Square Kilometre Array (SKA) Observatory

Why in News?

India had decided to formally join the Square Kilometre Array (SKA) project, an international scientific collaboration working to build the world's largest radio telescope.

What is SKA?

- **SKA** – It will be the ***world's biggest and most advanced radio telescope*** ever constructed.
- It will not be a single large telescope, but a *collection of thousands of dish antennas* operating as a single unit.
- **SKA Observatory Convention** – The international treaty that established the facility as an intergovernmental organisation.
- **Objective** – To ***create 1 square kilometre*** of effective area for collecting radio waves using radio telescopes.
- **Mission** – To build and operate cutting-edge radio telescopes to transform our understanding of the Universe, and deliver benefits to society through global collaboration and innovation.
- **Headquarters**– United Kingdom (UK)
- **Implementation** – By installing *1000's of smaller antennas* in a specific array design that would make them function like a single radio telescope.
- **Budget** – USD 2.4-billion project
- **Distribution of antennas** – About 200 of them in South Africa and more than 130,000 in Australia.

  In SKA Observatory, the South African array will focus on mid-frequency signals, while the Australian telescope will cover low-frequency ranges.

- **Installation location** – In *sparsely populated areas* in order to *minimise signal interference* from undesirable Earth-based sources.
- **Consortium Members** – It includes **16 member countries**, such as Australia, South Africa, Canada, China, India, Japan, and several European nations.
- **Significance** – Once operational, it would be between ***5 to 60 times more powerful*** than the most advanced existing radio telescopes functioning in comparable frequency ranges.

How does it work?

- The SKA telescopes will observe from 50 MHz to 15.4 GHz (with a goal of 24 GHz) in the radio frequency part of the electromagnetic spectrum.
- **Working** – It receive radio waves from space using antennas which are sent through a processing chain that enables the astronomical data ultimately to be turned into an image of the sky.



- **Advantage** – Unlike optical telescopes, radio telescopes can be used even in ***cloudy skies***, as the longer wavelengths can pass through clouds unhindered.
- They can ***detect invisible hydrogen gas***, the most abundant element in the Universe, which emits in the radio band at 1420 MHz.
- They can also reveal areas of space that may be obscured by cosmic dust, as radio waves are ***can travel through these dust clouds***.

Radio astronomy *has led us to some amazing astronomical discoveries, such as pulsars, exoplanets and the cosmic microwave background (a remnant signal left over from The Big Bang).*

What is the role of India in SKA?

- **Indian participation** – India has been involved in the SKA project right from its inception in the 1990s.
- It is being led by Pune-based ***National Centre for Radio Astrophysics (NCRA)***.
- **India's contribution** – In design and development of the telescope and the main contribution has come in the development, and operation, of the Telescope Manager, the '***neural network'*** or the software that will run the entire facility.
- **Benefits** – Though none of the SKA facilities would be located in India, there are immense science and technology gains to the Indian scientific community.
- It will promote *research in radio astronomy* where India is already taking leaps through
  - ***Giant Meterwave Radio Telescope (GMRT)***, Pune
  - Other similar facilities in Ooty, Nainital and Bengaluru
- It will get *preferential allocation of time* on the radio telescope, roughly in proportion to their contribution to the project, and only limited time slots would be available through competitive bidding.

Most existing telescopes operate under ***an open-use policy*** *which allows research groups from any country to get time on the facility through competitive bidding by making a scientific case.*

- The SKA would work on highest-end technologies and the *intellectual properties would be accessible* to all the member countries.

- Indian scientists can use SKA for studying concepts relating to the *evolution of the early universe and galaxies, neutron star* physics, and solar sciences.
- It helps in *capacity building and training* opportunities.
- **Future plans** – To set up an SKA regional centre in the country that will be part of the global network to process and store data and make it available for the scientific community.

References

1. The Indian Express| Significance of India's membership in SKA
2. SKAO| Square Kilometre Array Observatory

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