

Introduction to Scopes & Mounts

OAOG Workshop #3

July 26th, 2013

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What is a telescope?

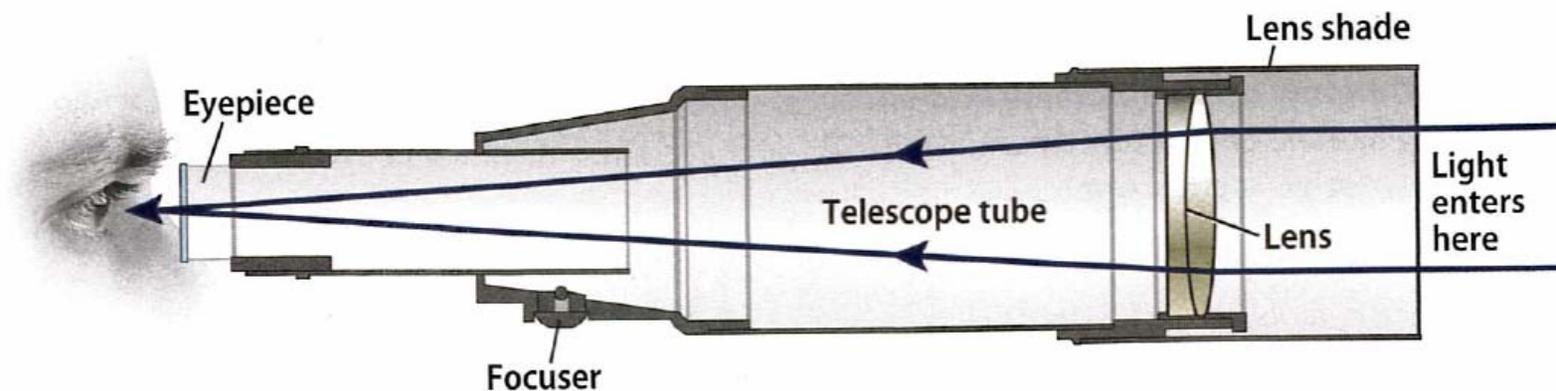
- A tool to help see things that appear very dim and/or very small
- Perform two basic functions:
 1. Collect light (much more than your eye)
 2. Focus the light into an image we can see
- Two main types:
 1. Refracting
 2. Reflecting

Numbers To Know

- **Aperture:** The diameter of the main lens/mirror – a measure of light gathering ability + resolution
- **Focal Length:** The distance from the main lens/mirror at which the focused image is produced – a measure of the magnification/field of view
- **Focal Ratio = Focal Length / Aperture:**
A measure of the relative efficiency with which the scope gathers light

