

Introduction to Scopes & Mounts

Virtual Astronomy Day

May 2nd, 2020



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Telescopes

What is a telescope?

- A tool to help see things that appear very dim and/or very small
- Perform two basic functions:
 1. Collect light (much more than your eye)
 2. Focus the light into an image we can see
- Two main types:
 1. Refracting
 2. Reflecting

Numbers To Know

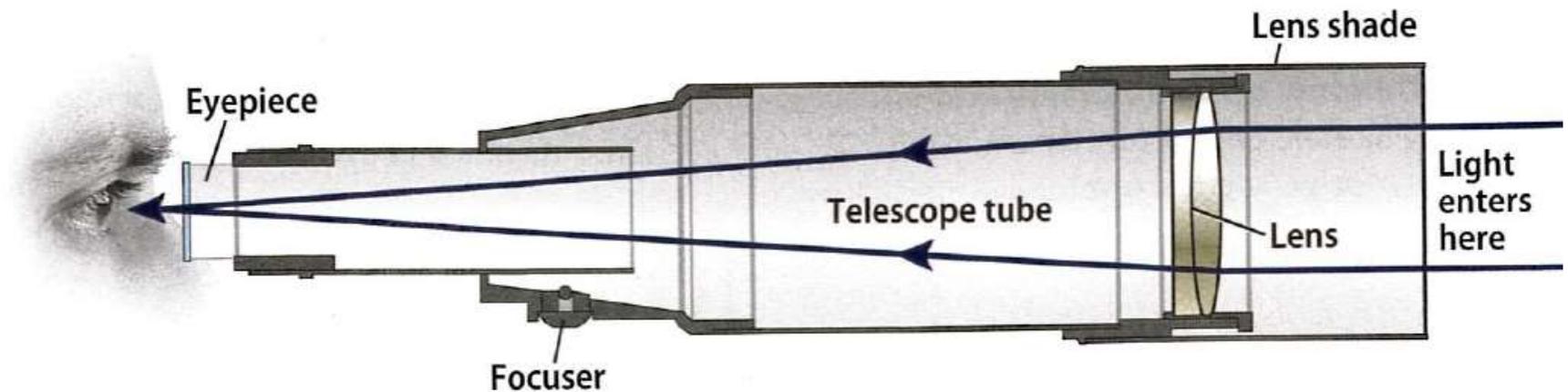
- **Aperture:** Diameter of main lens/mirror
= light gathering ability + resolution
- **Focal Length:** Distance from main lens/mirror to the focused image
= magnification/field of view
- **Focal Ratio = Focal Length / Aperture:**
= light gathering efficiency (image brightness)

What About Magnification?

- Power or Magnification = Telescope Focal Length / Eyepiece Focal Length
- More magnification = object larger **but** also less sharp and dimmer
- Useful magnification limited by scope aperture ~ 50x aperture in inches
- Turbulence in atmosphere (“seeing”) limits max magnification

