Probing coronal magnetic fields using high fidelity spectro-polarimetric low radio frequency observations of the Sun using the Murchison Widefield Array

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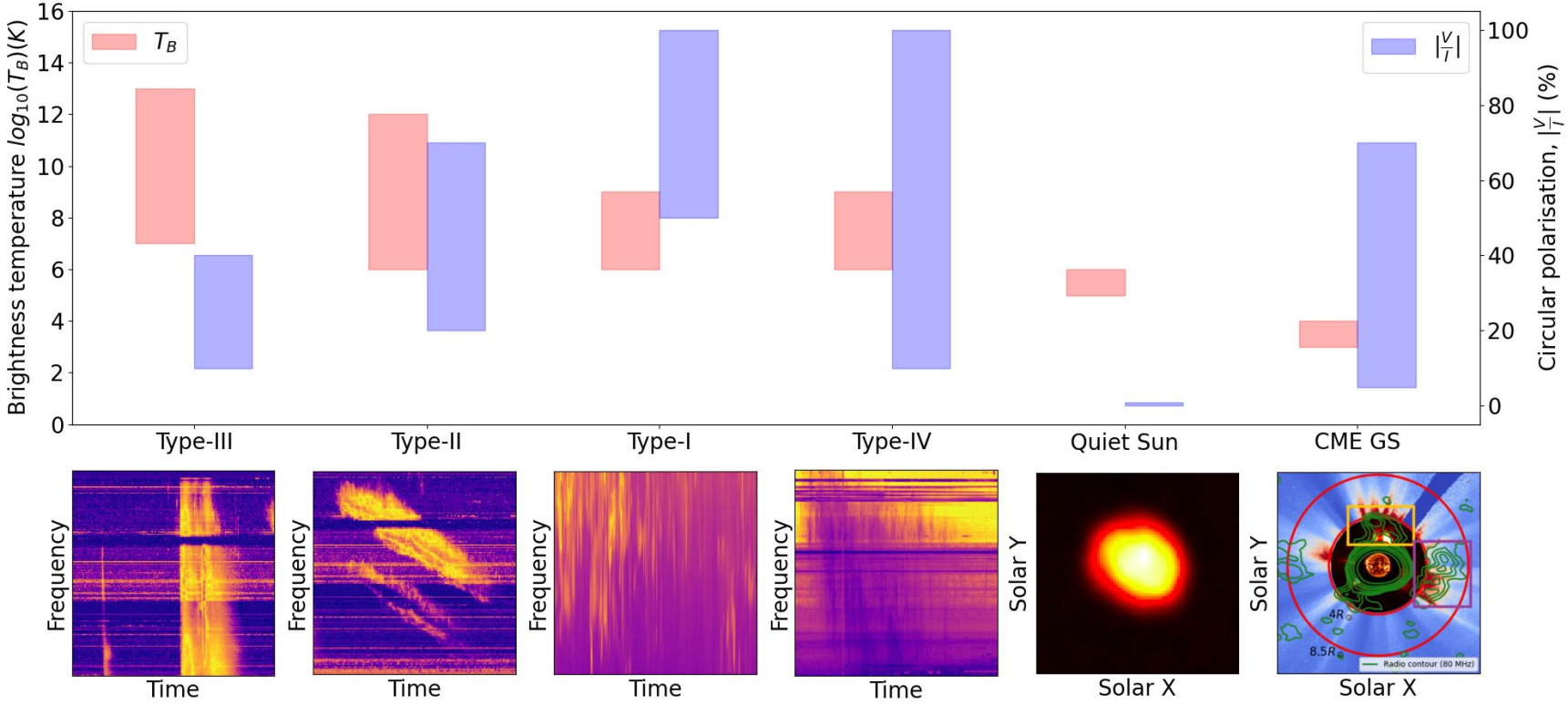
MWA
MURCHISON
WIDEFIELD
ARRAY