Refracting Telescope

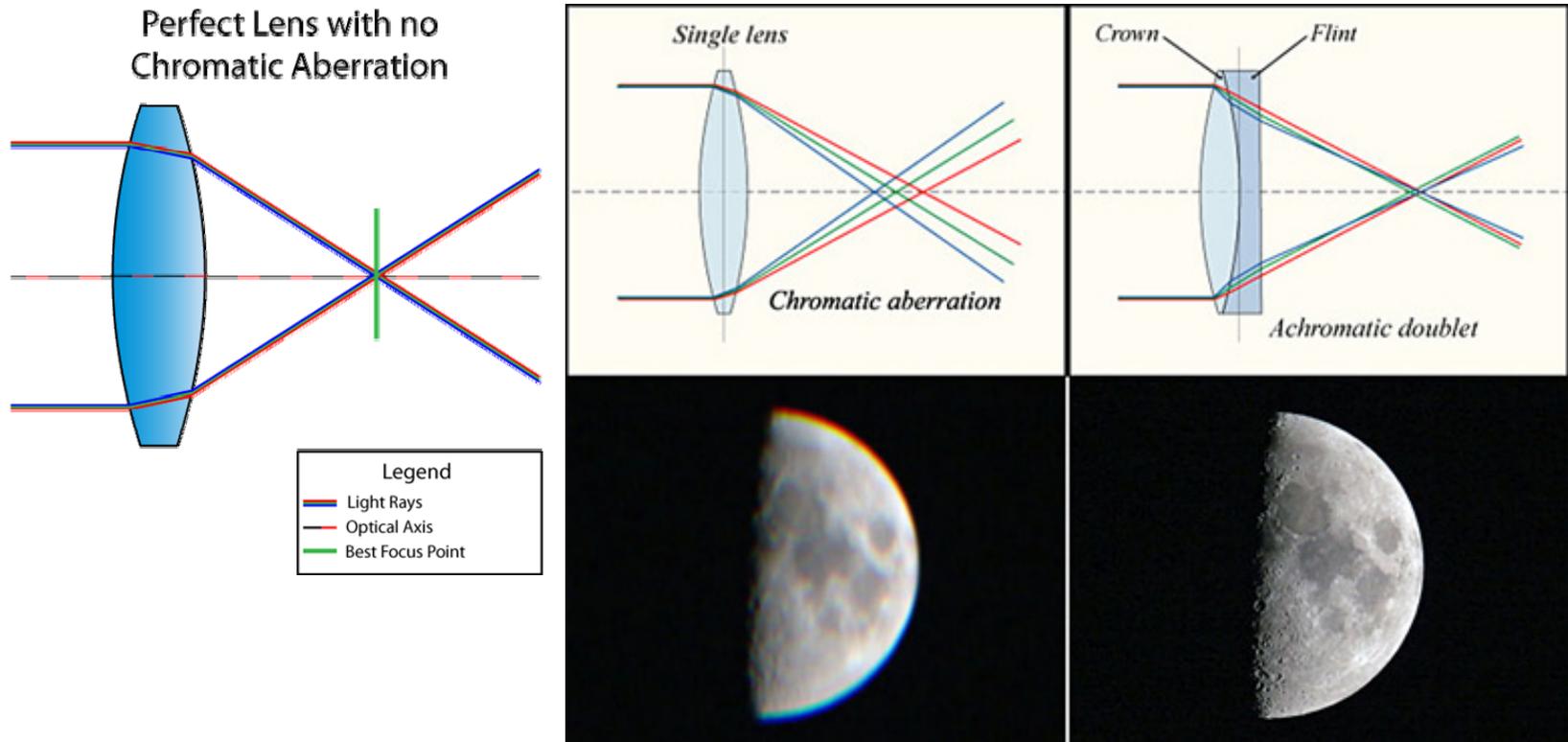
- Refraction: the tendency of light to change direction when it passes from one transparent medium into another (eg. air to glass)



