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, radio telescopes **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** electromagnetic radiation **that have wavelengths ranging from about 1 millimetre to 10 metres.**
    - They can **penetrate dust and gas clouds that block** visible light, 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** antenna **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)**
  - Atacama Large Millimetre/submillimetre Array (ALMA) **(Atacama Desert, Chile)**
  - **Five-hundred-metre Aperture Spherical Telescope (FAST)** (China) (one of the biggest with a 500-metre-wide dish.

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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 Ionosphere 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)

Source: TH