NCRA • TIFR

Magnetic field measurements using radio polarisation

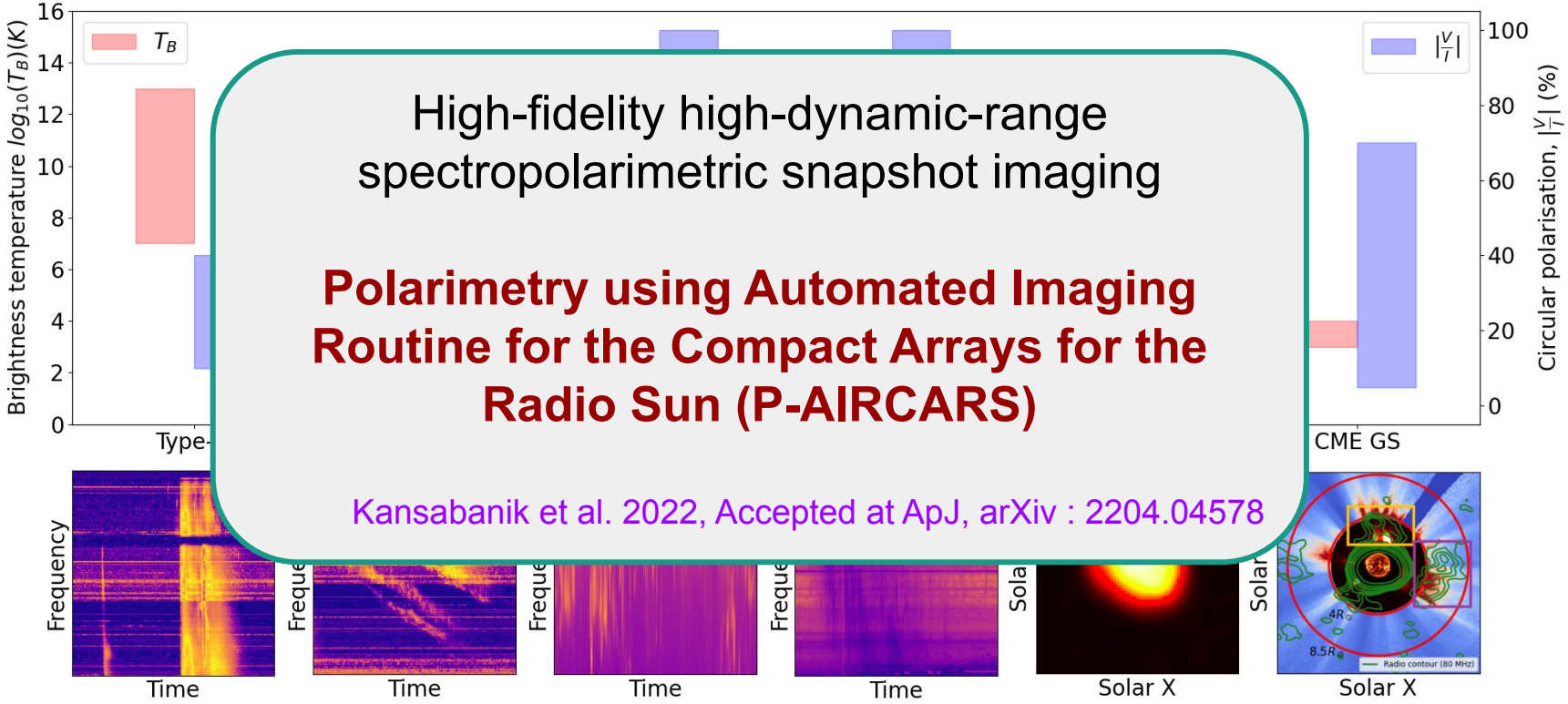
1. Measure global coronal magnetic fields :
    1. Over the active regions using different radio bursts.
    2. Quiet Sun regions using very small (<1%) induced circular polarisation of thermal emission.
    3. Robust modeling of gyrosynchrotron emission from coronal mass ejections (CMEs) to measure plasma properties and magnetic field.
2. Measuring the heliospheric magnetic field using Faraday Rotation measurements of background radio sources.