Refracting Telescope

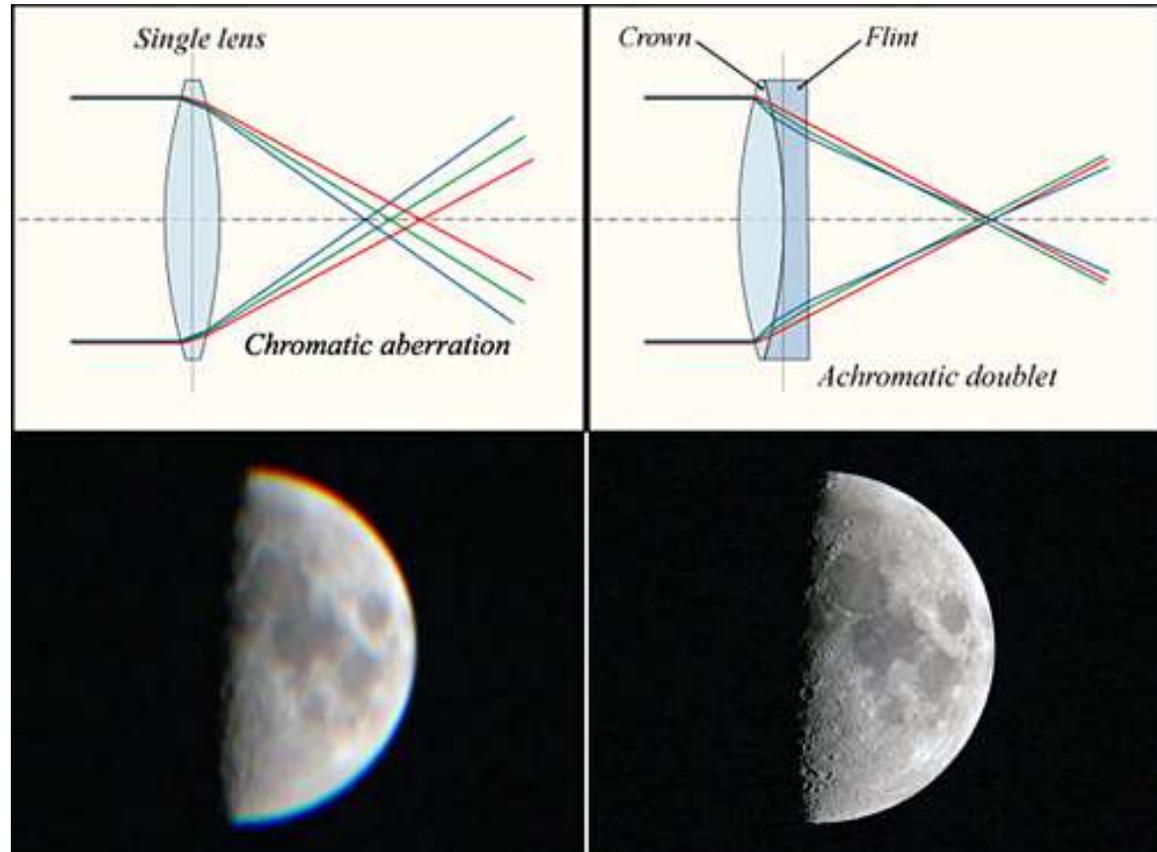
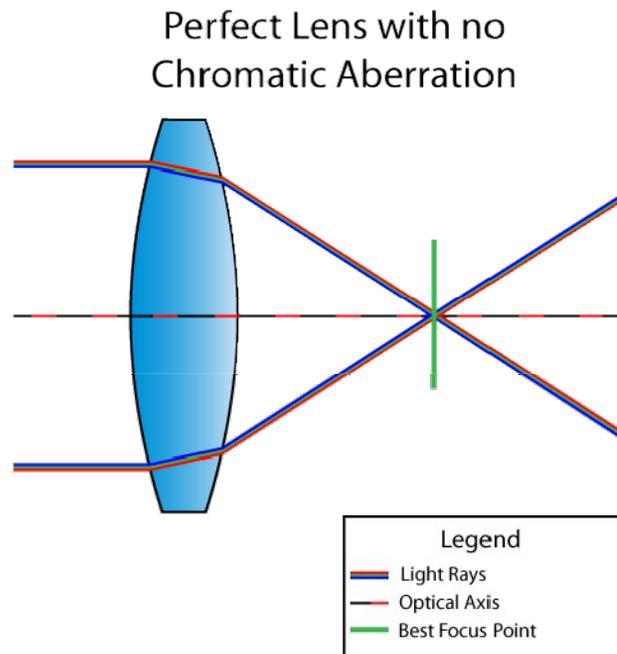
- Refraction: light changes direction when passing from one medium into another (eg. air to glass)



Refractor Pro/Con

- Pros:
 - Can be very inexpensive (achromatic)
 - Can be small in size
 - Short focal lengths (wide FOV) possible
 - Very good contrast possible
- Cons:
 - Can also be very expensive (apochromatic)
 - Long focal lengths or large apertures make scope very long and heavy
 - Chromatic and other aberrations (distortions) to deal with

