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The Large European Array for Pulsars (LEAP) as a precursor of SKA

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One of the top science goals for the SKA is the study of pulsars, and in particular the use of pulsar timing arrays (PTAs) for the detection of low-frequency gravitational waves (GWs). In 2023, PTA collaborations around the world have revealed evidence for a background of low-frequency GWs, possibly from supermassive black hole binaries or cosmological sources. A higher significance is however needed to confirm this result and to identify its origin. This can be achieved in part by improving the timing sensitivity of pulsar observations. This is the scope of the Large European Array for Pulsars (LEAP), a project of the European Pulsar Timing Array (EPTA) collaboration, which has been ongoing since 2012. It consists in the simultaneous, monthly observing of about 20 pulsars in baseband mode with all five radio telescopes of the EPTA, including the Sardinia Radio Telescope. This setup allows for the coherent addition of the radio pulses, the maximization of the signal-to-noise of pulsar signals and the increased precision in times-of-arrival. Pulsar observing at the EPTA telescopes in simultaneous “LEAP” mode effectively makes LEAP the sixth telescope of the EPTA, and, with a sensitivity that is equivalent to a 194-meter dish and thus equivalent to SKA-1, makes it an efficient precursor to the SKA. LEAP data acquired over the last few years have been included in EPTA datasets. Additionally, access to the combined baseband LEAP data has allowed for the detailed study of pulsar single pulses, giant pulses, pulse micro-structure and interstellar delays, which provide important information to both pulsar and PTA science.

Research area

Pulsars

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