Session 2

Recent Developments in Low-frequency Spectro-Polarimetric Snapshot Imaging Studies of the Radio Sun

Devojyoti Kansabanik[1], Divay Oberoi[2], Surajit Mondal[3], Soham Dey[2], Puja Majee[2]

[1] National Centre for Radio Astrophysics, Tata Institute of Fundamental Research, [2] NCRA-TIFR, [3] Center for Solar-Terrestrial Research, New Jersey Institute of Technology, USA

Meter-wavelength radio emissions are generated by the different physical processes in corona. All of these processes are governed by the magnetic field of the solar corona. The emission mechanism, magnetic field, and propagation effect imprint some of their signatures on the polarization of these radio emissions. The circular polarization fraction of these emissions vary by two orders of magnitude, while their brightness temperature varies by about nine orders of magnitude. To observe both the faint and bright radio sources, which also show dramatic spectro-temporal variability, one needs high dynamic range spectro-polarimetric snapshot imaging. Despite its importance, this has not been possible until recently due to instrumental and technical limitations. With the new technology instrument, the Murchison Widefield Array (MWA), and our recently developed polarisation calibration and imaging pipeline (P-AIRCARS; Kansabanik et al. 2022), it has now become possible to make high-fidelity polarimetric solar radio images at high temporal and spectral resolution. This has led to several interesting discoveries and results in the field of radio polarimetric studies of the Sun. These include the measurement of the magnetic field of CMEs, the measurement of the magnetic field of the quiet solar corona at mid and higher coronal heights, and detailed polarization studies of different solar radio bursts. We have also made progress in making full heliospheric magnetic field measurements using the Faraday rotation measurement of the background radio sources. Here I will present glimpses of all of these discoveries, results, and the current status of solar polarimetry at radio wavelengths with the MWA. I will also briefly describe the key science objectives, which can be accomplished with spectro-polarimetric radio imaging using the future Square Kilometre Array.