Space physics

Unit :- Telescopes : Optical telescopes - Magnifying power, brightness, resolving power and f/a ratio - types of reflecting and refracting telescopes - detectors and image Processing - radio telescopes - Hubble space telescope.

Telescope :-

A telescope is a device whose basic technical purpose is to provide technical purpose is to provide a high quality image of distant objects which may be point sources or extended objects.

Types :-

Telescopes are broadly classified is to two types Reflecting Telescope and Refracting Telescope.

Reflecting Telescope :-

Sir Isaac Newton is always remembered as the inventor of the reflecting Telescope.

The Newtonian telescope is a type of reflecting telescope using a concave primary mirror and flat diagonal secondary mirror. Newton's first reflecting telescope was completed

in 1668 and is the earliest known functional reflecting telescope.

In reflecting telescope the primary mirror reflects the light back to a back instead of refracting. The Primary mirror has a Concave Spherical or parabolic shape and as it reflects the light it inverts the image at the focal plane. ~~The basic~~

Reflecting telescopes do not suffer from chromatic aberration.

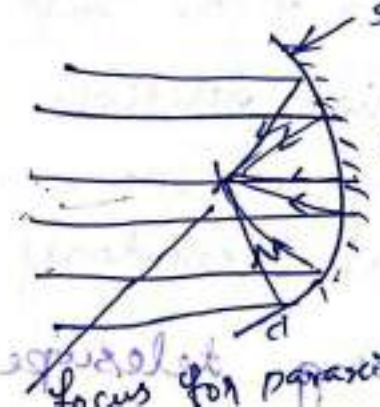
⇒ Reflecting telescope is a telescope that uses mirror as a surface to redirect light toward a focal point which is then observed through an eyepiece.

⇒ A Reflecting telescope uses curved mirrors to redirect light off their reflective surface to focal points.

Two kinds of reflecting telescopes that vary in they implement mirror.

(i) Newtonian reflecting telescope

(ii) Cassegrain reflecting telescope.



Refracting telescope :-

A refracting telescope is a telescope that uses lens to refract or bend light toward a focal point which is then observed by a user.

In a refracting telescope there are two lenses.

(i) A primary lens which is used to gather and bend light toward a focal point.

(ii) An eyepiece lens which is then used by the observer to absorb the focused light.

⇒ A refracting telescope uses lenses to reflect light in order to result in magnification.

⇒ Refracting telescopes use convex lenses.

⇒ Refraction through lenses basically does is gather a lot of light, which can be thought of as optical information. from a large and distant area and then focuses it into a smaller area allowing for the human eye to in turn absorb it.

Magnifying power :-

Magnifying power of a telescope is defined as the "ratio of the angle subtended at the eye by the image formed at least distance of distinct vision to angle sustended at the eye by the object lying in infinity.

where

h_1 = height of the object

u = distance of the object from the objective

Magnifying power $m = \frac{f_o}{f_e} \frac{1 + f_e}{D}$.

f_o = focal length of the object

f_e = focal length of the eyepiece

D = least distance of the distinct vision.

Brightness :-

The brightness of an image from a telescope depends partly on how much light is collected by the telescope.

The light gathering power of a telescope is directly proportional to the area of the objective lens.

The larger lens the more light the telescope can gather.

Doubling the diameter of the lens increases the light gathering power by a factor of 4.

Brightness of images also depends on how big on area the image light is spread over.

The small the area the brighter the image.

Resolving power and D/a ratio.

Resolving power of a telescope is defined as the reciprocal of the smallest angle subtended at the objective lens of the telescope by two point object.

$$\text{Resolving Power} = D/d = \frac{1}{1.22\lambda}$$

λ = 589 nm wave length of light.

D = distance of the object from objective of the telescope.

d = distance b/w two consecutive slits or objects.

a = critical width of the rectangular slit for just resolution of two slits or objects.

"It is defined as the inverse the distance or angular separation b/w two object which can be resolved when viewed through the optical instrument."

The angular separation b/w two objects must be

$$\Delta\theta = 1.22\ \lambda/d.$$

$$\text{Resolving power} = \frac{1}{\Delta\theta} = \frac{d}{1.22\lambda}$$