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# PEGASUS, mapping polarized radio emission from the Southern sky

## Abstract

PEGASUS, the POSSUM EMU GMIMS All-Sky Ultra-wideband-low Survey, is mapping polarized emission from the Southern sky with the Muriyang 64-m Telescope at Parkes, covering the frequency range 704 to 1440 MHz, over declinations -90 to +20 degrees. The survey, now in progress, uses the technique developed by Carretti et al (2019), employing long azimuth scans at the elevation of the South Celestial Pole (33 degrees). Angular resolution ranges from 29 to 14 arcminutes across the band. Observations, spread over 168 nights, will be complete by early 2025. The major technical challenge, radio-frequency interference (RFI) in the bottom half of the band, is overcome by observing with 500 Hz frequency channels; RFI is excised offline, and data are averaged to wider frequency bins.

PEGASUS is a major component of the Global Magneto-Ionic Medium Survey, GMIMS, which has set out to map polarized emission from the entire sky, North and South, fully covering 300 to 1800 MHz with single-antenna radio telescopes. The aim is to improve understanding of the strength and configuration of Galactic magnetic fields, and their role in interstellar processes.

GMIMS has already mapped the Southern sky with the 64-m Muriyang Telescope at Parkes from 300 to 480 MHz (Wolleben et al 2019 – data public through the Canadian Astronomy Data Centre), and from 1324 to 1800 (Sun et al in preparation). The addition of PEGASUS will give almost complete coverage of the GMIMS frequency range, enabling Rotation Measure Synthesis with excellent resolution and low sidelobes in Faraday depth spectra. PEGASUS data alone will have resolution in Faraday depth of 27 radians per square metre, with sensitivity to structures as large as 72 radians per square metre, already yielding resolution of complex spectral features in Faraday depth. The corresponding numbers for the complete GMIMS dataset are resolution of 4 radians per square metre, with the ability to “see” structures as large as 113 radians per square metre.

PEGASUS will contribute single-antenna data to the two major continuum mapping projects on ASKAP, the Australian SKA Pathfinder. They are POSSUM, the spectro-polarimetry survey, and EMU, the total-intensity mapping project. ASKAP loses sensitivity to structures larger than about 15 arcminutes. After incorporation of PEGASUS data, POSSUM will be able to investigate the Galactic diffuse polarized emission with arcsecond resolution.

References: Carretti et al, 2019MNRAS.489.2330C, Wolleben et al, 2019AJ....158...44W