Need for spectropolarimetric snapshot imaging



Kansabanik 2022, Under Review in Solar Physics

Need for spectropolarimetric snapshot imaging



High-fidelity high-dynamic-range spectropolarimetric snapshot imaging

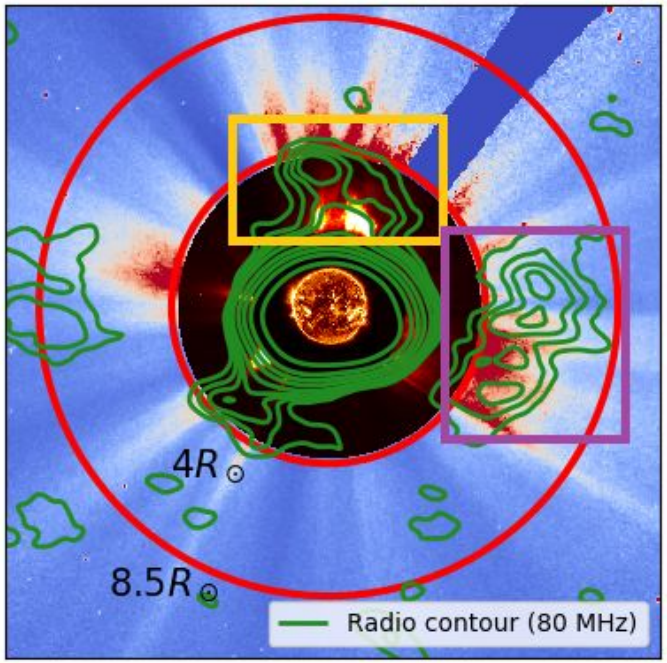
Polarimetry using Automated Imaging Routine for the Compact Arrays for the Radio Sun (P-AIRCARS)

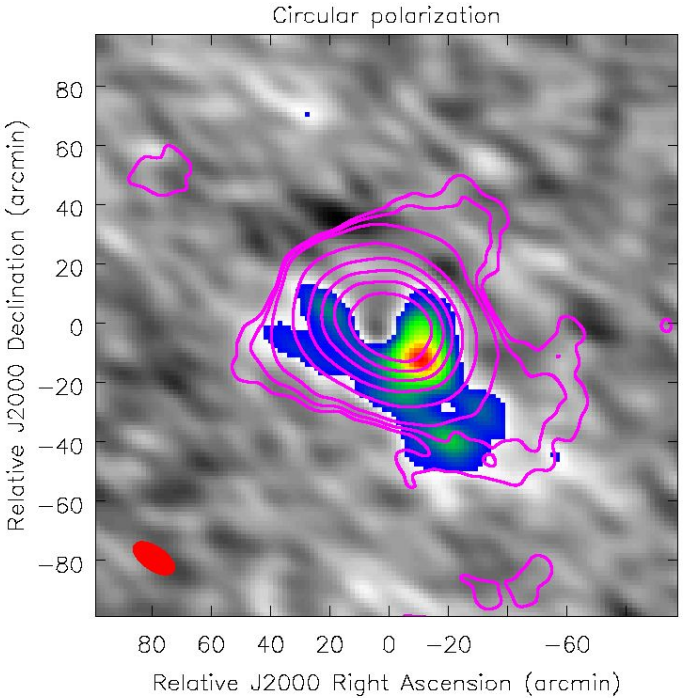
Kansabanik et al. 2022, Accepted at ApJ, arXiv : 2204.04578

