Title

Detecting Radio Pulsations from the False Widow Candidate Swift J1858.6-0814

Abstract

Our understanding of binary millisecond pulsar evolution has advanced significantly through observations of pulsations. A well-known example is the detection of millisecond X-ray pulsations from SAX J1808.4-3658, which provided definitive proof of the pulsar recycling scenario, connecting neutron star (NS) X-ray binaries (XRBs) and binary millisecond pulsars (MSPs). Subsequently, the discovery of transitional millisecond pulsars (tMSPs), which switch between accretion-powered X-ray pulsations and rotation-powered radio pulsations, further demonstrates the connections between different classes of NS binaries. One sub-category of binary MSPs, spider pulsars, is characterised by the destruction of their companions via ablation. Until recently, ablation was considered unique to spider pulsars. However, the discovery of false widows -- accreting NS XRBs undergoing X-ray-driven ablation -- suggested that there may be an evolutionary connection between false widows and spider pulsars. Here, we propose to confirm this likely evolutionary connection by detecting radio pulsations from the X-ray quiescent false widow candidate Swift J1858.6-0814. Swift J1858.6-0814 is a strong false widow candidate, exhibiting photon-energy dependent and asymmetric X-ray eclipses, analogous to those observed in spider pulsars, and its phase-folded optical light curve appears asymmetric too, like those observed in tMSPs. Furthermore, evidence of millisecond X-ray pulsations at ~559 Hz have been uncovered, thus Swift J1858.6-0814 is the ideal target to answer the question -- are false widows the evolutionary link between neutron star X-ray binaries and spider pulsars? This proposal will guide future observations to investigate the radio properties of other false widow candidates.