Exploring the Solar System

Types of Space Probes

Fly-by: space probe explores many targets
- e.g. Voyager 1 and 2 (visited outer planets)
- New Horizons (explored Pluto and outer Solar system)

Orbiters: orbit specific celestial bodies
- e.g. Juno (Jupiter)
- Dawn (asteroid Vesta and Ceres)

Impactor: impacts to study seismic things
- e.g. Deep Impact (comet Tempel 1)

Lander: designed to land safely on the target
- e.g. Philae (comet 67P/ζ)
- Curiosity Rover (Mars)

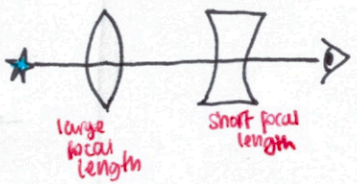
A space probe must reach Earth's escape velocity, and this is only possible by using rockets

Manned missions:

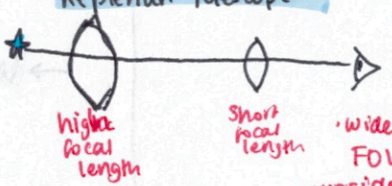
advantages	disadvantages
• carry out some repairs • react to unexpected	• very long and tiring • lots of resources to keep alive • small space • low/zero gravity bad for health • radiation risk

Apollo's main mission was to land men on the moon and return them safely back to Earth

Galilean telescope

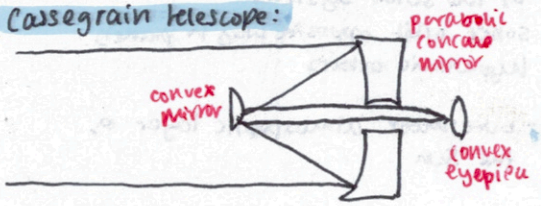


Keplerian telescope



- wider FOV
- upside down image

Cassegrain telescope:



Newtonian telescope:

Why reflecting telescopes better:

- less chromatic abberation
- larger aperture objective element can be manufactured and supported
- can use multiple mirrors and almost no loss in light intensity
- can be smaller and more compact

The human eye is limited for astronomical observations due to small aperture and limited low light sensitivity

Objective element - collects as much light as possible and focuses the light to a small bright image

Eyepiece lens - magnifies the image and increases resolution

Aperture - diameter of its objective lens or mirror

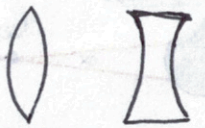
the larger the aperture:
- more light enters, brighter images
- the 'sharper' the image

the longer the wavelength, the worse the resolution

Light Grasp - measure of how much light is captured by the objective element, depends on cross-sectional area

Light grasp ∝ area ∝ (diameter of objective lens)²

e.g. if telescope A has diameter 2× bigger, light grasp is $\times 2^2$ bigger than B



Focal length of objective element fixed so different magnifications achieved by using eyepieces of different focal lengths

FOV:

the circle of sky visible through the eyepiece measured as an angle

the bigger the magnification, the smaller the FOV

$1° = 60'$ $1' = 60''$

the full moon subtends an angle of ~~50°~~ 0.5°

Magnification:

$$m = \frac{\text{focal length of objective}}{\text{focal length of eyepiece}} = \frac{f_o}{f_e}$$

Barlow lens - allows more eyepieces to be slotted in, increasing magnification by a factor of 2 or 3