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Tracking the long-term emission and rotational dynamics of four radio-loud magnetars

Abstract

The decaying, ultra-strong magnetic fields of magnetars result in sudden high-energy outbursts, believed to be triggered by magnetic reconnection events or plastic deformation (and even fracturing) of their crust. Observations of the small sub-population of 'radio-loud' magnetars offer unique insights into the response of a neutron star magnetosphere to impulsive, and sometimes explosive, changes in magnetic structure. Recent connections between magnetars and the mysterious fast radio bursts suggest these objects may also be excellent Galactic analogues to study the progenitor objects of these highly energetic transients. Such studies are performed through tracking of their radio pulse profile shape changes, spin-down variations, and shifts in radio polarization corresponding to changes in magnetic and viewing geometry. Four of these radio-loud magnetars have been regularly observed by Murriyang, the Parkes 64-m radio telescope, over the past decade every 7-10 days. The unstable nature of their pulse profile shapes and spin-down necessitate a high observing cadence in order to construct a coherent history of their rotational and radiative evolution. However, upcoming extended shut-downs of the telescope for much needed maintenance threaten our ability to maintain phase-coherent timing solutions for the three currently active magnetars, and may result in the initial reactivation of the fourth being missed. We propose to conduct eight 1-hr observations of these magnetars with MeerKAT to ensure the continued tracking of their emission and rotational properties, and to capture renewed radiative activity during early phase of a new outburst.