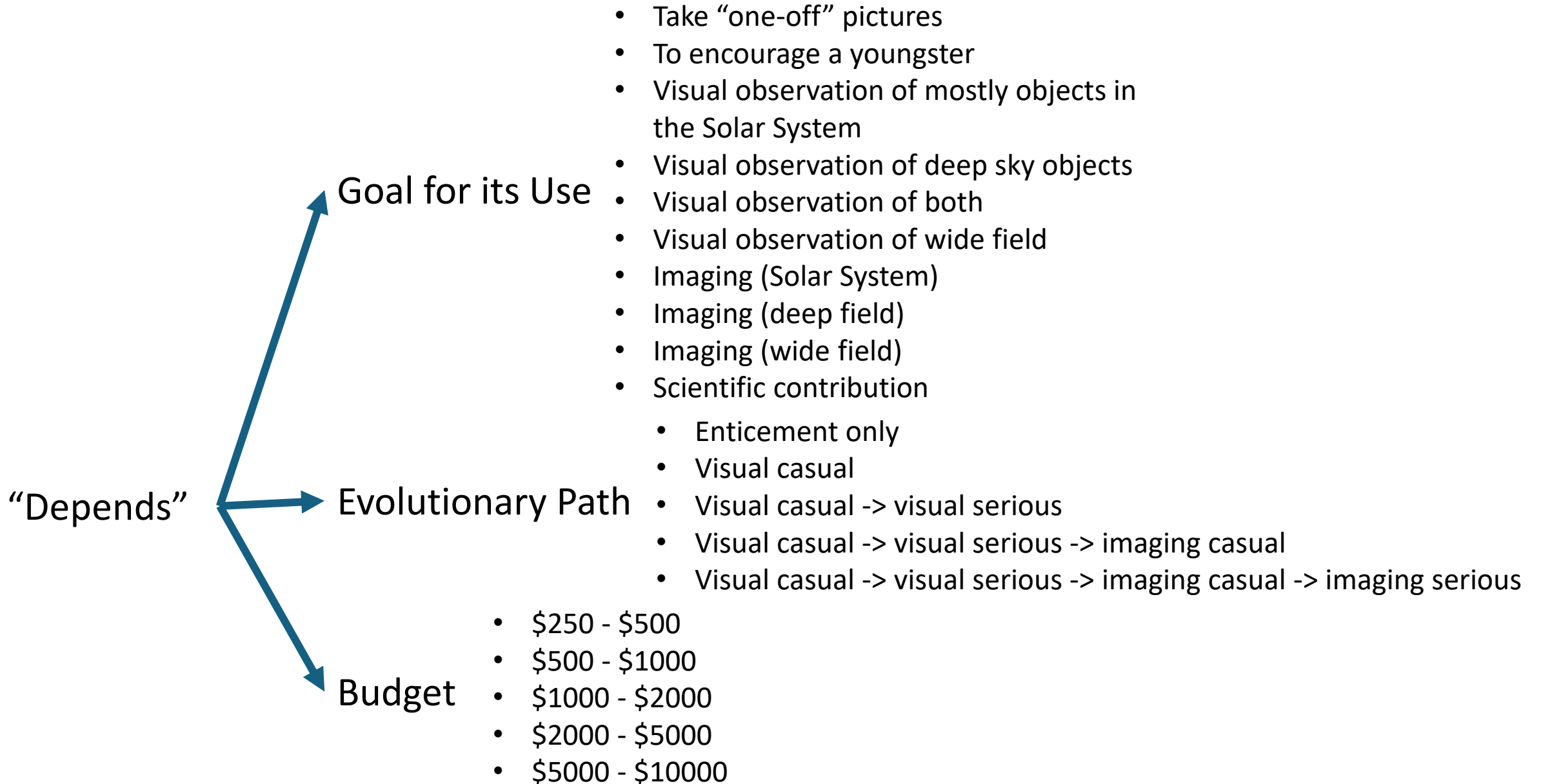
- typically used for both planets and deep sky
- require periodic collimation
- may require corrector cleaning



