



# 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).



**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)**

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