

Revealing the Mysteries of the Magnetised Universe with the Square Kilometre Array

*Melanie Johnston-Hollitt^{*1} and the SKA Cosmic Magnetism Working Group*

¹School of Chemical and Physical Sciences, Victoria University of Wellington, PO Box 600, Wellington, 6140, New Zealand, Melanie.Johnston-Hollitt@vuw.ac.nz

Abstract

Conducting an all-sky polarimetric survey on the SKA has been a mainstay for cosmic magnetism science for over a decade. The resultant rotation measure grid which will be obtained from this survey continues to provide a compelling observational goal to understand both the polarised sources themselves, and as a means to statistically probe numerous important extended sources including the Milky Way, Magellanic clouds, clusters of galaxies, the lobes of giant radio galaxies and perhaps even the elusive warm hot intergalactic medium. Using these data we will address a host of outstanding questions such as:

- What is the mechanism to generate and sustain magnetic fields in the Milky Way, Magellanic clouds and other nearby galaxies?
- How do magnetic fields manifest in HII regions, supernova remnants, planetary nebulae and high velocity clouds in the Milky Way?
- Over what scales and at what strengths are magnetic fields generated in galaxy clusters and how does this correlate with cluster dynamical state?
- What is the large-scale structure of the magnetised Universe and can we statistically detect the magnetic fields in the cosmic web?
- Finally, how do magnetic fields in galaxies and clusters evolve over cosmic time?

The SKA Cosmic Magnetism Working Group have recently consolidated the science case for cosmic magnetism (Johnston-Hollitt et al. in prep) and in this presentation we will highlight the most ambitious and interesting magnetism science that the SKA will deliver.