Kansabanik 2022, Under Review in Solar Physics

Measure magnetic field of CME

First ever imaging detection of circular polarisation from CME gyrosynchrotron

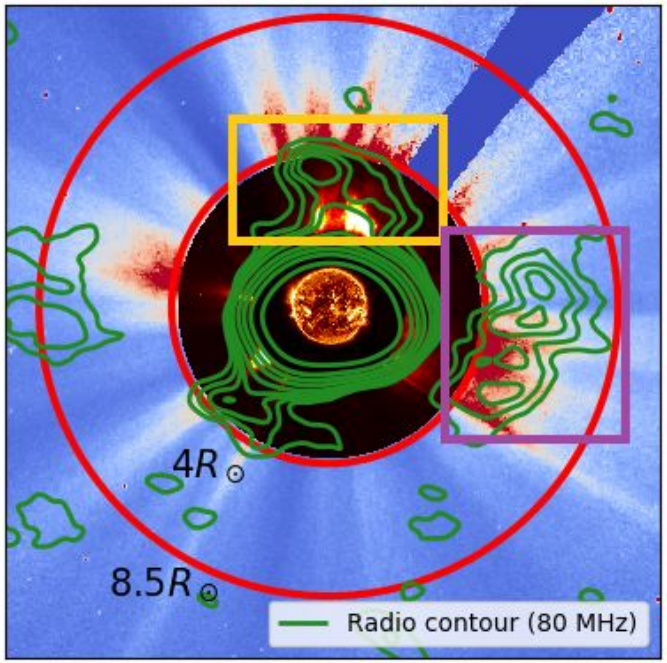


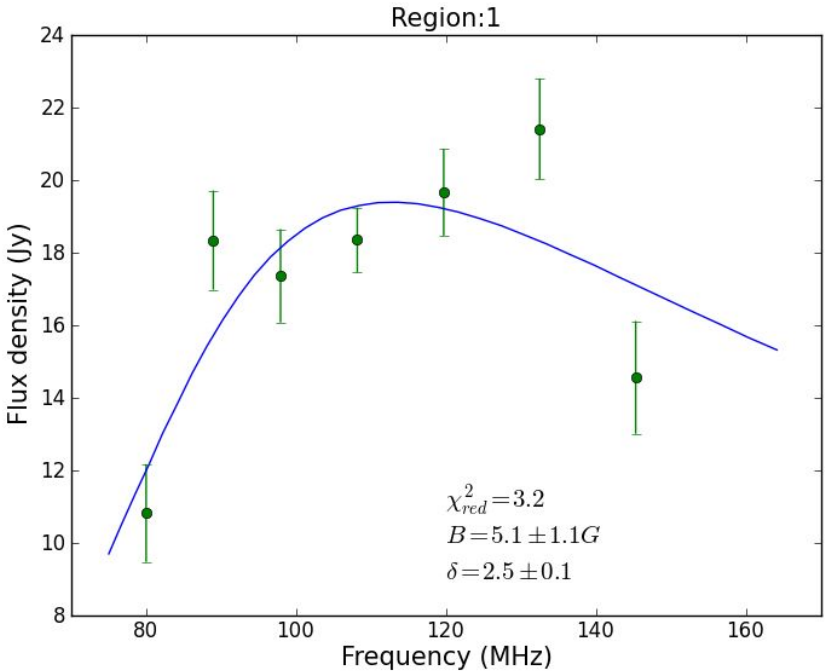


Kansabanik et al., 2022, in preparation

Measure magnetic field of CME

Faintest gyrosynchrotron emission detected at the largest heliocentric distance (8.3 solar radii)

