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NCRA discovers six neutron stars

'Finding Can Contribute To Study Of Gravitational Wave Background'

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Pune: City-based National Centre for Radio Astrophysics (NCRA) has discovered six exotic millisecond pulsars (MSPs), which are highly magnetised and rapidly rotating compact and dense neutron stars, with the help of its Giant Metrewave Radio Telescope (GMRT), said researchers at the centre on Friday.

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Software such as high performance computing back-end at the GMRT to collect high time-resolution data and a powerful high performance computing cluster at the IUCAA for data analysis have been used to make the discovery.

"We were trying to search for millisecond pulsars at certain positions, given by NASA's observatory Fermi Gamma-Ray Space Telescope. They provided us with 65 positions where these pulsars could be by means of which we found these six MSPs through GMRT," said Bhattacharyya.

Earlier, in August 2008, NASA launched the Fermi Satellite, which has on-board the Large Area Telescope (LAT) instrument for surveying the sky. One of the successes of this mission has been the discovery of a large population of gamma ray-emitting MSPs.

"An international Pulsar Search Consortium was formed to search for millisecond pulsars and our team from GMRT joined the consortium. The discovery of such gamma ray selected MSPs, which also emit radio waves, is of great value, not only to enhance the MSP population that can contribute to the study of gravitational wave background, but also for probing the physics of pulsars," Roy added.

MSPs include a 2.16 millisecond (ms) period pulsar which is in a very tight binary orbit of 2.8 hours with another very low-mass companion star. "This pulsar is eclipsed for about 10% of its orbit by the material of its companion star. It, however, can provide the missing link between isolated and fully recycled pulsars, wherein the strong radiation from the pulsar slowly evaporates away the material from the companion star, leaving behind an isolated pulsar," said Roy, adding that such systems are called Black Widow systems, derived from the analogy of the black widow spider that destroys its companion in the later stage of life.

The discovery is important because only two such systems have been discovered in the disk of our galaxy in the last 20 years.

"Another millisecond pulsar has the widest pulse profile shape among all known MSPs; while the team discovered another with a feature-less sharp-narrow profile. This pulsar can also be included in the International Pulsar Timing Arrays (IPTA)," said Bhattacharyya. IPTA detects gravitational waves using an array of pulsars.

Another MSP exhibits a [illegible] form of profile evolution different from that of the known radio MSPs, while yet another that was discovered is an isolated pulsar at the end of its evolutionary phase of life.