

POSSUM Data Format and Access Requirements

Draft version 3: October 11th 2010. Subject to change.
Lisa Harvey-Smith and the POSSUM Collaboration

Introduction

This document outlines the data format and access requirements for the Polarization Sky Survey of the Universe's Magnetism (POSSUM) survey on the Australian Square Kilometre Array Pathfinder (ASKAP). We propose to release two primary data catalogues and three additional data products. This document is intended as a preliminary guide to the ASKAP computing team and project scientists. The precise data requirements will continue to evolve as the project develops and to avoid duplication of effort between the SSPs.

We will release two primary data products. First, the 'POSSUM Polarisation Catalogue' will contain the rotation measure of every Stokes-I source in the sky visible to ASKAP. This catalogue will be the default source of data for the general user and will contain the derived data products of interest to researchers studying the evolution of magnetic fields with cosmic time, the properties of magnetic fields in the intergalactic medium, galaxy clusters and nearby galaxies. It will also facilitate studies of the large-scale magnetic field of the Milky Way and of supernova remnants, stellar wind bubbles, HII regions and Planetary Nebulae. The second (and much larger) product is the 'POSSUM Polarization Atlas'. This resource will list the characteristics of every polarized source in the sky visible to ASKAP. It will contain measured data products, including tables of Q,U vs. λ^2 and images in all Stokes parameters, polarization and RM. The atlas will allow advanced users to re-analyse the data to derive RMs of sources, if required and will be valuable to those studying the polarization properties of individual objects such as radio galaxies and quasars.

Data Format

Here we list the essential components of the two catalogues produced from the POSSUM survey.

1. The POSSUM Polarization Catalogue

This catalogue will include information on the Faraday Rotation and polarization of each EMU source that has a peak polarized intensity greater than $5 \sigma_{\text{RMS}}$ noise in the polarized intensity image (Note: discuss this limit with the source-finding group). In designing this catalogue, we assume that EMU will identify source components in Stokes-I and then assign probabilities that pairs or small groups of nearby components are physically associated as a single object in space (such as a radio galaxy). For each EMU component, the POSSUM Polarization Catalogue will contain the following information:

* Position of polarized source: RA, Dec, l,b, uncertainties

* A polarized source position identifier: POSSUM_rarara-decdecdec

- * A source identifier that links to the corresponding entry in EMU catalogue (if applicable) and the EMU value added data (peak total intensity, integrated total intensity, redshift, spectral index, etc.).
- * Polarized intensity, P, debiased, with uncertainties, or upper limits.
- * Integrated polarized flux (Note: we will discuss whether this is a calculable and useful parameter)
- * Percentage polarization, %P at the band centre (Note: we have not yet decided precisely how to define P and %P – work with WG2 on this).
- * Polarization position angle (three entries: observed, de-rotated at the centre of the observing band and de-rotated at $\lambda=0$).
- * Angular size of fitted polarized source (Note: should we quote both major & minor axes? Work with source finding group on defining this).
- * Peak Rotation Measure, RM, with uncertainties.

2. The POSSUM Polarization Atlas

The atlas will contain information on every polarized source in the sky that is visible to ASKAP, including value-added data from related surveys. Source-finding for this catalogue will be carried out in an unbiased search through images of total polarized intensity. The Polarization Atlas will contain the following information:

- * Position of polarized source: RA, Dec, l,b, uncertainties
- * A polarized source position identifier: POSSUM_rarara-decdecdec
- * A source identifier that links to the corresponding entry in EMU catalogue (if applicable)
- * Polarized intensity, P, debiased, with uncertainties
- * Percentage polarization, %P at the band centre (Note: we have not yet decided precisely how to define P – work with WG2 on this).
- * Integrated polarized flux (Note: we will discuss whether this is a calculable and useful parameter).
- * Polarization position angle (three entries: observed, de-rotated at the centre of the observing band and de-rotated at $\lambda=0$).
- * Integrated polarized flux (Note: we will discuss whether this is a calculable and useful parameter).
- * Angular size of fitted polarized source (Note: quote both major & minor axes? Work with source finding group on defining this).
- * Tables of source flux density vs. λ^2

For each POSSUM source, there will be a searchable form that can produce a table with all or a subset of the following rows and columns:

	Frequency	λ^2
I		
P		
Q		
U		

Note that I, P, Q, U are the peak values and frequency and λ^2 are mid-channel values. For each source, this table will have up to 600 columns to cover the entire 300 MHz band in 1 MHz channels (Note: The details of this data product are still under discussion, as we may consider using only 16 channels – speak to Larry Rudnick about this).

* Postage Stamp Image Server

The POSSUM Polarization Atlas will be searchable using source identifiers, position matching, flux density or percentage polarization cutoffs, RM cutoffs and EMU add-ons such as redshift information using Boolean logic. It will return the RM Catalogue entries that match those qualifiers and provide a link to the RM, Stokes-I, Stokes-Q, or Stokes-U images of any size requested by the user in fits or image (.jpg, .png) format. (Note: we should discuss with EMU how we can create a single image server that will allow the user to download images of a region of sky in any selected Stokes parameters or polarization).

3. Downloadable uv-data

The calibrated uv-data from each ASKAP pointing will be available to download. Supplementary information accompanying this will be the tables relating to the RFI excision and ionospheric and polarization leakage calibrations that have been carried out. (Note: to discuss – should we provide 100% raw uv-data or calibrated, RFI-excised data? In the latter case, what calibration tables should we include?).

Value-added data

POSSUM will add single-dish data in all Stokes parameters to the ASKAP data as a 'value-added' data product. This will improve our sensitivity to low surface brightness emission and improve image quality for sources larger than the synthesized beam. Another cross-SSP value added product is redshift – vital for cosmological studies of magnetism.