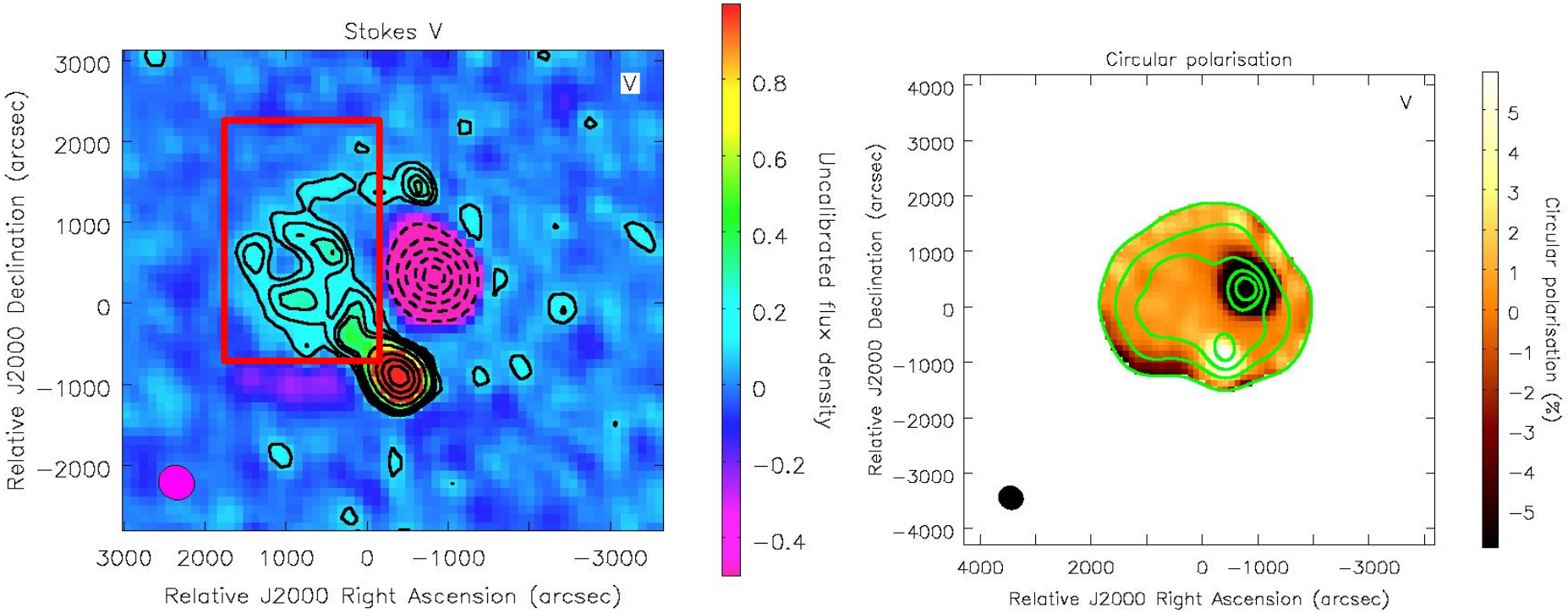




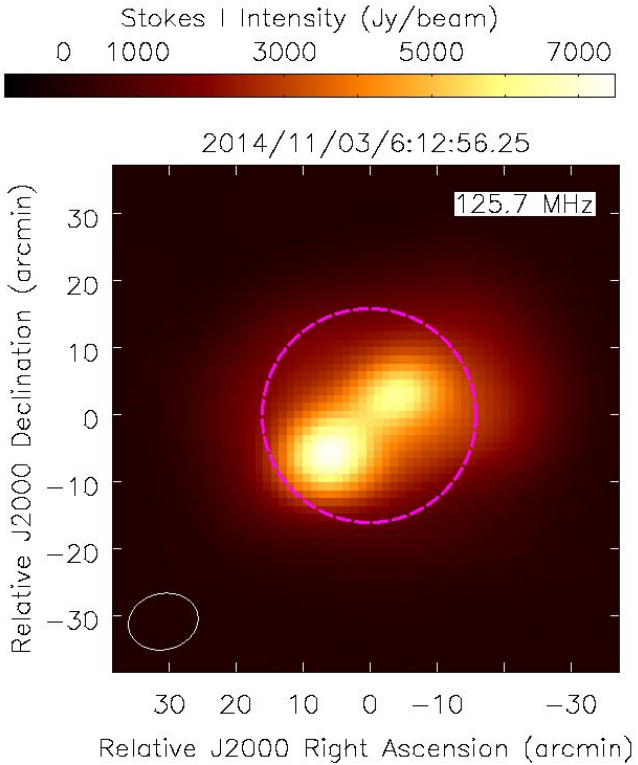
Kansabanik et al., 2022, in preparation

