A Short Tutorial on Optical Telescopes

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Types of Optical Telescopes

<u>The Optics</u>

Refracting Telescope Newtonian Reflecting Telescope Schmidt-Cassegrain Telescope (SCT) Others

<u>The Mount</u>

Altazimuth Dobsonian Equatorial

Optical Telescopes

Refracting Telescope:

Objective Lens



Optical Telescopes

Newtonian Reflecting Telescope:



Diagonal Mirror

Concave (Main) Mirror (Parabolic Curvature)

Optical Telescopes

Schmidt-Cassegrain Telescope (SCT):

Corrector Plate (a type of lens)

Convex (Secondary) Mirror

Concave (Main) Mirror (Spherical Curvature)

Eyepiece

Some Optical Telescope Characteristics

Light-Gathering Power Resolution (Resolving Power) Magnification

Detectors

Human Eye Photographic Film Digital Detectors



aperture is 2x larger, ...

Resolving Power (θ_{min}) is the angular separation (in seconds of arc) between objects which are just barely distinguishable.

4 second of are is 1/60th of 1/60th of a degree 1



A Formula...



D = Diameter of Aperture in Meters θ_{min} = Angular Resolution in Seconds of Arc

Recall: 600 nm = 600 x 10⁻⁹ m = 6 x 10⁻⁷ m



D	nim ⁶	comment
$5 \text{ mm} = 5 \times 10^{-3} \text{ m}$	30"	human eye*
2.5 inch = 0.064 m	2.3"	low-price telescope
8 inch = 0.2 m	0.75"	nice telescope
200 inch = 5 m	0.03"	Hale telescope

* Actual human-eye resolution is about 1' = 60"

* Actual human-eye resolution is about 1' = 60" (one arc minute)

For a large crater on the Moon (50 miles):



Magnification

$\frac{\text{Magnification}}{\text{Magnification}} = \frac{\text{focal length of objective}}{\text{focal length of eyepiece}}$