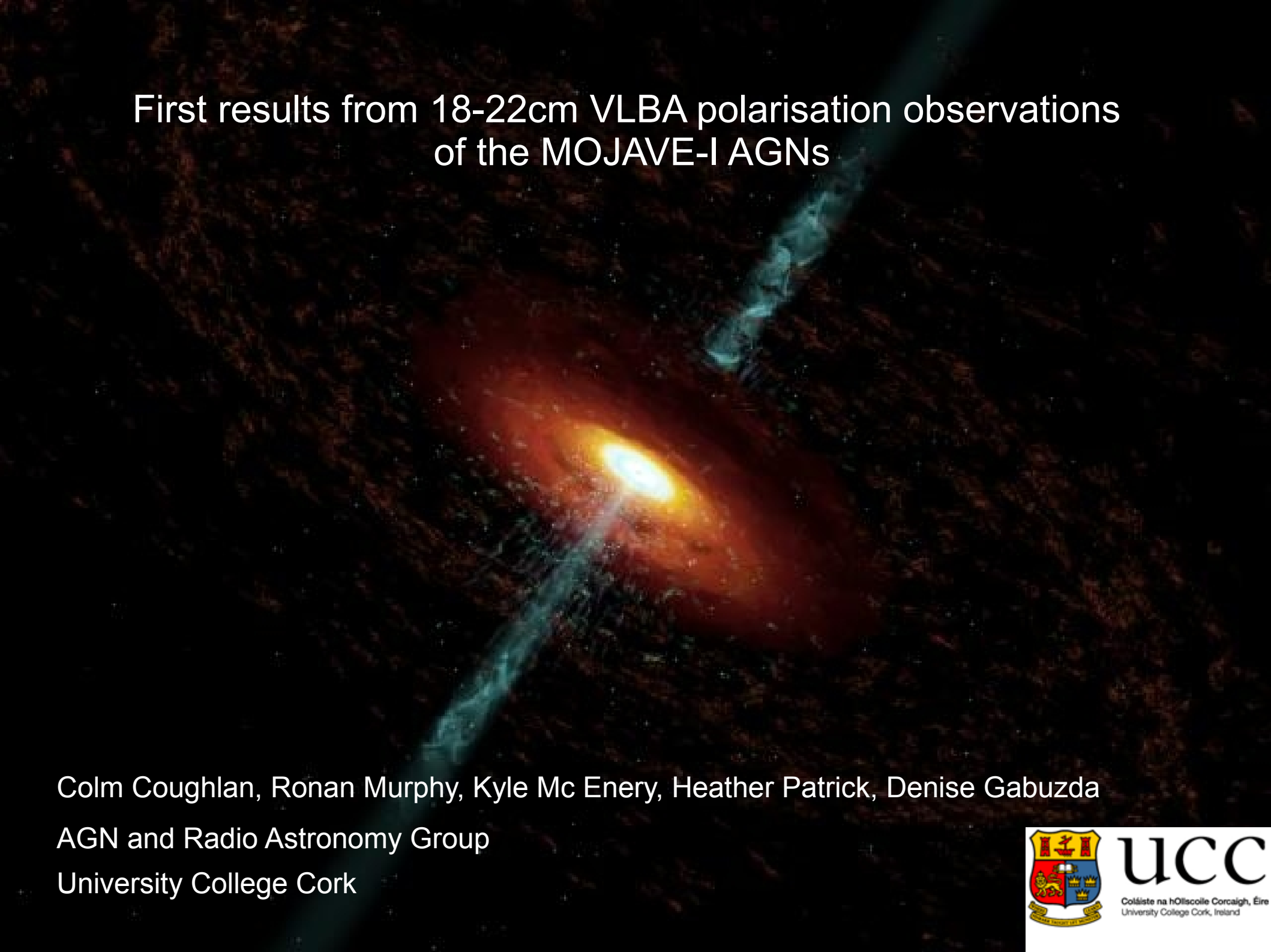
First results from 18-22cm VLBA polarisation observations of the MOJAVE-I AGNs



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The Science: Studying the Jets of AGN on Scales of 10-100 pc

- Active Galactic Nuclei emit jets of plasma at relativistic speeds
- Polarisation of the synchrotron radiation emitted by these jets can be studied to get information about jet magnetic fields
- Multiwavelength VLBA observations at 18-22cm probe scales from parsecs to 100s of parsecs, enabling study of spectral indices and Faraday rotation

Examples of science addressed by multi-wavelength 18-22cm VLBA observations:

- Jet collimation, bending, interaction with surrounding medium
- Evolution of morphology and magnetic field with distance from jet origin
- Studies of Faraday rotation occurring local to the AGN
- Investigation of specific jet magnetic field structures, such as evidence for helical magnetic fields (expected due to rotation of central accretion disc and jet outflow)

