PRATUSH Telescope

Source: TH

Why in the News?

Astronomers globally are anticipating a new era of exploration with **high-resolution telescopes** set to be placed on the moon and in orbit around it. Various proposals, like **India's PRATUSH (Probing ReionizATion of the Universe using Signal from Hydrogen**), aim to open this new window to the universe.

What is PRATUSH?

- **About:**
  - PRATUSH is a **radio telescope** designed to be placed on the far side of the moon. It is built by Raman Research Institute (RRI), Bengaluru **and** Indian Space Research Organisation (ISRO).

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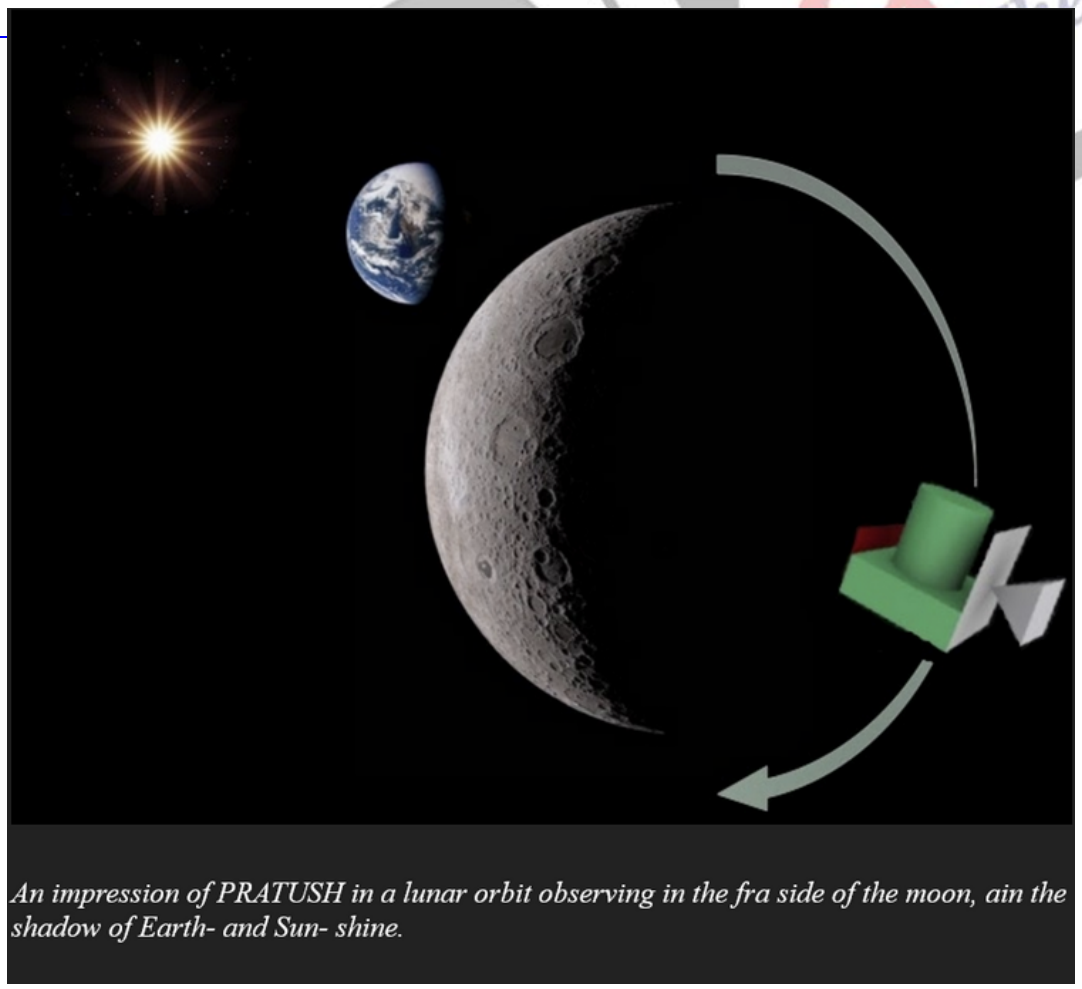

An impression of PRATUSH in a lunar orbit observing in the fra side of the moon, ain the shadow of Earth- and Sun- shine.