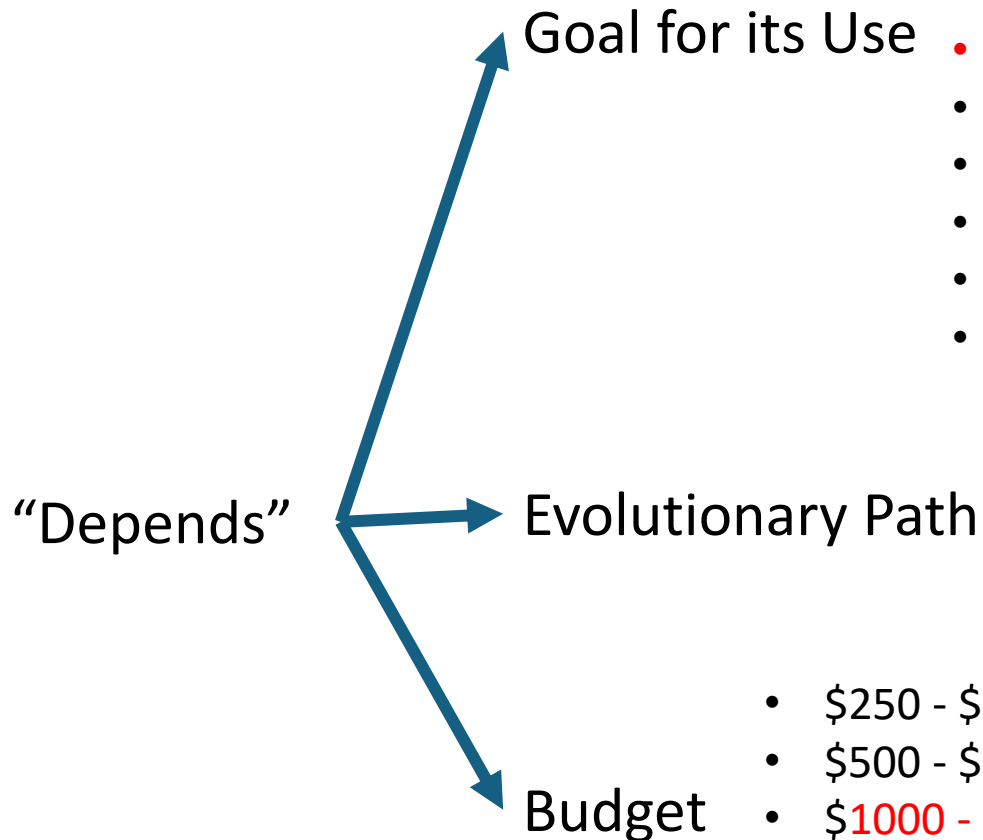
Similar scope designs:

- Maksutov-Cassegrain
- Ritchey-Chretien

What is the Best Telescope to Buy??

