

Sensing gravitational waves with the Galactic clocks

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Abstract

Gravitational waves (GWs), predicted by Albert Einstein a century earlier, were finally discovered 10 years back by terrestrial detectors. While the frequency of these GWs was few Hertz, their ultra-long wavelength counterparts can be sensed by a Galactic scale detector consisting of radio wave emitting celestial clocks, which are rotating massive compact neutron stars called radio pulsars. These clocks form a pulsar timing array and sense GWs by observing these stars with large sensitive radio telescopes over several decades. The Department of Atomic Energy facilities, the Ootacamund Radio Telescope (ORT) and the upgraded Giant Meterwave Radio Telescope (uGMRT), built and operated by NCRA-TIFR, have been used by a multi-institutional Indian collaboration, known as Indian Pulsar Timing Array (InPTA) since 2012 for sensing these waves. The InPTA, along-with other international experiments, announced a compelling evidence for such GWs in June 2023 for the first time. The InPTA continues to work towards a high significance detection of such waves produced most likely by an ensemble of super-massive black hole binary systems. In this presentation, the contributions made by DAE facilities in this cutting-edge research are presented after a brief and general introduction to the subject and the future landscape, including a possibility of breakthrough in 2026, is outlined.