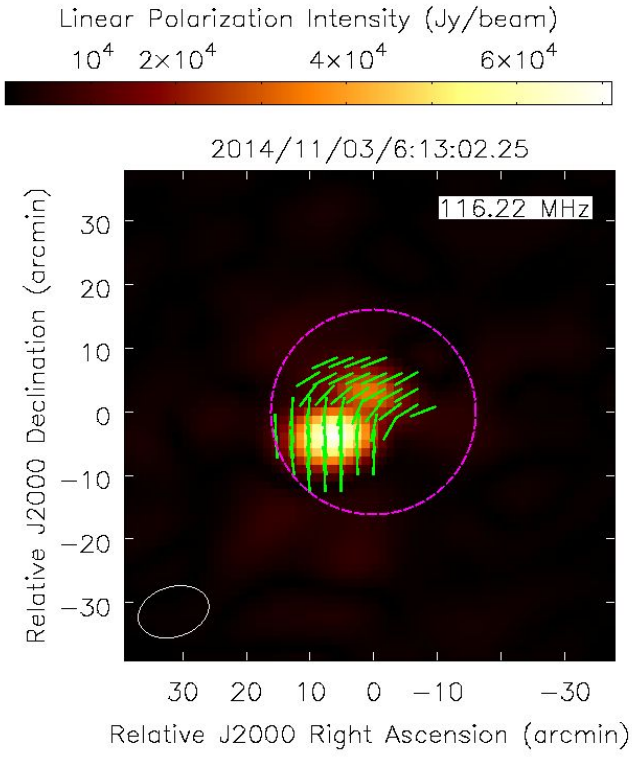
Quiet Sun magnetic field using circular polarisation

Expected induced circular polarisation