
Searching for Binary and Millisecond Pulsars using the SMART pulsar survey

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Description:

With applications ranging from testing strong-field gravity to probing the state of ultra-dense matter, pulsars enable us to push the boundaries of fundamental physics. Over 3000 pulsars are currently known, but most were found using large single-dish telescopes such as Parkes (*Murriyang*). Large pulsar surveys have proven track record of success in discovering exotic objects and specialised targets, such as pulsars in relativistic binary systems, millisecond pulsars, and those with extreme magnetic fields. *Fundamental physics with pulsars* is a headline science theme for the SKA project, and a full cosmic census of the Galactic pulsar population is a key science driver for Phase 1 SKA.

The Southern-sky **MWA Rapid Two-metre (SMART)** survey is an all-sky pulsar search project with the MWA – it is an ambitious program to search the vast southern skies with high sensitivity at low radio frequencies, and is expected to discover hundreds of pulsars and many millisecond pulsars. It will serve as an important reference for future surveys planned with the SKA. The survey presents a multitude of opportunities to explore new parameter space, and hence potential for new discoveries. Possible projects include:

1. Implementation of novel algorithms to to attain optimal detection sensitivities to short-period millisecond pulsars, whose clock-like timing stability can be exploited for applications such as the searches for ultra-low frequency gravitational waves;
 2. Undertaking targeted searches toward promising pulsar candidates identified in Gaia DR3 with excess astrometric noise (indicating a potential binary system); and
 3. Exploiting the long dwell times for sensitive acceleration searches to target exotic objects such as relativistic binary systems, the type of pulsars especially valuable for performing exquisite tests of the theories of strong-field gravity.
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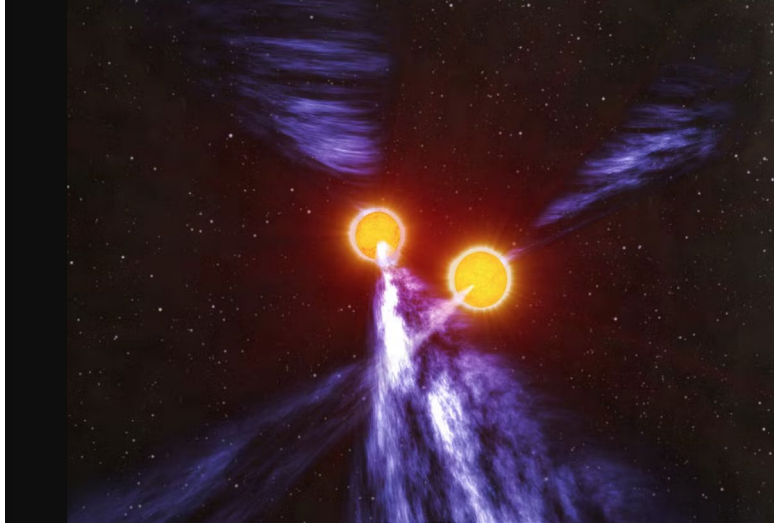


Figure: An artist's impression of the Double Pulsar system in which the two pulsars orbit each other every 2.5 hours and send out high-energy beams that sweep across the sky. [Image credit: John Rowe Animations/CSIRO](#)
