

National Centre for Radio Astrophysics (NCRA), Pune

Press Note – 19th March 2021

India joins the global hunt for Gravitational Waves (GW) from monster black holes

A consortium of mainly Indian researchers under the banner “Indian Pulsar Timing Array (InPTA)”, became a full member of the “International Pulsar Timing Array (IPTA)”, an international effort to discover and study very low-frequency gravitational waves from supermassive binary black holes orbiting each other. InPTA regularly employs the upgraded Giant Metrewave Radio Telescope (uGMRT), situated near Pune to monitor pulsars to obtain high precision timing measurements. The unique frequency range of the uGMRT, 300 - 800 MHz is not covered by other big telescopes used by IPTA, therefore the inclusion of uGMRT is crucial in improving the precision of IPTA to detect nano-hertz GWs.

According to Einstein, the gravitational waves (GWs) are ripples in the space-time of our Universe. These ripples are created by celestial black hole pairs going round each other. The discovery of short period GWs by the LIGO detectors in 2016, which was awarded the Nobel Prize a year later, has opened up a new window to study the universe. The GW detectors like LIGO measure the tiny deformations of the Earth caused by passing GWs from black hole pairs that weigh many times our Sun. Heavier blackholes, with mass billions of times that of our sun, however produce Gravitational Waves with periods too long to be detected by instruments like LIGO. These long period waves called nano-hertz GWs, minutely deform the space and time near the Earth and this imprint can be found in the measured ticks of millisecond pulsars which are the most accurate clocks in the universe.

The largest telescopes in the world are routinely being used by an international experiment, called International Pulsar Timing Array (IPTA), to precisely measure the clock periods of a collection of these pulsars. This in turn, allows one to identify changes in periods caused by the passage of a Gravitational Wave. When discovered, these waves will refine evolutionary models of our universe as well as masses and orbits of members of our own solar system and open a new window of GW astronomy.

Last week, the Indian initiative, Indian Pulsar Timing Array (InPTA), formally joined IPTA as a full member. InPTA is a collaboration of currently about 25 research scientists and students from 15 institutions in India and abroad. The InPTA has been using the uGMRT, operated by National Centre for Radio Astrophysics of Tata Institute of Fundamental Research, since 2015 for monitoring around 6 to 20 millisecond pulsars regularly for these studies. The inclusion of uGMRT will allow removing the delays introduced by the interstellar medium in the arrival of radio pulses from these Galactic clocks by a factor of 5 more precisely than before, which should be crucial to improve the precision of IPTA. Therefore, the InPTA and the uGMRT are likely to play significant roles in the detection of nano-hertz GWs and gravitational astronomy with these waves in future.

Contact:

1. Bhal Chandra Joshi: NCRA-TIFR, Pune (bcj@ncra.tifr.res.in) Phone:02025719244 / 9422315542
2. A Gopakumar: TIFR, Mumbai, (gopu@tifr.res.in) Phone: 9869039269
3. Manjari Bagchi: IMSc, Chennai (manjari@imsc.res.in) Phone: 9677146926
4. Shantanu Desai: IIT Hyderabad (shantanud@phy.iith.ac.in) Phone: 9619127162
5. T Prabu: Raman Research Institute, Bangalore (prabu@rri.res.in) Phone: 9448573994
6. Yashwant Gupta: NCRA-TIFR, Pune (ygupta@ncra.tifr.res.in) Phone: 020-25719242
7. Prof. Jayaram Chengalur (chengalu@ncra.tifr.res.in) ; Phone: 020-25719248
8. CH. Ishwara-Chandra (ishwar@ncra.tifr.res.in); Mobile: 9403136630
9. J. K. Solanki (solanki@ncra.tifr.res.in); Mobile: 9890447888
10. Anil Raut: (anil@gmrt.ncra.tifr.res.in); Mobile: 8605525945