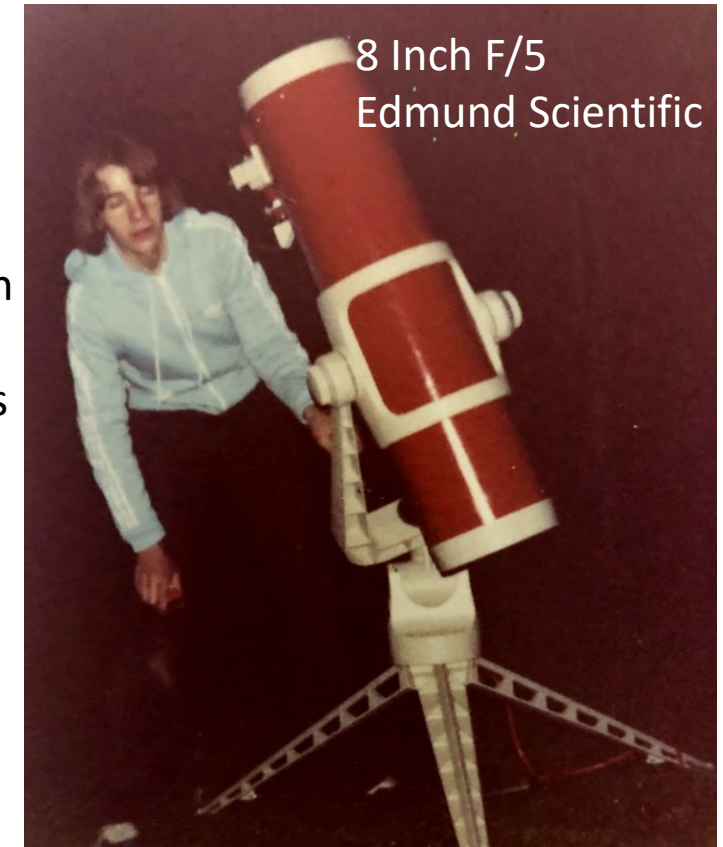


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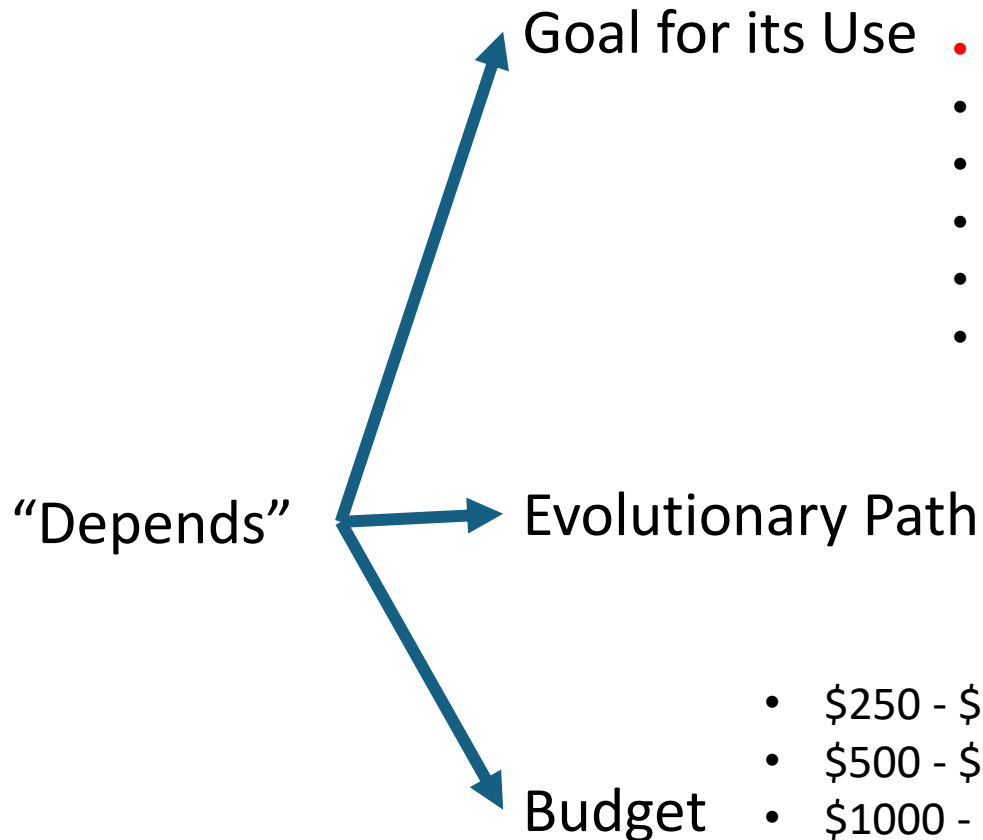
- Take “one-off” pictures
- To encourage a youngster
- Visual observation of mostly objects in the Solar System
- Visual observation of deep sky objects
- **Visual observation of both**
- Visual observation of wide field
- Imaging (Solar System)
- Imaging (deep field)
- Imaging (wide field)
- Scientific contribution
 - Enticement only
 - Visual casual
 - **Visual casual -> visual serious**
 - Visual casual -> visual serious -> imaging casual
 - Visual casual -> visual serious -> imaging casual -> imaging serious

- \$250 - \$500
- \$500 - \$1000
- **\$1000 - \$2000**
- \$2000 - \$5000
- \$5000 - \$10000



My Personal Journey

What is the Best Telescope to Buy??



