

Title

The Edge of Gravity: DNS as test beds for Gravity Theories

Abstract

Double Neutron Star (DNS) binaries allow for precise tests of gravity in the strong field regime. In this proposal we select seven DNS systems for which sensitive MeerKAT data and dedicated orbital campaigns will allow for improved tests of gravity theories:

- 1) We propose a test of the fundamental nature of gravitational radiation, in particular the most sensitive search ever for dipolar gravitational wave emission in an asymmetric DNS.
- 2) Geodetic precession: In some DNSs with misaligned pulsar and orbital spin axes, spin-orbit coupling results in changes of the spin orientation, which modifies the pulse profile of a pulsar. Five of our selected sources are expected to display this phenomenon; when quantified it provides additional tests of gravity theories.
- 3) We also propose detailed observations of a system where we might detect the "orbit" part of spin-orbit coupling, Lense-Thirring precession. Such a detection would provide estimates of the moment of inertia for neutron stars with extremely well-known masses, which would provide highly valuable constraints on the equation of state of neutron matter at supra-nuclear densities.