

Studying Extreme Lensing and Magneto-Active Environment in Pulsar Binaries

Abstract

MeerKAT, with its great sensitivity, has a unique advantage to study rare, highly time-variant propagation effects. We propose to observe 6 pulsar binaries to search for extreme plasma lensing events and study the magneto-active environment. Lensing occurs at the distance of the companion can provide tight constrain on the pulsar emission region and constrain the mass loss rate. The fast-varying polarization properties when the pulsar emission approaches the companion reveal the magnetic structure in the companion wind, disk, and magnetospheres. It, in turn, constrains the evolution of the binary system and the eclipse properties of the pulsar emission. The study of propagation effects in pulsar binary systems is also highly relevant to understanding fast radio bursts (FRBs) -- short, intense extra-galactic radio bursts. The progenitors of FRBs are unknown, but the observed spectra and polarization properties show great similarity with the pulsar binaries. The study of the local environments of pulsar binaries under different conditions will help us understand the local environment of FRBs.