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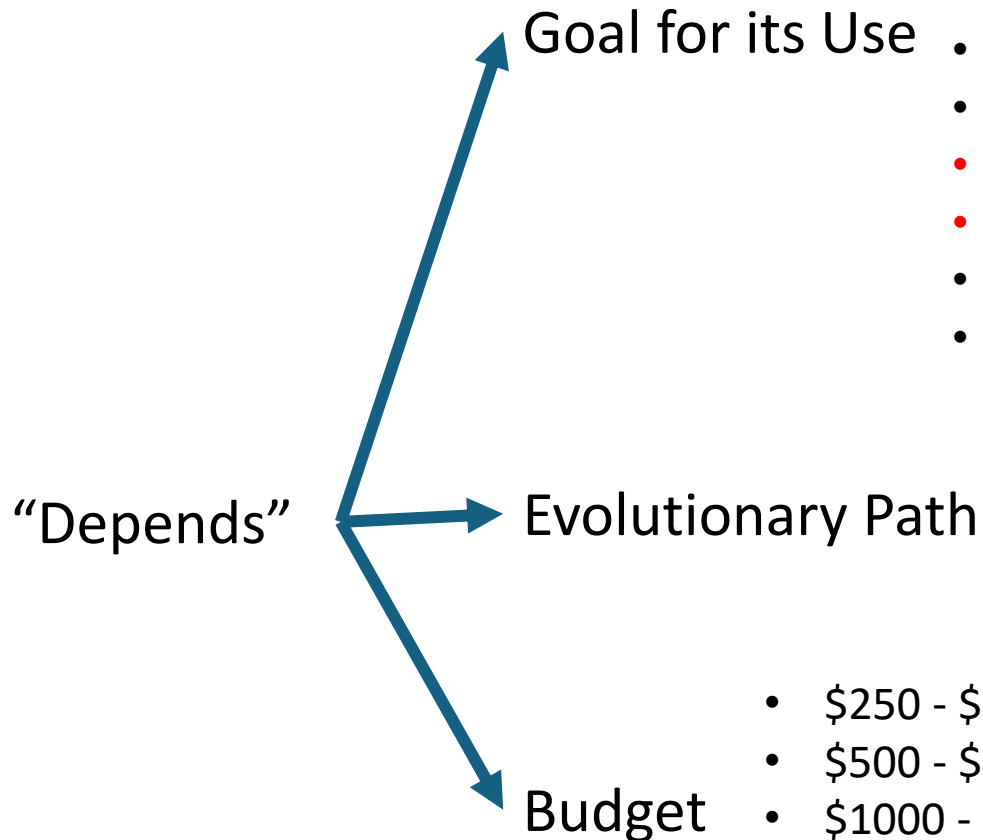
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My Personal Journey

What is the Best Telescope to Buy??

High Point Scientific

BEST TELESCOPES FOR 2024

BEST OVERALL



APERTURA AD8 8"
DOBSONIAN

MOST INTERACTIVE



CELESTRON STARSENSE 130
DX

MOST INNOVATIVE



ZWO SEESTAR S50 SMART
TELESCOPE

BEST BUNDLE



CELESTRON NEXSTAR 8SE
BUNDLE

BEST TABLE TOP



SKYWATCHER VIRTUOSO
130

Digitally Assisted Astronomy



Celestron StarSense Explorer
DX 130AZ Newtonian
Reflector Telescope
SKU: CEL-22461



Celestron NexStar 130 SLT
Computerized Telescope
SKU: CEL-31145
★★★★★



Celestron StarSense Explorer
8" Dobsonian
SKU: CEL-22470



Celestron NexStar 4SE
Essential Telescope Bundle
SKU: CEL-11049-BUN-E
☆☆☆☆☆

What is the Best Telescope to Buy??