The Experiment: BG196

- Simultaneous VLBA observations at 1358, 1430, 1493 and 1665 MHz (22.1, 21.0,20.1 and 18.0 cm)

- 135 MOJAVE-I AGN observed across 9 epochs; first epoch obtained in early 2010, observations and processing expected to be finished in 2011-2012

- Designed for intensity and polarisation studies of AGN jets on scales out to100s of parsecs

- Enables studies of multi-wavelength phenomena, such as spectral indices and Faraday rotation

- First 6 epochs obtained, first 3 (A, B, C) have been calibrated and some results are shown here

Calibration and Imaging

- Preliminary calibration and polarisation (D-term) calibration done using standard techniques
- Polarisation angle calibration done using integrated (VLA) observations of compact polarised sources; for epoch C, used previously calibrated VLBA observation in same mode, due to failure to include EVPA calibrator in VLBA schedule

$$\Delta\chi = \chi_{true} - \chi_{observed}$$

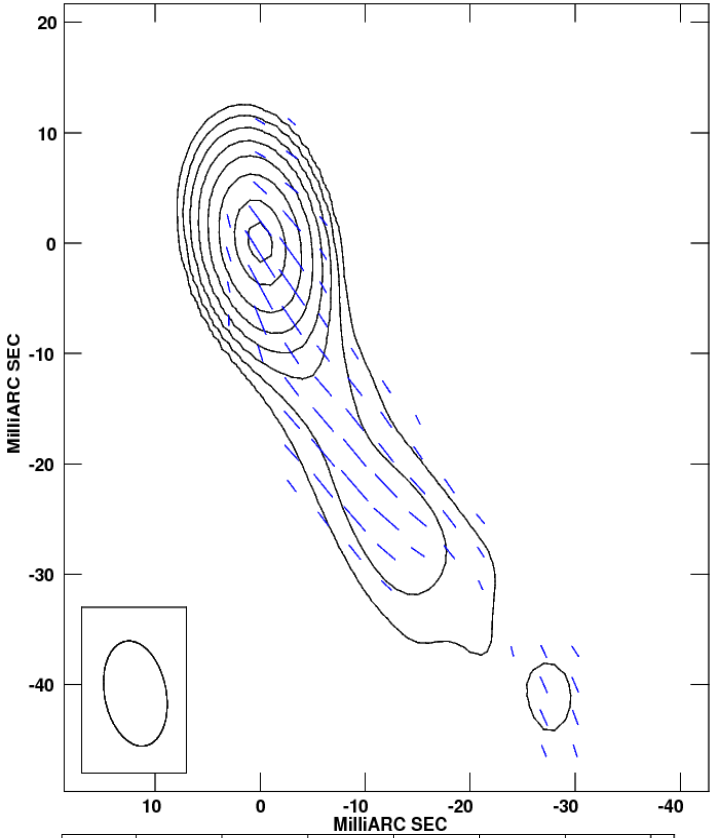
Frequency MHz	Jan 2004 BG139 ΔX (deg.)	Feb 2010 Epoch A ΔX (deg.)	Mar 2010 Epoch B ΔX (deg.)	May 2010 Epoch C ΔX (deg.)
1358	128	130	91	132
1430	113	113	112	113
1493	100	147	84	96
1665	82	91	49	37

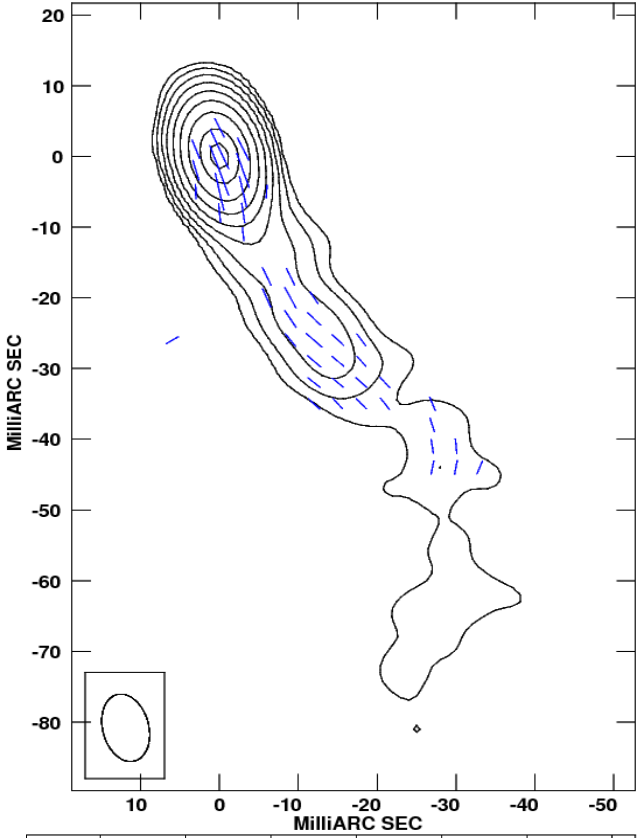
- Scripts written to enable semi-automated construction of intensity, polarisation, spectral-index and Faraday-rotation maps