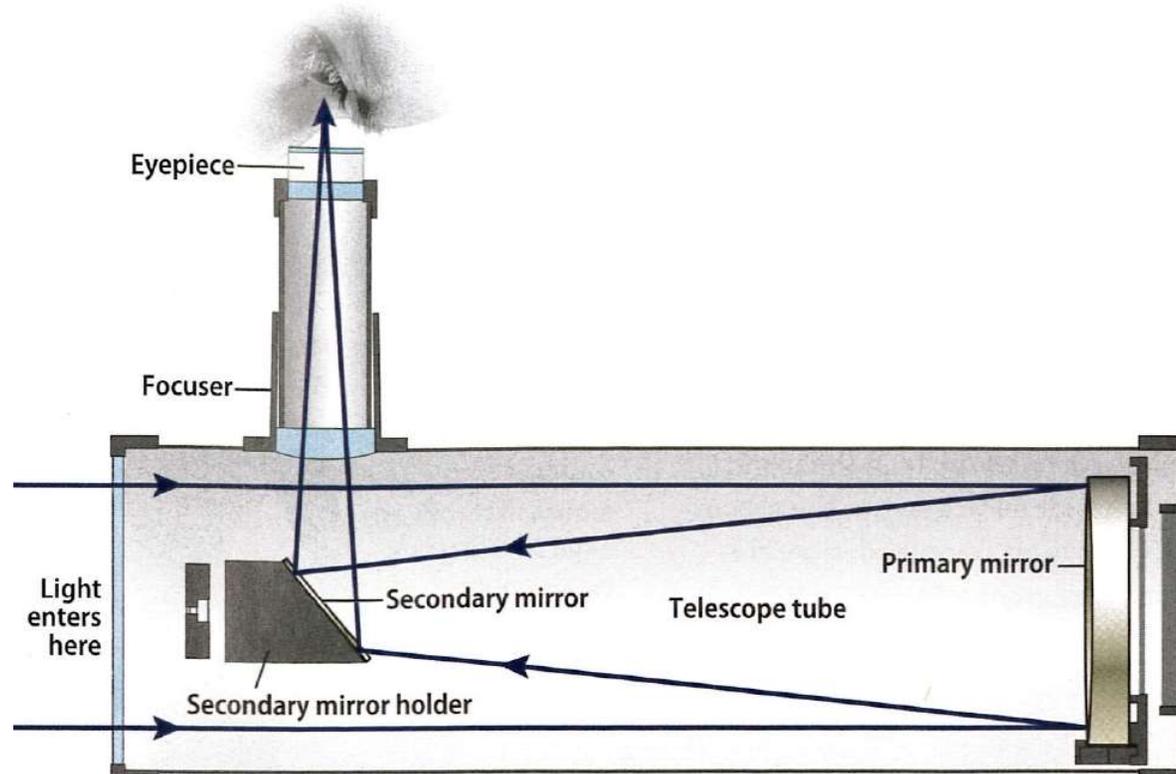
Chromatic Aberration



- \$ • **Achromat:** 2 types of glass Crown and Flint, improves chromatic aberration
- \$\$ • **ED Achromat:** still 2 lens, but use Extra Low Dispersion glass, improve over achromat
- \$\$\$ • **Apochromat (APO):** very special glass, 3 or more lens elements – best performance

Reflecting Telescope

- Reflection: light bounces off a smooth surface in a predictable way (angle in = angle out)