- **Objective:**
    - It aims to uncover the timing and characteristics of the first stars' formation in the universe, including the colour of the light during **Cosmic Dawn.**
    - It will unveil the evolution of our early universe from its initial cold gas state to the formation of stars, galaxies, and the universe as we observe it today **post-Big Bang.**
        - The Cosmic Dawn marks the period when the **first sources of radiation**, such as stars and galaxies, formed in the universe.
- **Capabilities:**
    - PRATUSH will carry advanced radio equipment covering a wide frequency range from **30 to 250 MHz.**
        - It will observe large sky areas continuously, recording detailed radio spectra with a resolution of **100 kHz.**
    - It includes a **custom-designed antenna, analog receiver, and digital correlator** for high-resolution spectral analysis.
        - The goal is to achieve a sensitivity level of a few millikelvin with precise
        - Millikelvins (mK) are a unit of measurement used to express temperature on the Kelvin scale, where **1 millikelvin is equal to 1000 of a Kelvin.**
    - It is designed for a **two-year mission** in a circumlunar orbit to avoid interference and achieve optimal radio sky measurements.

What are the Other Global Missions Related to Telescopes on the Moon?

- **Lunar Surface Electromagnetic Experiment (LuSEE) Night Project:** It is a collaboration between **NASA** and **Berkeley Lab** and aims to land on the moon's far side. It is scheduled for launch in December 2025.
- **NASA's Long-Baseline Optical Imaging Interferometer:** It will be launched in parts and be assembled on the moon's far side.
    - It will study magnetic activity in stars and galaxies using visible and ultraviolet wavelengths.
- **ESA’s Argonaut:** European Space Agency plans to launch a **Radio Telescope** aboard its lunar lander, **'Argonaut'**, by 2030, along with other projects focusing on **gravitational wave detection** and **infrared observations.**
- **China's Moon-Orbiting Radio Telescope:** China is set to launch a moon-orbiting radio **telescope in 2026**, positioning itself **at the forefront of lunar exploration** and astronomical research.
    - The **Queqiao-2 satellite,** deployed in lunar orbit, carries a 4.2-meter antenna for radio astronomy.

What are Telescopes?

- **About:** Telescopes are devices designed to gather and focus light to form **magnified images of distant objects.**
    - Developed over centuries, with early telescopes credited to inventors like Galileo Galilei and Johannes Kepler in the 17th century.
- **Function:** Telescopes **gather and magnify light from space,** allowing astronomers to study celestial objects in detail.
    - They help observe distant objects, map the sky, study cosmic events, detect exoplanets, and **explore different wavelengths of** electromagnetic radiation**,** enhancing our understanding of the universe.
    - Telescopes use **lenses or mirrors** to collect and concentrate light, resulting in an enlarged and **clearer view of celestial objects.**
- **Types of Telescopes:**
    - **Catadioptric or Compound Telescopes**: Combine both lenses and mirrors for focusing light.
        - Examples: **Schmidt-Cassegrain and Maksutov-Cassegrain telescopes.**
    - **Radio Telescopes:** Detect radio waves emitted by celestial objects. Comprise large dish

antennas and receivers.
        - Example: Giant Metrewave Radio Telescope (GMRT), Pune.
    - **Space Telescopes:** It is a telescope in outer space used to observe astronomical objects.
        - Examples: **Hubble Space Telescope** (a reflecting telescope) and the **James Webb Space Telescope**(a reflecting telescope).

Note

NASA is planning the next big space telescope, called the **Habitable Worlds Observatory (HWO).** This telescope focuses on **ultraviolet, visible, and near-infrared wavelengths**, ideal for searching for potentially habitable exoplanets. The project is currently in its initial development phase.

UPSC Civil Service Examination, Previous Year Questions(PYQs)

Prelims:

Q 1. In the context of space technology, what is "Bhuvan", recently in the news? (2010)

A. A mini-satellite launched by ISRO to promote distance education in India

B. The name given to the next Moon Impact Probe, for Chandrayan-II

C. A geoportal of ISRO with 3D imaging capabilities of India

D. A space telescope developed by India

Ans: C

Q.2 In the context of modern scientific research, consider the following statements about 'IceCube', a particle detector located at South Pole, which was recently in the news: (2015)

1. It is the world's largest neutrino detector, encompassing a cubic kilometre of ice.
2. It is a powerful telescope to search for dark matter.
3. It is buried deep in the ice.

Which of the statements given above is/are correct ?

(a) 1 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Ans: D