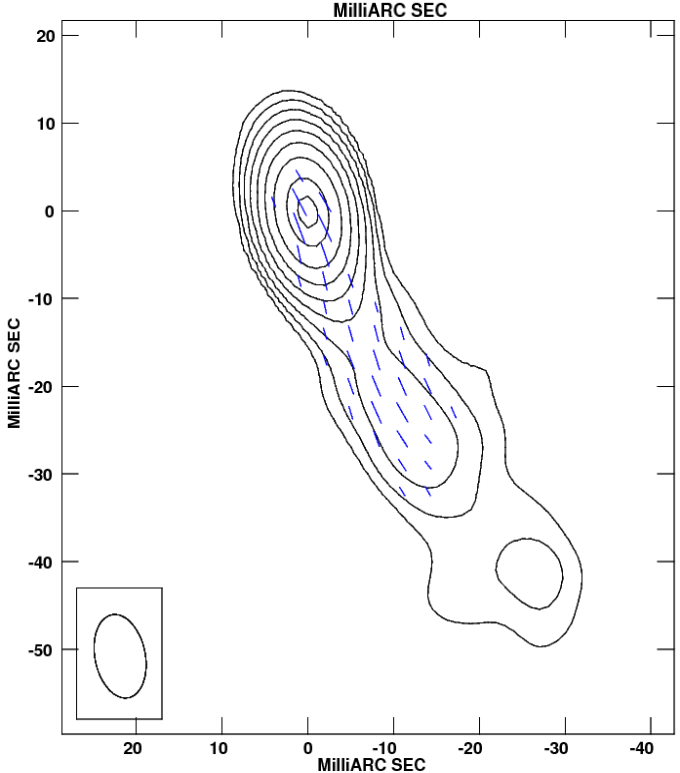
EVPA calibrations for Epoch B

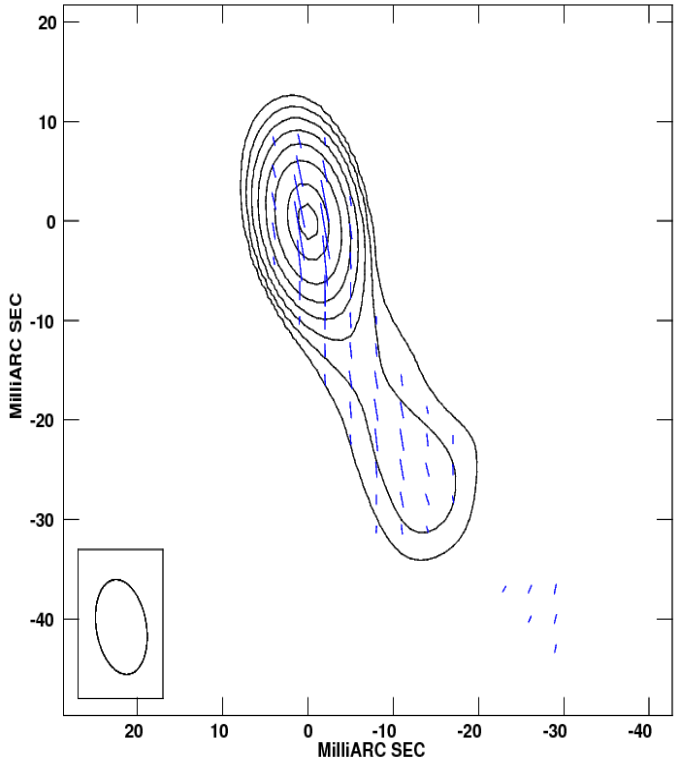