Reflector Pro/Con

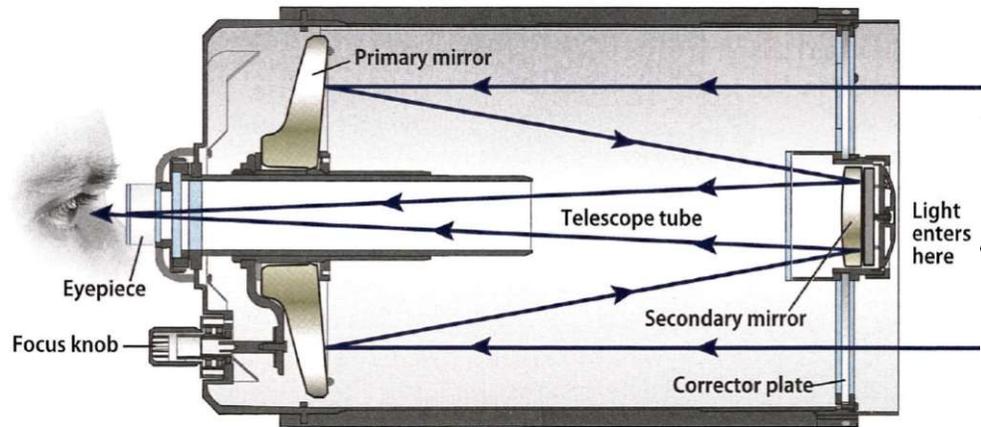
- Pros:

- Lowest cost per unit aperture
- Do not have chromatic aberration
- Long focal lengths possible

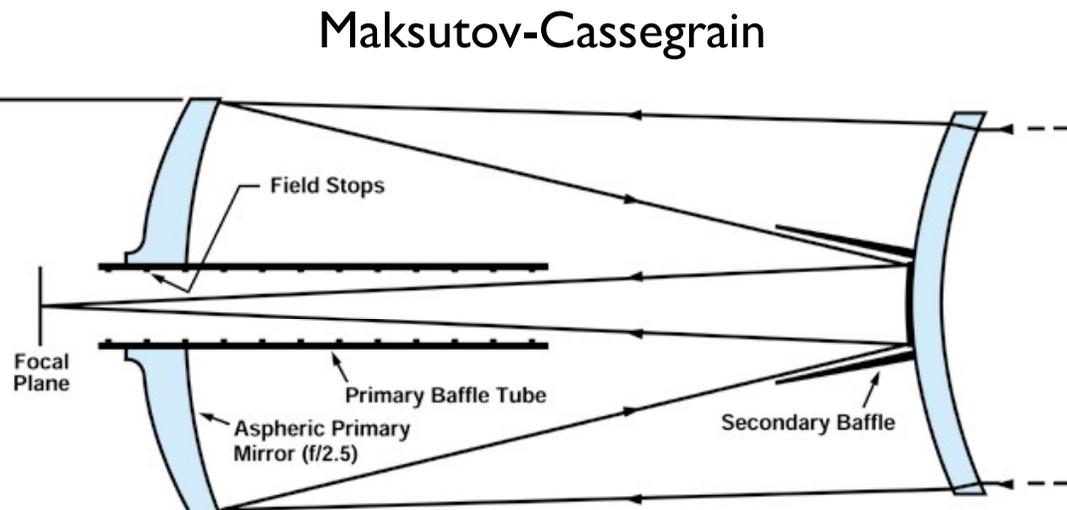
- Cons:

- Mirror alignment must be maintained
- Take longer to come to stable temperature
- Still suffer from shape related aberrations
- Central 2nd mirror reduces contrast