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

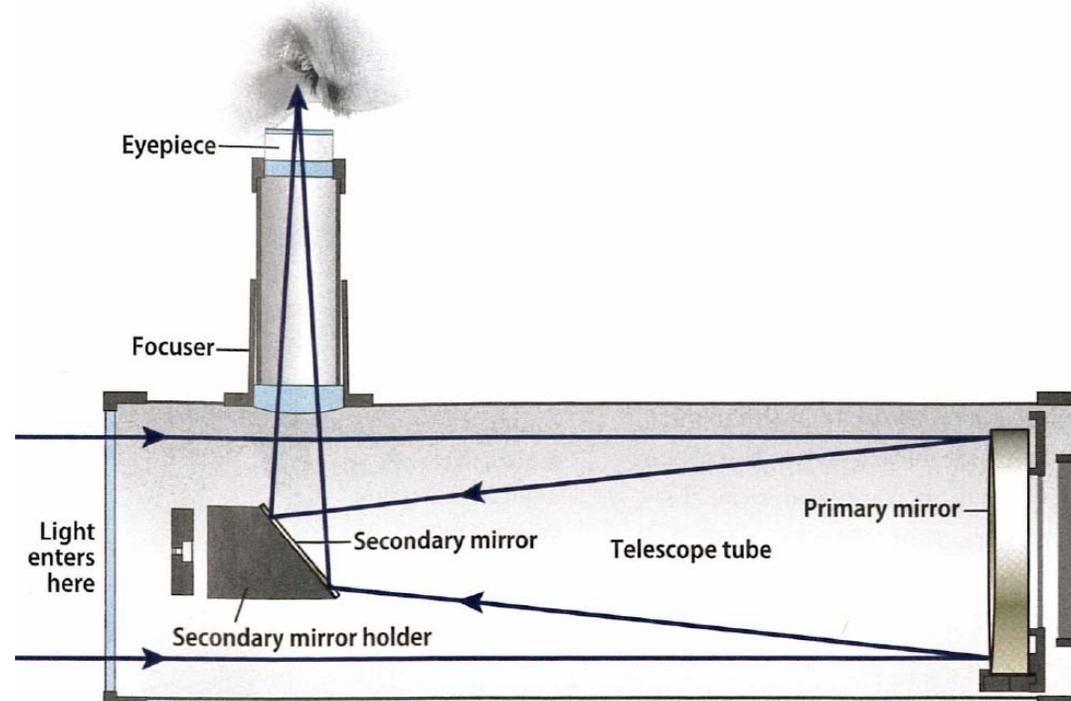
Chromatic Aberration



- **Achromat:** uses two types of glass to make Crown and Flint, improving chromatic aberration, \$
- **ED Achromat:** still a doublet (2 lens) system, but use Extra Low Dispersion glass to make the lenses – marked improvement over achromats, \$\$
- **Apochromat (APO):** use very special glass, in 3 or more lens elements – best performance, \$\$\$\$

Reflecting Telescope

- Reflection: the tendency of light to bounce off a smooth surface in a predictable way (angle in = angle out)



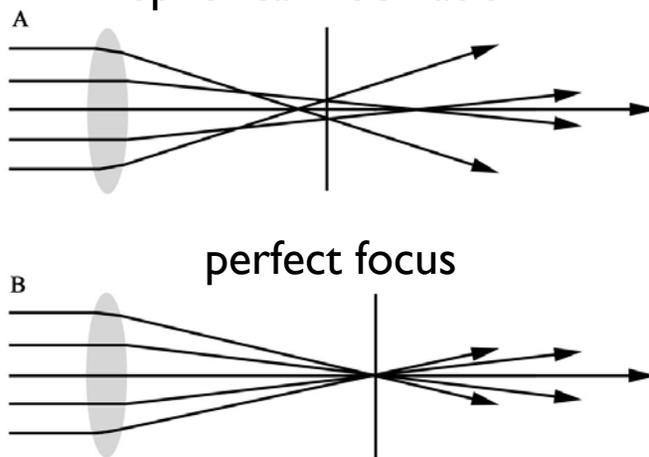
Reflector Pro/Con

- 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 Spherical, Coma, and other aberrations
 - Central 2nd mirror reduces contrast

