International Pulsar Timing Array

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In news

Recently, the International Pulsar Timing Array (IPTA) approved India's full membership as the Indian Pulsar Timing Array (InPTA).

Key updates

- India has officially joined an elite group of international radio telescopes that are involved in tracking very low-frequency gravitational waves,particularly those emerging from two orbiting very large supermassive blackholes.
- With the India's joining, observations made by Pune-based upgraded Giant Metrewave Radio Telescope (uGMRT), operated by TIFR – National Centre for Radio Astrophysics (NCRA), will be used along with the data gathered by some large radio telescopes located in Europe, America and Australia.

About International Pulsar Timing Array (IPTA)

- IPTA is multi-institutional, multi-telescope collaboration, comprising the European Pulsar Timing Array (EPTA), the North American Nanohertz Observatory for Gravitational Waves (NANOGrav), and the Parkes Pulsar Timing Array (PPTA).
- Goal of IPTA is is to detect gravitational waves using an array of approximately 30 pulsars

IPTA experiments

- In 2016 when short-period gravitational waves were first detected using two Laser Interferometer Gravitational

wave Observatories (LIGO) located in the US.

- However, in order to monitor and capture the much fainter long-period gravitational waves emerging from blackhole pairs measuring billions of times larger than our Sun, collaborative and synchronised observations from multiple large radio telescopes are required.
- As the long-period gravitational waves measure some nano Hertz, ground-based instruments like LIGO too fall short in capturing these.
- To tackle this problem, the IPTA set up three international experiments using EPTA, PPTA and NANOGrav. Now India is also part of it with InPTA joining it
- These together make up the millisecond pulsars, considered the most accurate clocks in the universe.

Advantages of IPTA experiments

- Through these experiments, it will be possible to identify changes in periods caused by the passing long-period gravitational waves and remove any delays caused by the interstellar medium.
- Such discoveries can further our understanding about the universe and offer newer insights into gravitational wave astronomy
- With the help of IPTA experiments, it will be possible to make discoveries in fewer year

Significance

With uGMRT, India has become the **first Asian country to be a full member of IPTA consortium** comprising European Pulsar Timing Array (EPTA), North American Nanohertz Observatory for Gravitational Waves (NANOGrav) and Parkes Pulsar Timing Array (PPTA) from Australia.

It will now be able to obtain improved observations by an order of 5, making the overall data more robust. Here on, Indian researchers will get access to international data

Indian Pulsar Timing Array (InPTA)

- It was set up in 2019
- InPTA is an experiment aimed at detection of Gravitational waves (GWs) in the sub-microHertz frequency range by observing an ensemble of millisecond pulsars (MSPs).
- GWs from both the stochastic GW background as well as the individual sources like supermassive black hole binaries (SMBHBs) leave an imprint on the time-of-arrival (TOA) of the pulsed emission from MSPs, which could be detected with high precision due to the clock-like stability of these pulsars.
- InPTA aims to contribute its data and its analysis results to an international effort, called the International Pulsar Timing Array (IPTA)
- InPTA currently has about 25 radio astronomers and research students from Tata Institute of Fundamental Research (TIFR), NCRA, Raman Research Institute, IIT Hyderabad and Indian Institute of Mathematical Sciences.

About Giant Metrewave Radio Telescope (uGMRT)

- A special accolade for a very special telescope – GMRT – designed, built and operated by Indian scientists and engineers.
- It is used by radio astronomers from across the world to study our Universe.
- GMRT was set up by National Centre for Radio Astrophysics (NCRA) for radio astronomical research using the metre wavelengths range of the radio spectrum
- It is located at a site about 80 km north of Pune.
- ith 30 dish antennas each measuring 45m diameter and positioned over 25 km around Khodad village in Junnar, the uGMRT is one of the world’s largest and highly sensitive instruments offering a frequency range between 300 to 800 MHz.

As of now, the **uGMRT is the only radio telescope in the world offering this wide a frequency range and sensitivity.**

Extra Reading: https://journalsofindia.com/the-giant-metre-wave-radio-telescope-gmrt/