Compound Reflectors

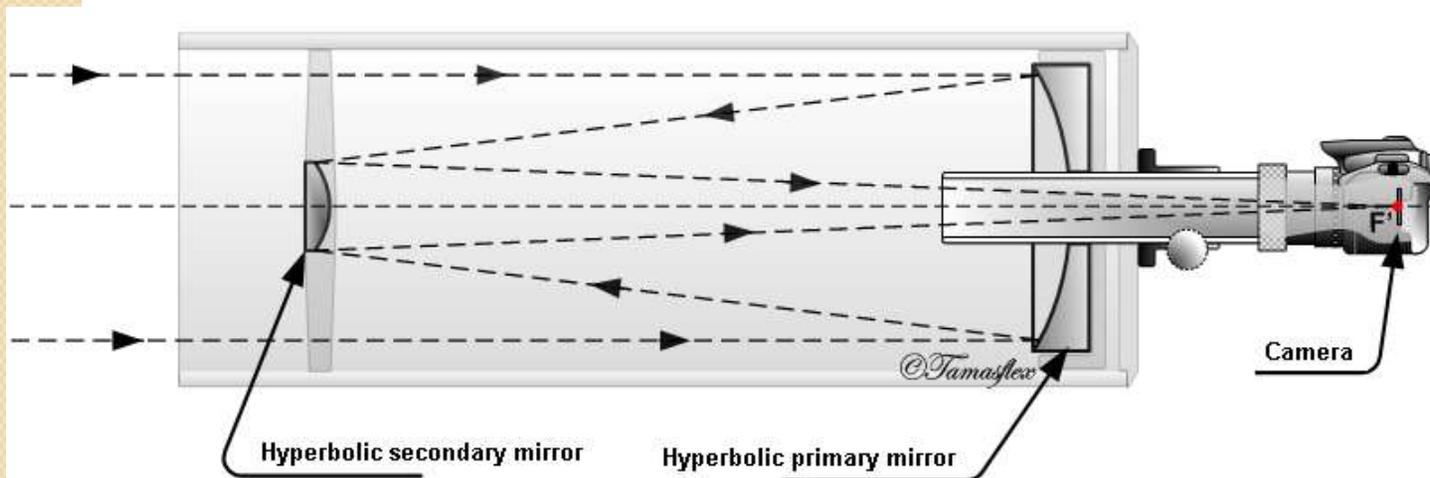


Schmidt-Cassegrain



Maksutov-Cassegrain

Ritchey-Chretien



How Do You Pick?

- How much are you able/willing to spend?
- What do you want to look at?
- Where & how often will you use it?
- The best telescope is the one you will **actually use!**