from thermal emission is ≲1%.



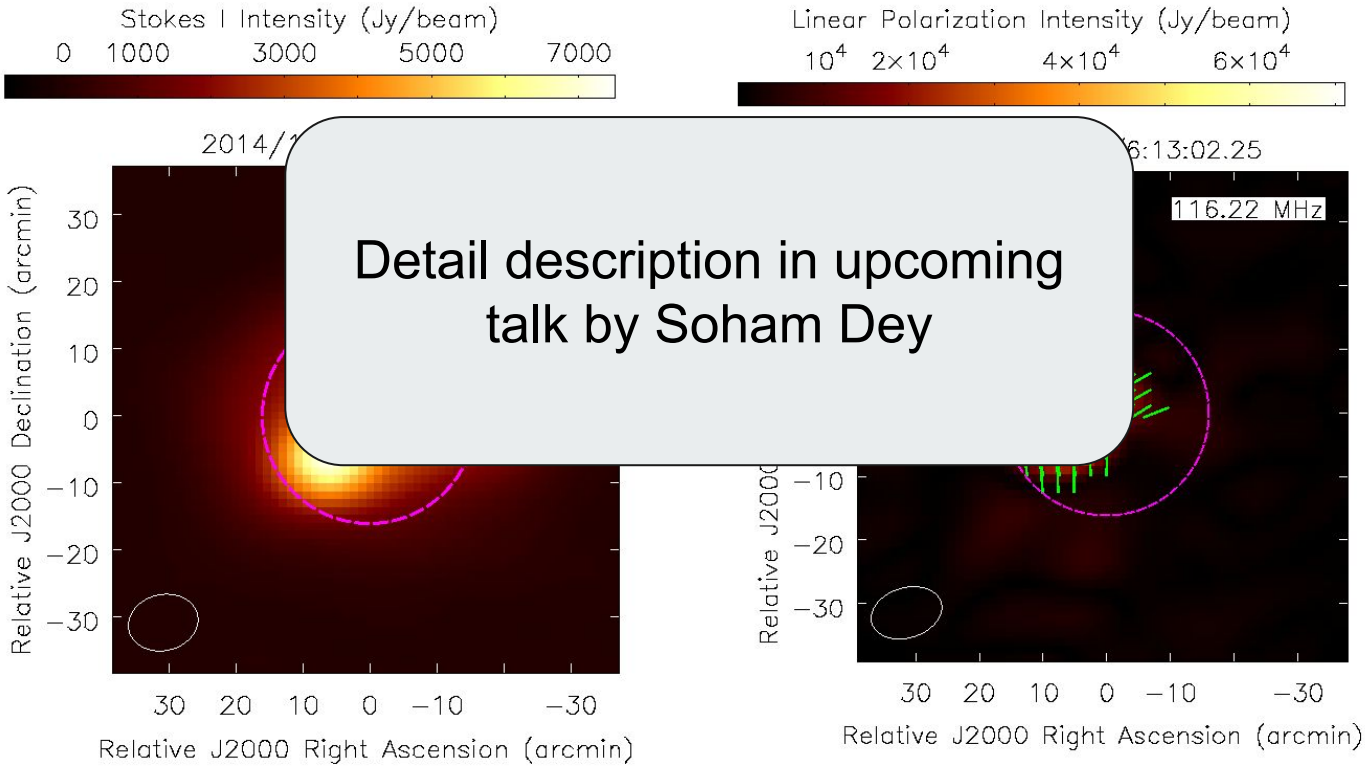
First ever detection of Linearly Polarised Emission