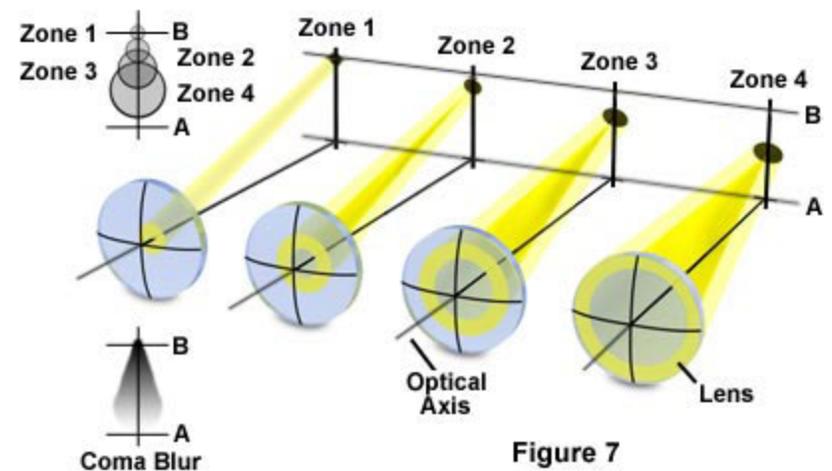
Other Aberrations



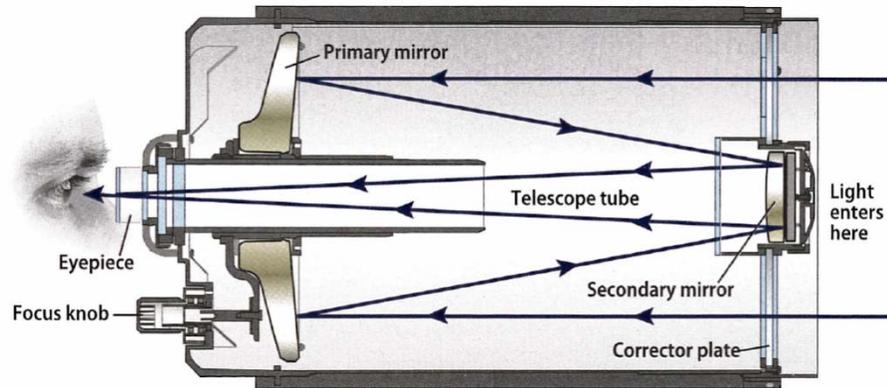
Spherical Aberration



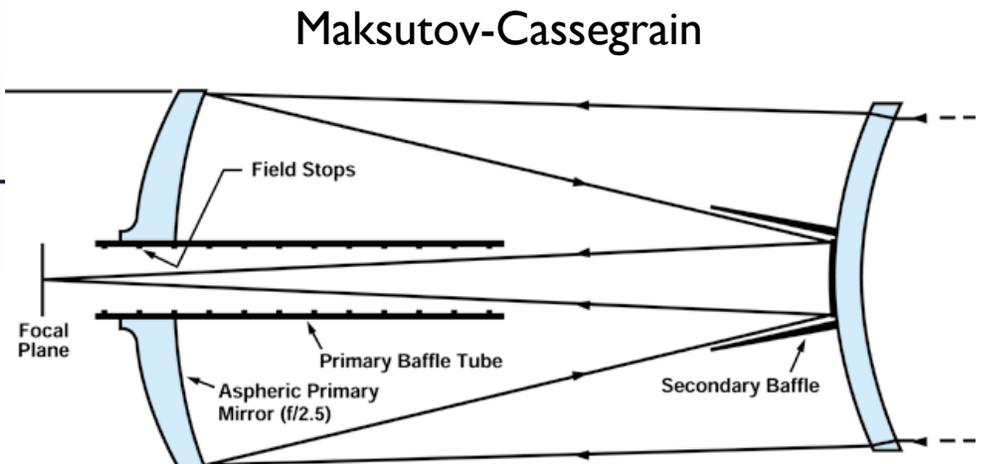
Off-Axis Comatic Aberration



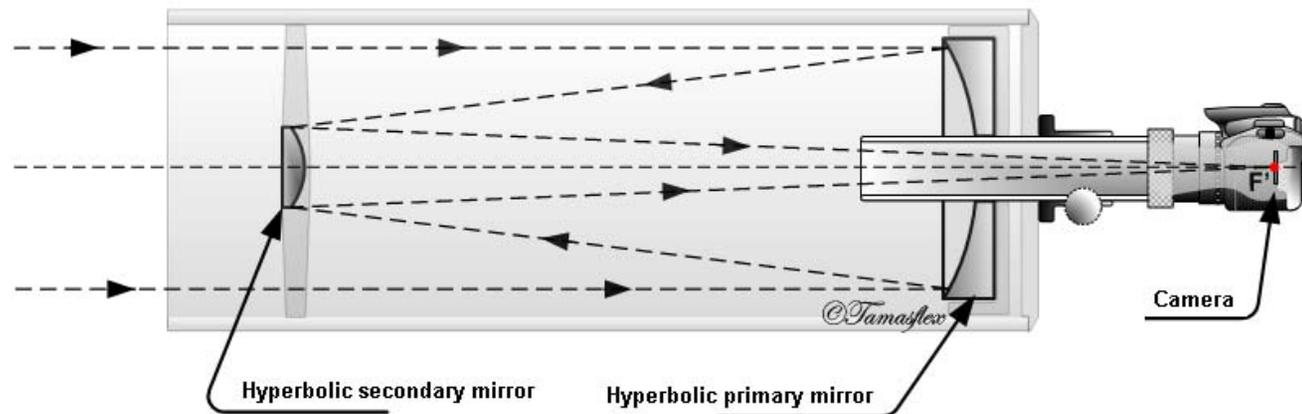
Compound Reflectors



Schmidt-Cassegrain



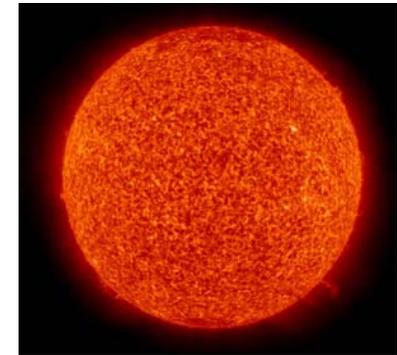
Ritchey-Chretien



How Do You Pick?

