

Session 1

Tackling the unique challenges for low-frequency solar polarimetric calibration and imaging for Sun with the Murchison Widefield Array

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Polarization properties of the various solar emissions have long been known to be a rich source of information for understanding the emission mechanisms and the magnetic field topology. Nonetheless, largely due to technical challenges, polarimetric solar observations at low radio frequencies have remained perhaps the least explored regime. The brightness temperature and degree of polarization of the solar radio emission varies dramatically depending on the type of the emission. The strong radio bursts are very bright, approaching up to 10^{12} K and show moderate to high degree of circular polarization, while with brightness temperature as low as 10^4 K the non-thermal gyrosynchrotron emissions are many orders of magnitude weaker, and the quiet sun thermal emissions at a 10^5 K show very little degree of circular polarization ($\sim < 1\%$). The coronal magnetic field is extremely hard to measure, and the degree of circular polarization from the quiet Sun is the only known remote sensing tool which can estimate the average coronal magnetic fields. To the best of our information, such a measurement is yet to be done. Perhaps the most rewarding, and also challenging, of polarimetric observations will be the measurements of Faraday rotation of linearly polarised light from background sources as it passes through the magnetised plasma of the coronal mass ejections (CMEs) on its way to the observer. Such measurements will enable us to estimate the vector CME magnetic field, the holy grail of space weather and in the fullness of time will have enormous societal impact. Towards meeting these aims we have initiated the effort to build a solar high fidelity spectro-polarimetric snapshot imaging capability at low radio frequencies. This pipeline is being designed to work with data from the Murchison Widefield Array (MWA), one of the SKA-Low precursors. I will briefly summarise the various challenges which need to be overcome for polarimetric calibration due to reasons ranging from the nature of the wide field-of-view aperture arrays like the MWA to the issues specific to solar imaging. I will then present the strategies developed to address these challenges and conclude by sharing the preliminary but very interesting results which our efforts are yielding.