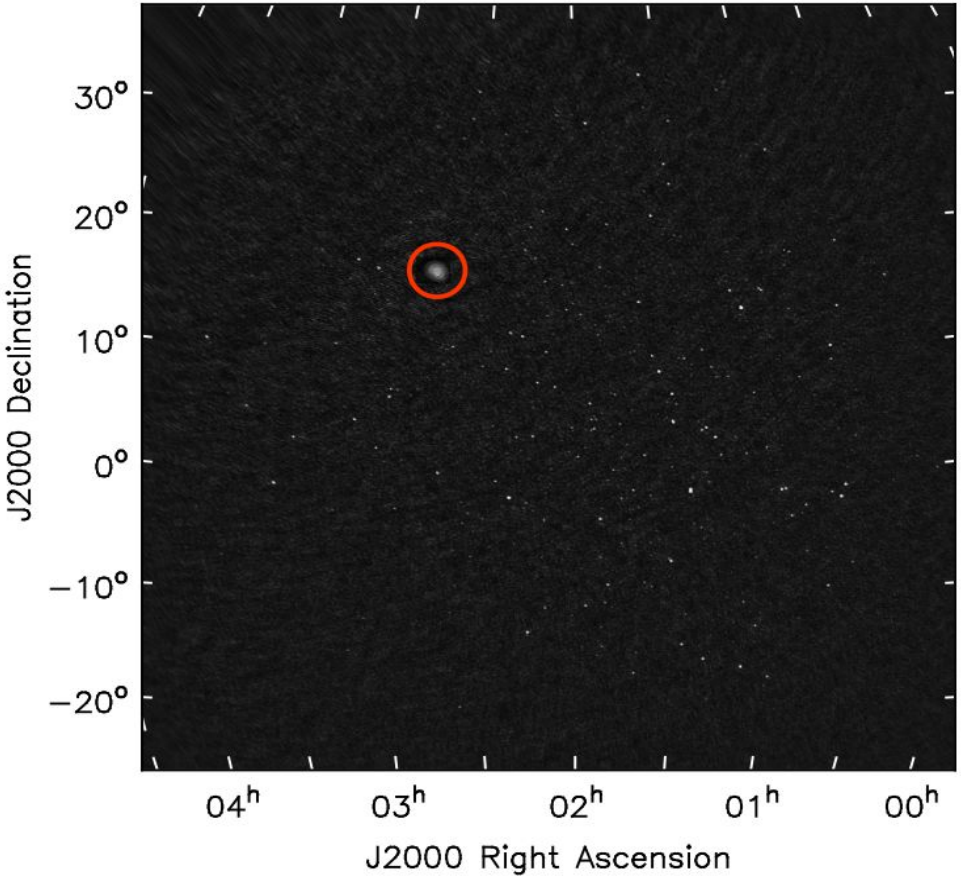
Soham et al., in preparation

First ever detection of Linearly Polarised Emission



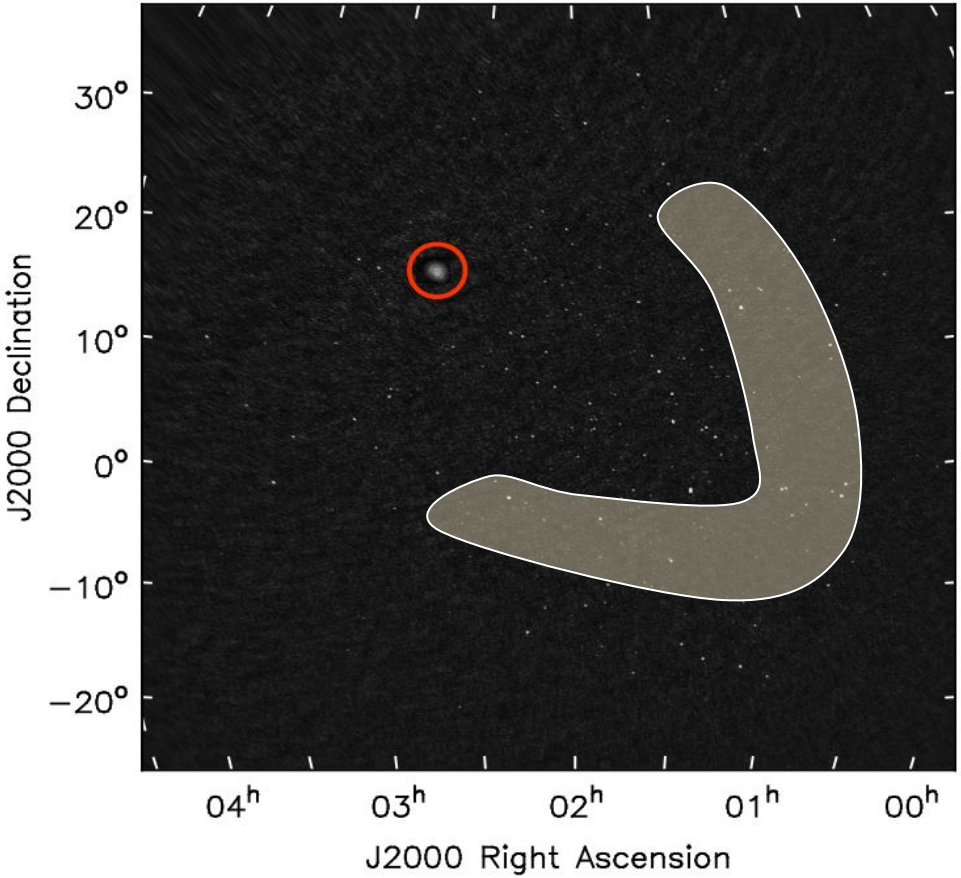
Soham et al., in preparation

Towards full heliospheric Faraday rotation measurement



- Large number of background radio sources (>80) detected.
- Sources detected with flux density down to 4.6 Jy with the Sun in FoV.

Towards full heliospheric Faraday rotation measurement



- First step towards measuring full heliospheric Faraday rotation.
- FR measurements along multiple line of sight can be used for heliospheric magnetic field measurements.