



Wide field polarimetry with ASKAP - Current Status and Insights from ASKAP Survey Science Observations.

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1 Extended Abstract

The Australian Square Kilometre Array Pathfinder (ASKAP) telescope [1] is a new generation radio interferometer with 36 fully steerable dishes, each 12 meters in diameter. One of the key science projects with ASKAP is mapping the sky in polarisation to probe the Universe’s magnetic field. Radio polarimetric measurements are notoriously challenging since the signals of astrophysical origin are modified by local propagation effects including through the ionosphere and the measuring instrument itself. Disentangling these effects require careful characterisation of the instrument (as a function of time, frequency, look-direction etc.). This exercise often involves multiple measurements of known calibrators thereby making the calibration extremely tedious.

Unlike conventional telescopes, each ASKAP dish is equipped with a Phased Array Feed (PAF) at its focal plane. An additional 3rd axis of rotation about the optic axes of the dishes allows the beam footprint to remain constant while tracking a given part of the sky. While these novel technologies make ASKAP a wide instantaneous field of view instrument with high dynamic range imaging abilities, they also add significant challenges for the polarisation calibration.

ASKAP began full survey operations towards the end of 2022. Over two hundred fields have so far been observed and imaged in polarisation for the survey science team POSSUM [2]. We use the data diagnostics and quality assessment reports generated for these data to analyse the current state of ASKAP polarimetry across its wide field of view. We discuss the calibration procedure adopted at ASKAP, and suggest how some of the residual artifacts in its images could be due to inadequate calibration. We also highlight additional calibration strategies that could improve the polarisation purity and discuss the associated challenges.

References

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- [2] Gaensler, B. M., et al., “The Polarisation Sky Survey of the Universe’s Magnetism (POSSUM): Science Goals and Survey Description,” *Publications of the Astronomical Society of Australia*, (under review).