Smart Telescopes



**ZWO Seestar S50 All-in-One
Smart Telescope**

SKU: ZWO-SEESTAR-S50



**Vaonis Hestia Smartphone-
Dedicated Smart Telescope -
Ultimate Package**

SKU: VAO-HE30-ULT



**Vaonis Vespera II Smart
Telescope**

SKU: VAO-VE50-II



**Celestron Origin Smart
Telescope**

SKU: CEL-12099

Dobsonian



**Apertura AD10 Dobsonian
10" Telescope with
Accessories**

SKU: APT-AD10

Computerized Telescopes



**Celestron NexStar 6SE
Telescope Bundle**

SKU: CEL-11068-BUN1



**Celestron NexStar Evolution
8" EdgeHD with StarSense**

SKU: CEL-12096



**Celestron CGX-L 1100
EdgeHD Computerized
Telescope**

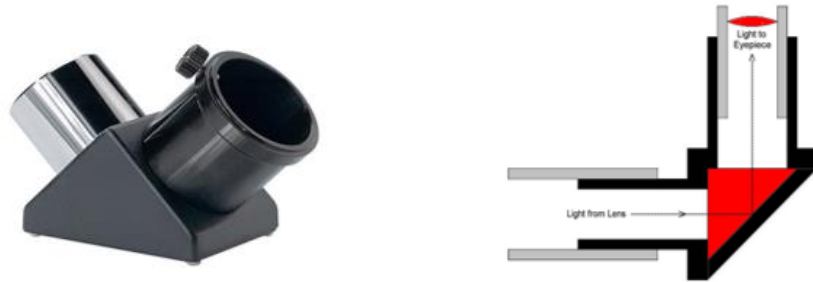
SKU: CEL-12076

Useful Beginner Telescope Accessories

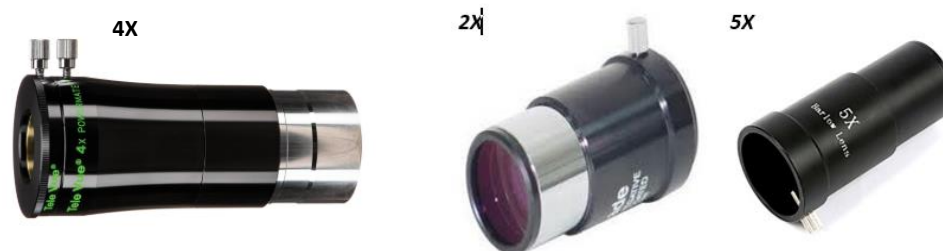
Finder Scopes / Telrads: A low power or zero power telescope used to locate objects



Diagonal: Changes the viewing angle 90 degrees allowing more comfortable viewing with some scopes



Barlows and Powermates: negative lenses that effectively increase the telescope's focal length, thus increasing magnification, but maintaining or increasing eye relief



Reputable Vendors

Telescope Manufacturers

Name	Website	Products
Celestron	www.celestron.com	telescopes, binoculars, accessories
Sky-Watcher	www.skywatcher.com	telescopes, mounts, access., binocs.
Explore Scientific	explorescientificusa.com	telescopes, eyepieces, mounts, access.
iOptron Corporation	www.ioptron.com	mounts, mounts + telescope
Vixen Optics	explorescientificusa.com	telescopes, eyepieces, mounts, access.
Tele Vue Optics, Inc.	www.televue.com	telescopes, eyepieces, mounts, access.
Stellarvue	www.stellarvue.com	telescopes, mounts, eyepieces, access.
William Optics	www.williamoptics.com	telescopes, eyepieces, finders, access.

Telescope Vendors

Name	Website	Products
Highpoint Scientific	www.highpointscientific.com	telescopes, mounts, access., binocs., microscopes
Agena	http://Agenaastro.com	telescopes, mounts, access., binocs.
B&H Sales	www.bhphotovideo.com	cameras, telescopes, binoculars, accessories
Celestron	www.celestron.com	telescopes, binoculars, accessories
Sky-Watcher	www.skywatcher.com	telescopes, mounts, access., binocs.
Explore Scientific	explorescientificusa.com	telescopes, eyepieces, mounts, access.
iOptron Corporation	www.ioptron.com	mounts, mounts + telescope



Beginning's End