Researchers measure magnetic field in eclipse medium of a spider pulsar PSR J2051-0827

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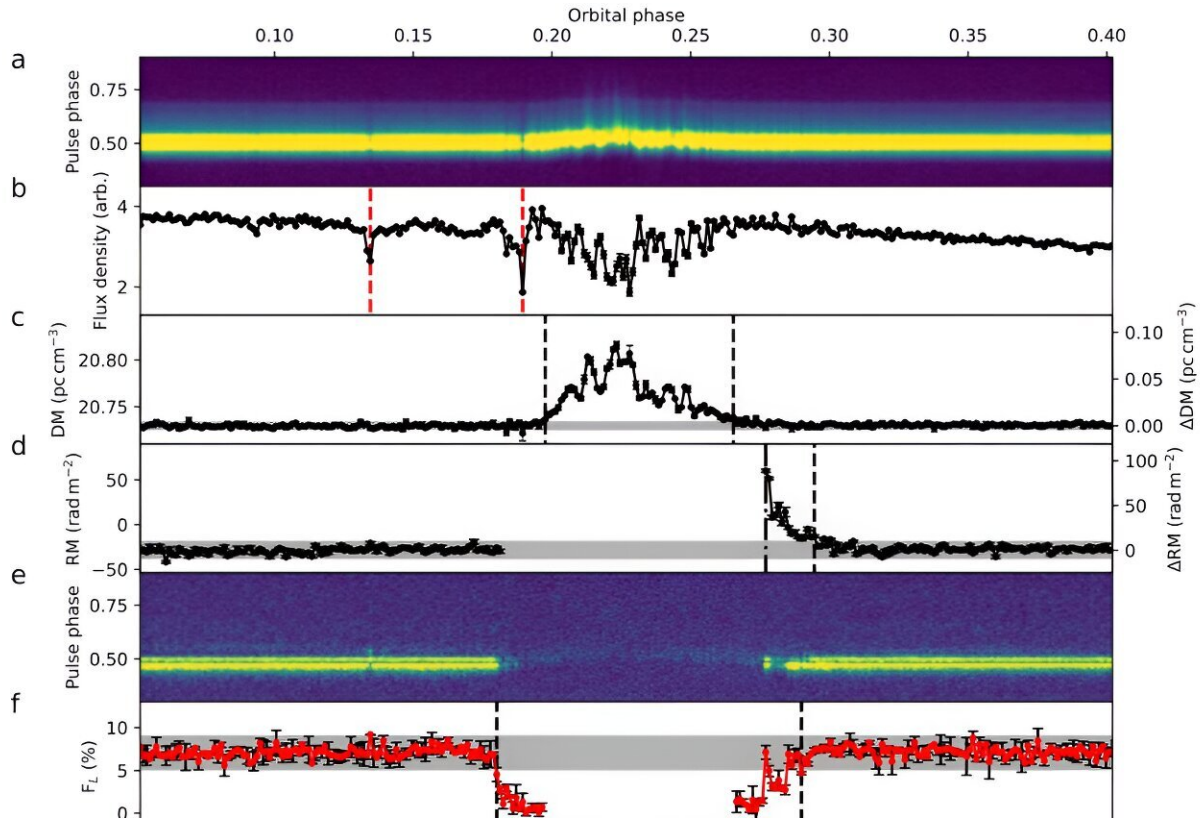

The polarization properties of PSR J2051-0827 vs. orbital. Credit: XAO

Spider pulsars are a subclass of millisecond pulsar binary systems with low mass companions in short-period orbits. In spider pulsars, the pulsar

wind and electromagnetic emission ablate and may destroy the companion.

Researchers from the Xinjiang Astronomical Observatory (XAO) of the Chinese Academy of Sciences have measured the magnetic field of a spider pulsar PSR J2051-0827.

The study was published in *The Astrophysical Journal* on Sept. 14.

Using the Five-hundred-meter Aperture Spherical radio Telescope (FAST), the researchers investigated the polarization properties of a spider pulsar PSR J2051-0827 and found direct evidence of the existence of magnetic field in the eclipse medium of PSR J2051-0827.

During the egress of the eclipse of PSR J2051-0827, they found a regular decrease in rotation measure (RM), which changes from 60 to -28.7 rad m^{-2}. This regular decrease in RM indicates that there is a significant magnetic field in the eclipse medium.

The line-of-sight magnetic field strength was estimated to be 0.1 G based on the variation of RM. Considering the magnetic field levels in the eclipse medium, the researchers suggested that cyclotron damping may not be the primary eclipse mechanism at the L-band.

Furthermore, the RM reversal phenomenon was detected, which could be caused by a change in the magnetic field strength along the line of sight due to binary orbital motion. The RM reversal phenomenon provides evidence for a complicated, magnetized immediate environment of the source. The results suggest that environments of spider pulsars share some similarities with some fast radio bursts (FRBs).

More information: S. Q. Wang et al, Change of Rotation Measure

during the Eclipse of a Black Widow PSR J2051−0827, *The Astrophysical Journal* (2023). DOI: 10.3847/1538-4357/acea81

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