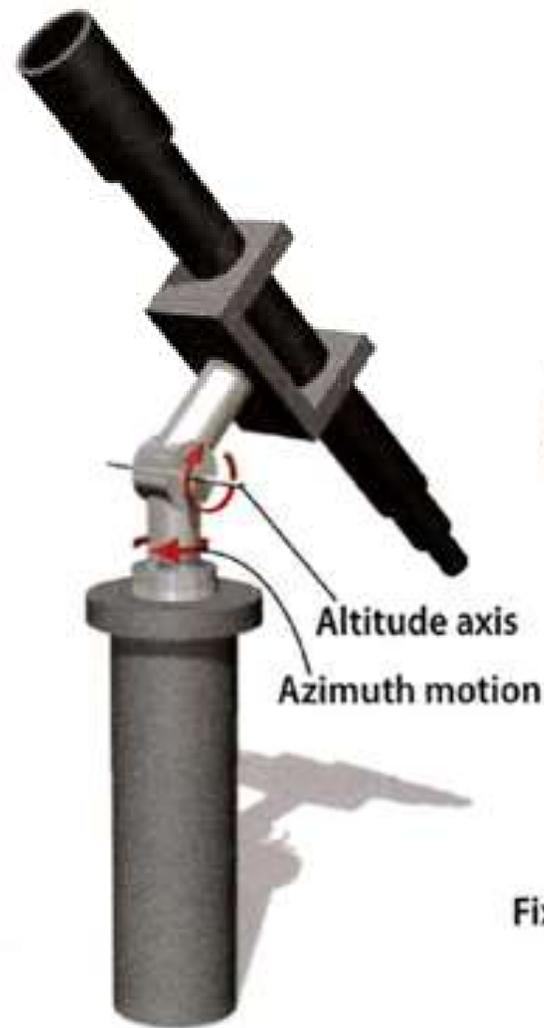


Mounts

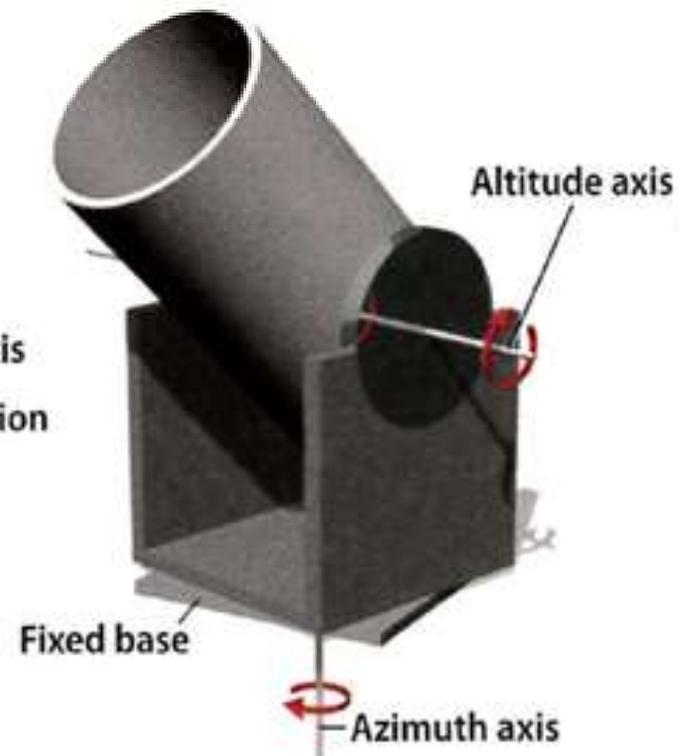
Mounts

- Two basic types:
 1. Altitude-Azimuth
 2. German Equatorial
- Can be manual, motorised, or computer controlled
- Your telescope & type of observing will define the mount you need