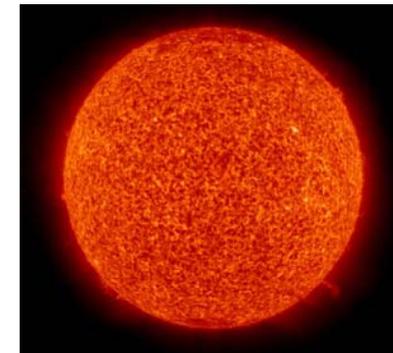
- How much are you able/willing to spend?
- What do you want to look at?
- Where & how often will you use it?
- The best telescope for you is the one you will USE!

Small Refractor Targets



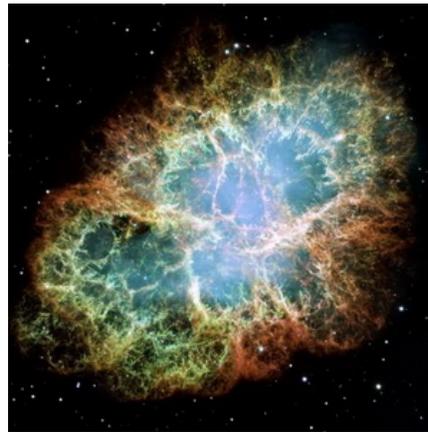
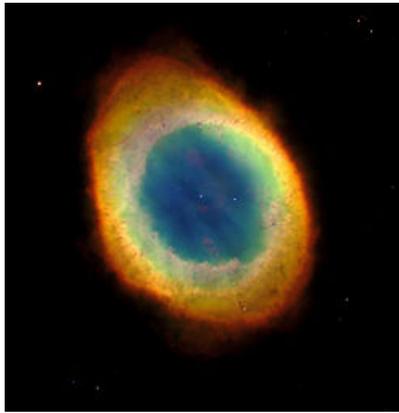
Large galaxies, large nebulae, bright nebulae, open clusters, Moon, Sun

