

Session 3

Evolution of Telescopes

- Hans Lippershey created the first telescope using a concave and a convex lens.
- Kepler proposed using both lenses to be convex for increased field of view and magnification.
- Christoph Scheiner implemented Kepler's idea.

Types of Telescopes (Based on mechanism)

1. Refracting Telescope

- Uses both objective and eyepiece as lenses
- 2 issues:
 - (a) Chromatic Aberration - Light of different colors converge at different points.
 - (b) Spherical Aberration - Paraxial and Marginal rays converge at different points due to different curvature of lens as we move away from principal axis.

2. Reflecting Telescope

- Uses concave mirror (primary mirror) as objective which reflects light to secondary mirror, which then reflects it to the eyepiece.
- Developed by Sir Isaac Newton

3. Catadioptric Telescope

- Uses a combination of lenses and mirrors to magnify the object

Mounts

1. Equatorial

- An equatorial mount is a telescope mounting system designed to align one of its axes with the Earth's axis of rotation.

2. Alt-Az

- A telescope mounting system that uses two axes: altitude (up-down) and azimuth (side-to-side)
- Allows the telescope to move vertically (up and down) and horizontally (left and right) to track celestial objects across the sky.

Black Holes

Types

- Stellar
- Supermassive
- Intermediate
- Micro

Formation

- Mass > 3 Solar masses (TOV Limit)

End (Hawking Radiation)

- With a pair of virtual particles one is pulled inside and one is thrown out of black hole and to separate them the energy is provided by black hole's own mass and by losing its mass it ends its life.

Quasars and Blazars

When black holes engulf an enormous amount of matter, the accretion disk gets bigger, more energetic, and more luminous, and it throws some matter out in the form of very luminous and high energy jets. Those black holes are known as Quasars.

If these jets point towards Earth, they are known as Blazars.

Neutron Stars

Types

- Pulsars
- Magnetars
- Binary Systems

Formation

- $1.4 \text{ solarmasses} < \text{mass} < 3 \text{ solarmasses}$
- Immensely dense objects formed after the supernova explosion of a red supergiant

Pulsars

- Very fast rotating Neutron stars emitting high energy jets through their poles

Magnetars

- A tremendously fast spinning Neutron Star which has an enormously large magnetic field, nearly a trillion times that of Earth!

Binary Systems

- A binary system includes a neutron star and a red giant which is engulfed by the neutron star eventually leading it to a black hole.