

# PRESS RELEASE

## Indian Pulsar Timing Array Unveils Data Release 2: Amplifying the Search for Nanohertz Gravitational Wave Background

The Indian Pulsar Timing Array (InPTA) has released its second and most advanced dataset, marking a major milestone in India's role in the global search for ultra-low-frequency gravitational waves. Collected with the upgraded Giant Metrewave Radio Telescope (uGMRT), the release spans over seven years of precision observations of 27 rapidly rotating neutron stars, or millisecond pulsars, covering time spans from 1.2 to 7.3 years.

Using uGMRT's unique ability to record low and high radio frequencies simultaneously, a capability unique among all current Pulsar Timing Array experiments, astronomers measured and corrected for delays in pulse arrival times caused by clouds of charged particles between the stars. This phenomenon, known as dispersion, is quantified by the dispersion measure (DM), which in this study was determined with unprecedented accuracy — in some cases to one part in a million — setting a new benchmark for pulsar timing. Such precision is essential for mitigating interstellar medium and solar wind effects, thereby sharpening the search for gravitational waves. The dataset also reveals subtle patterns such as annual solar wind variations and a possible sudden change in one pulsar's DM, hinting at dynamic processes in deep space.

In addition, data release 2 (DR2) expands the pulsar network with 13 more pulsars compared to the first InPTA data release (DR1), mitigates scattering-related distortions in certain pulsars, and achieves timing accuracy better than a millionth of a second for some sources. While DR1 contributed to international studies that reported early evidence of the faint “cosmic hum” from pairs of supermassive black holes, DR2 is expected to be pivotal in the International Pulsar Timing Array's upcoming DR3.

“This new dataset represents a major leap for the InPTA experiment and highlights India's role in global pulsar timing research. By extending our observations to seven years and expanding our sample to 27 pulsars — nearly twice that of our first release — we are now well positioned to independently search for the ultra-low-frequency gravitational wave background. The significant advances in our observing methods and data analysis using concurrent dual-band observations from uGMRT will enhance our understanding of the interstellar medium, and consequently, will drive gravitational wave search forward.”, said Dr. Prerna Rana, lead author of the DR2 study.

Beyond gravitational waves, DR2 will advance studies of interstellar plasma, scattering effects, and the solar wind. It lays the groundwork for wideband timing analyses, rare astrophysical event searches, and future contributions to the next-generation Square Kilometre Array, ensuring India's central role in this global scientific endeavor.

The full scientific publication describing the DR2 dataset is openly available at: <https://doi.org/10.1017/pasa.2025.10066>

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