Radio Telescope

Why in News?

Telescopes are **indispensable tools for astronomers,** enabling them to observe and study celestial objects.

 Among the various types of telescopes, <u>radio telescopes</u> are gaining traction by playing a crucial role in unveiling the mysteries of the universe by detecting radio waves.

What is a Radio Telescope?

- About:
 - A radio telescope is a device that detects and analyses radio waves from astronomical objects in the sky.
 - Radio waves are a type of <u>electromagnetic radiation</u> that have wavelengths ranging from about 1 millimetre to 10 metres.
 - They can **penetrate dust and gas clouds that block** <u>visible light</u>, so radio telescopes can reveal hidden structures and phenomena in the universe.
- Features:
 - They are typically situated on the ground rather than in orbit due to their large size.
 - It consists of two main components: a large <u>antenna</u> and a sensitive receiver.
 - The antenna is usually a parabolic dish that reflects and focuses the incoming radio waves to a focal point.
 - The receiver amplifies and converts the radio signals into electrical signals that can be recorded and analysed by computers.

Significance:

- It can **operate day and night, unlike optical telescopes** that need clear and dark skies.
- It can observe objects that are too faint or too distant to be seen by optical telescopes, such as the cosmic microwave background radiation, pulsars, quasars, and black holes.
- It can study the chemical composition and physical conditions of interstellar gas and dust clouds by detecting the spectral lines of various atoms and molecules.
- It can **measure the magnetic fields and rotation rates of stars and galaxies** by detecting the polarisation of radio waves.

Note:

- A pulsar (from pulsating radio source) is a highly magnetised rotating neutron star that emits beams of electromagnetic radiation out of its magnetic poles.
 - Most neutron stars are observed as pulsars.
- Quasars are very luminous objects in faraway galaxies that emit jets at radio frequencies.
 - Among the brightest objects in the universe, a quasar's light outshines that of all the stars in its host galaxy combined, and its jets and winds shape the galaxy in which it resides.

Examples of Radio Telescopes:

- Giant Metrewave Radio Telescope (India)
- SARAS 3 (India)
- <u>Atacama Large Millimetre/submillimetre Array (ALMA)</u> (Atacama Desert, Chile)
- **Five-hundred-metre Aperture Spherical Telescope (FAST)** (China) (one of the biggest with a 500-metre-wide dish.



UPSC Civil Services Examination, Previous Year Question (PYQ)

Q. Consider the following (2008):

Assertion (A): Radio waves bend in a magnetic field.

Reason (R): Radio waves are electromagnetic in nature.

Which of the following is correct?

- (a) Both A and R are individually true, and R is the correct explanation of A
- (b) Both A and R are individually true, but R is not the correct explanation of A
- (c) A is true but R is false
- (d) A is false but R is true

Ans: (a)

Q. A layer in the Earth's atmosphere called lonosphere facilitates radio communication. Why? (2011)

- 1. The presence of ozone cause the reflection of radio waves to Earth.
- 2. Radio waves have a very long wavelength.

Which of the statements given above is/are correct?

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Ans: (d)

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