Title

A Pilot Study to Measure Magnetic Fields of Solar Corona and Coronal Mass Ejections using Faraday Rotation Observations using MeerKAT

Abstract

Coronal mass ejections (CMEs) are large-scale ejections of magnetized plasma from the Sun and are associated with the most extreme space weather events. CMEs are routinely observed by coronagraphs providing several geometrical and dynamical properties of the CMEs. The impact of a CME on the Earth is primarily determined by the southward component of its magnetic fields (CME-Bz). Recent studies have shown that CMEs evolve significantly at around 5 - 15 deg solar elongation, and relying on extrapolations from low coronal heights can lead to wrong predictions of CME-Bz in the vicinity of Earth. Hence, it is important to measure CME magnetic fields at these solar elongations to improve CME-Bz prediction. A promising method to measure the CME-entrained magnetic field is by measuring the changes in Faraday rotation (FR) of linearly polarized emission from background radio sources as their line-of-sight crosses the CME plasma. To use this method, an instrument that can be pointed close to the Sun is required with good polarization capability and sensitivity, such that multiple spatial measurements crossing the CME can be done within a shorter period. This exceptional requirement is well-satisfied by MeerKAT. In this pilot project, we propose observing around a week when some big eruptive solar active region will appear on the visible part of the solar disk, which is common as we are close to the peak of solar maxima. This project capitalizes on the existing capabilities of the MeerKAT to expand into the increasingly important field of space weather research.