Large Refractor Targets



Bright galaxies, bright nebulae, globular clusters, planets, Moon, Sun

Reflector Targets



Most galaxies, small-medium sized nebulae, planetary nebulae, planets, Moon

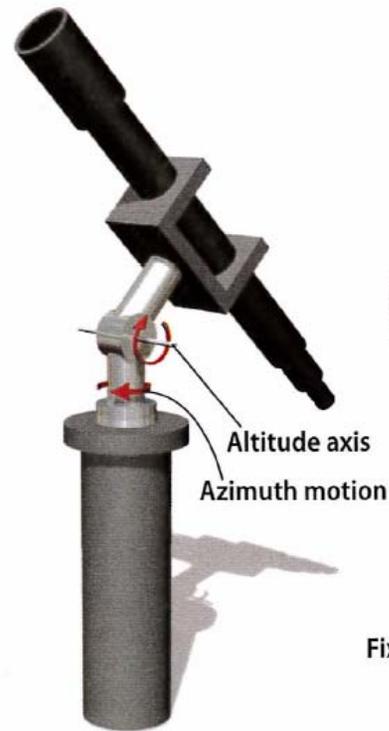
Mounts

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

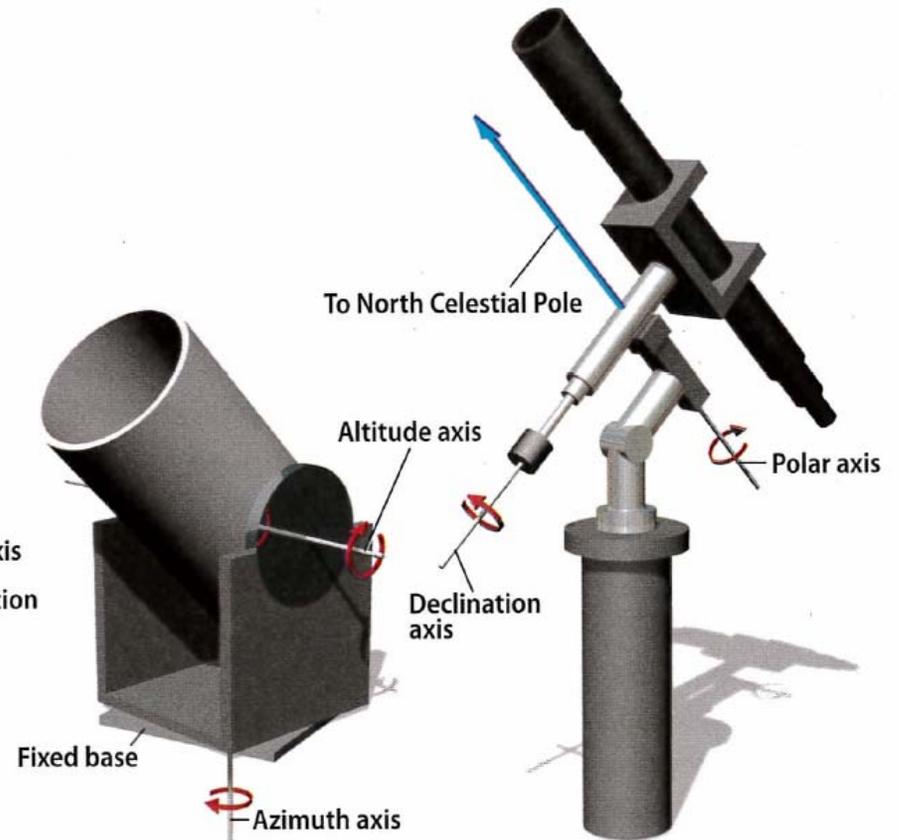
Mount Types



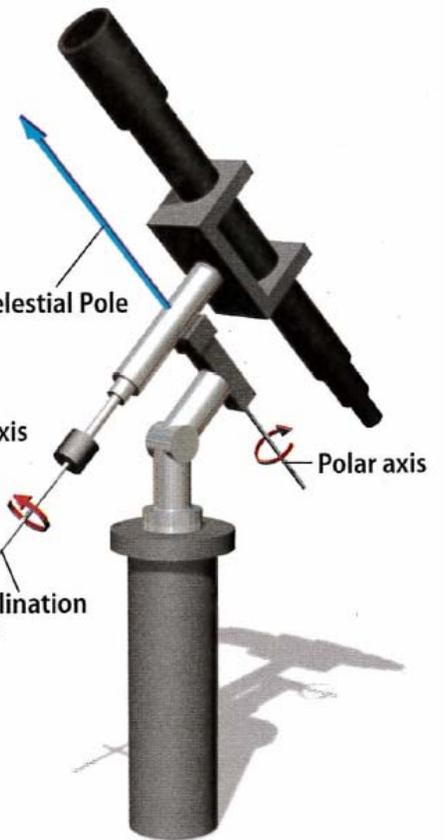
Fork mount



Altitude-Azimuth mount



Dobsonian mount



Equatorial mount

Sample Mounts - Manual

Alt-Az push-pull



Dobsonian push-pull



EQ fine control



Alt-Az fine control



Sample Mounts - Driven

Alt-Az GOTO



Fork GOTO



Alt-Az GOTO



EQ 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
 - Track in 1 axis only
 - Great for visual and imaging