

RADIO ASTRONOMY

2 MARKS

1. What is the basic principle of RA?

Hydrogen atom consists of a proton and an electron. The spins of the two particles can be aligned or anti aligned. If they are aligned, the atom has slightly more energy than if the spins are anti aligned.

A H-atom can make a transition from the aligned state to anti aligned state and emits radio energy of wavelength 21cm (frequency 1420 MHz). This 21 cm line is fundamental to radio astronomy.

2. List the importance of 21 cm line in RA.

By studying the 21 cm line, we learn the following:

- velocity of neutral hydrogen clouds (from doppler shifts)
- rotation of our galaxy and other galaxies (from doppler shifts)
- distribution of neutral hydrogen in our galaxy and in other galaxies (from images)
- tidal interactions between galaxies (from images and doppler shifts)
- amount of gas in the interstellar medium (from strength of the lines)

3. What are the sources of radio waves?

Pulsars, Quasars, Radio galaxy, Microwave back ground radiation etc are the sources of radio waves. These astronomical objects emit radio waves by means of (1) thermal radiation (2) bremsstrahlung radiation 3) synchrotron radiation 4) spectral line radiation and (5) pulsed radiation.

4. What is a RA telescope?

Radio telescope, an astronomical instrument used to detect radio-frequency radiation between wavelengths of about 10 metres (30 megahertz [MHz]) and 1 mm (300 gigahertz [GHz]) emitted by extraterrestrial sources, such as stars, galaxies, and quasars.

5. What is synchrotron radiation?

It is an electromagnetic energy (radiation) emitted by charged particles (electrons and ions) moving in a magnetic field at speeds close to that of light. The field compels the particles to move in a circular or spiral path around the magnetic lines of force. The particle is thus accelerated and radiates energy. Synchrotron radiation has astronomical importance. Quasars are one source of synchrotron radiations.

6. List few important discoveries in RA.

- 1) Understanding of our universe: cosmic microwave background
- 2) Mapping of our galaxy
- 3) Understanding our solar system
- 4) Discovery of pulsars
- 5) Discovery of radio galaxies, quasars and active galaxies
- 6) Origin and evolution of the cosmic magnetism
- 7) Discovery of dark matter: black holes in the universe

7. What are the significant contributions of India in RA?

Important scientific contributions and discoveries have been made by Indian radio astronomers in a wide variety of topics such as radio emission from the sun, pulsars, HII regions, recombination lines, supernova remnants, and centre of our galaxy, dwarf galaxies, nearby galaxies, supernovae, radio galaxies, quasars, HI studies and cosmology.

8. Mention few centers of RA in India.

- 1) The Kalyan Radio Telescope at Kalyan near Bombay
- 2) The Ooty Radio Telescope(ORT) at Ooty
- 3) The Giant Metrewave Radio Telescope (GMRT) at at Khodad near Pune
- 4) Radio Astronomy at the Indian Institute of Astrophysics, Bengaluru
- 5) Radio Astronomy at the Raman Research Institute, Bengaluru
- 6) Radio Astronomy at the Physical Research Laboratory, Ahmedabad

9. What are Quasars?

Quasar- Quasi Stellar Radio source, an astronomical object of very high luminosity found in the centres of some galaxies and powered by gas spiraling at high velocity into an extremely large black hole. The brightest quasars can outshine all of the stars in the galaxies in which they reside, which makes them visible even at distances of billions of light-years. Quasars are among the most distant and luminous objects known.

10. What is Active galactic nucleus (AGN)?

Active galactic nucleus (AGN) is small region at the centre of a galaxy that emits a prodigious amount of energy in the form of radio, optical, X-ray, or gamma radiation or high-speed particle jets. AGNs are powered by massive black holes with masses of tens to hundreds of millions solar masses.

ESSAY TYPE QUESTIONS

- 1) Explain the basic principle in RA (or) Explain the importance of 21 cm line.
- 2) What are radio telescopes? Explain the essential components.
- 3) Explain synchrotron radiation.
- 4) Explain the use of spectral lines in RA.
- 5) Discuss the achievements India's achievements in RA.
- 6) Describe the major discoveries in RA.
- 7) Explain the hot Big bang cosmology.

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