Mount Types: Alt-Az

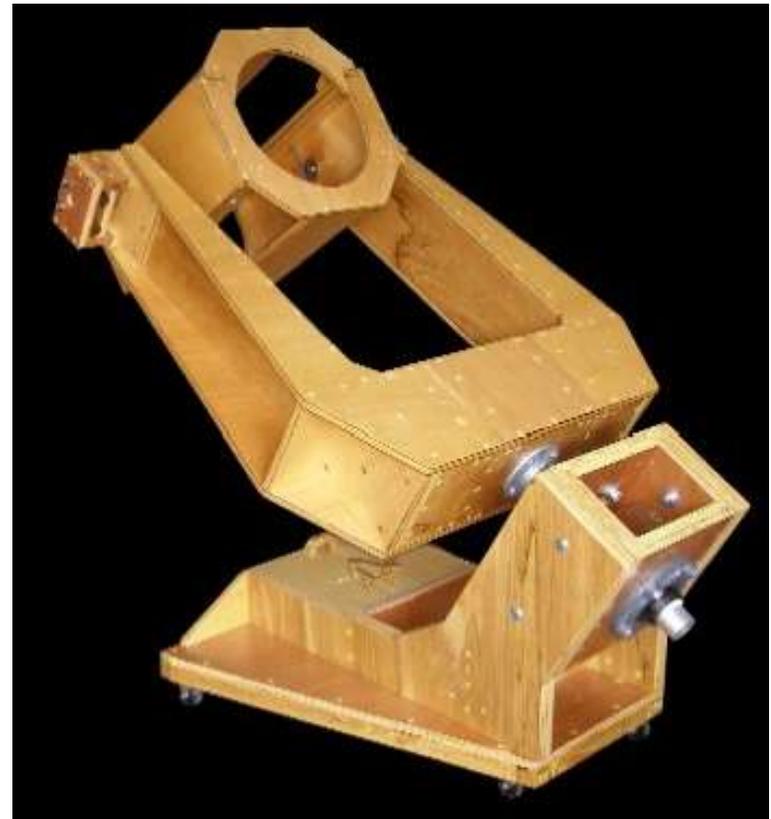
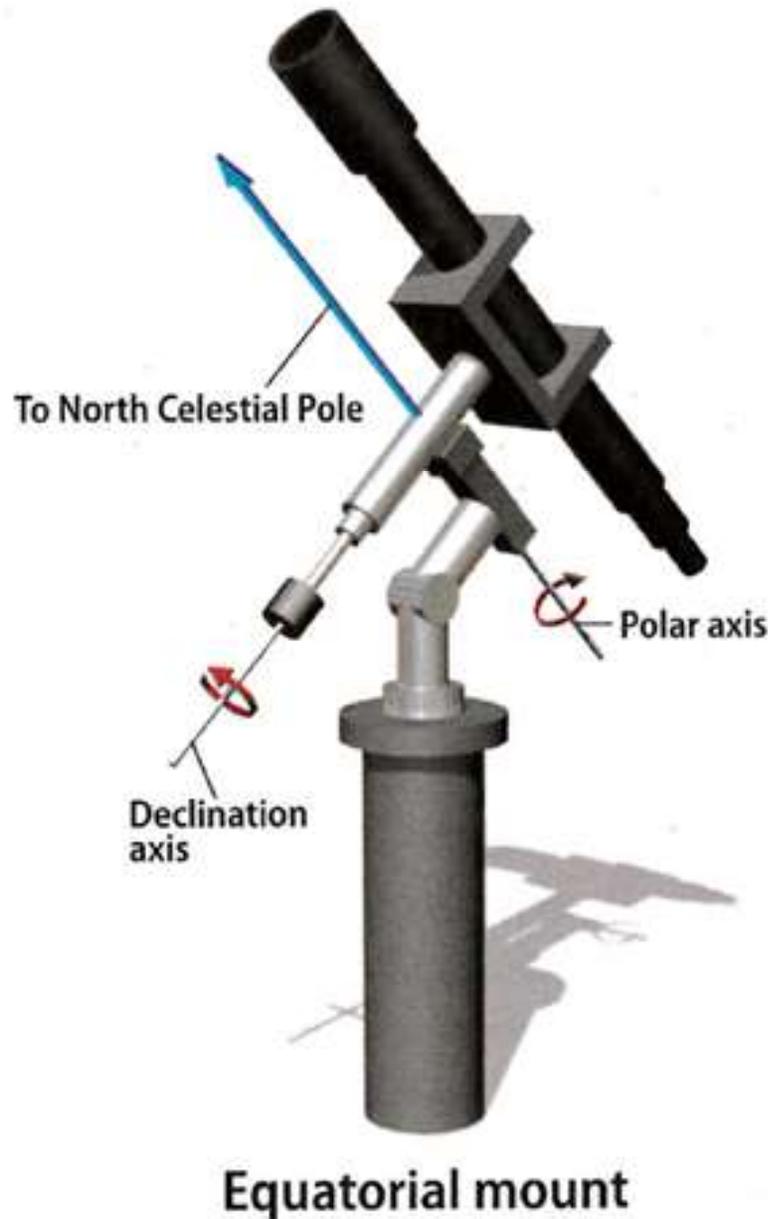


Altitude-Azimuth mount



Dobsonian mount

Mount Types: Equatorial



Equatorial fork mount

Sample Mounts - Manual

Alt-Az push-pull



EQ fine control



Dobsonian push-pull



Alt-Az fine control



Sample Mounts - Driven

“Fork” Alt-Az
GOTO



EQ GOTO



Alt-Az GOTO



Alt-Az
GOTO



ALT-AZ vs. EQ

- **ALT-AZ:**
 - Simple, easy to setup & use
 - Track in 2 axis (stair step) + view “rotates”
 - Great for visual, short exposure imaging only
- **EQ:**
 - More complex to setup and use
 - Counterweights & meridian flips to deal with
 - Tracks in 1 axis only
 - Great for visual and imaging
- **Computerized (GOTO) mounts:**
 - Have become very capable and affordable
 - Can greatly simplify setup and finding objects

How Do You Pick?

- Want to minimize fiddling in the dark
- Want a solid reliable support for your scope (tap test)
- Your money is well spent buying a good quality mount

Questions?



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