Source: J1801+4404

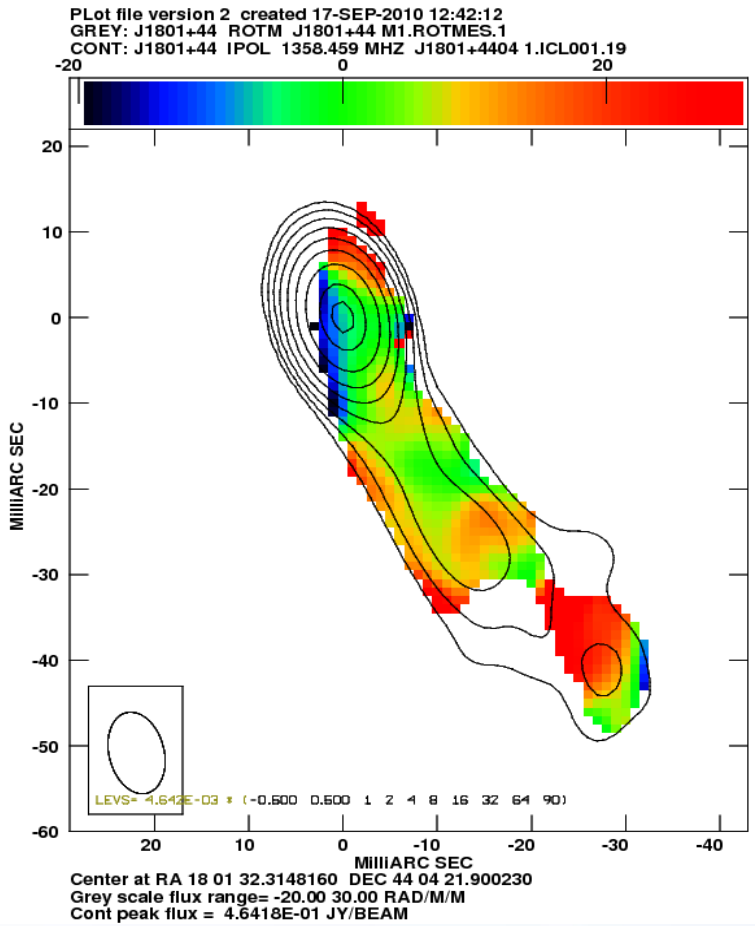
Rotation Measure Map

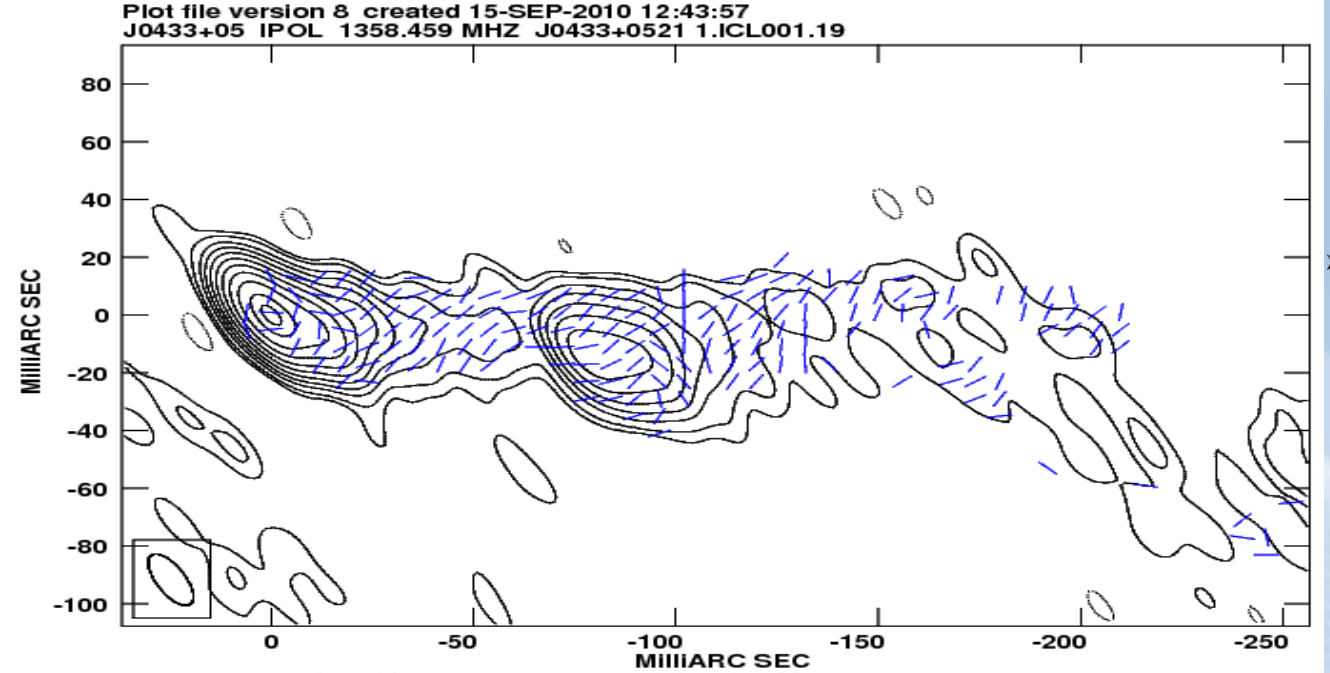


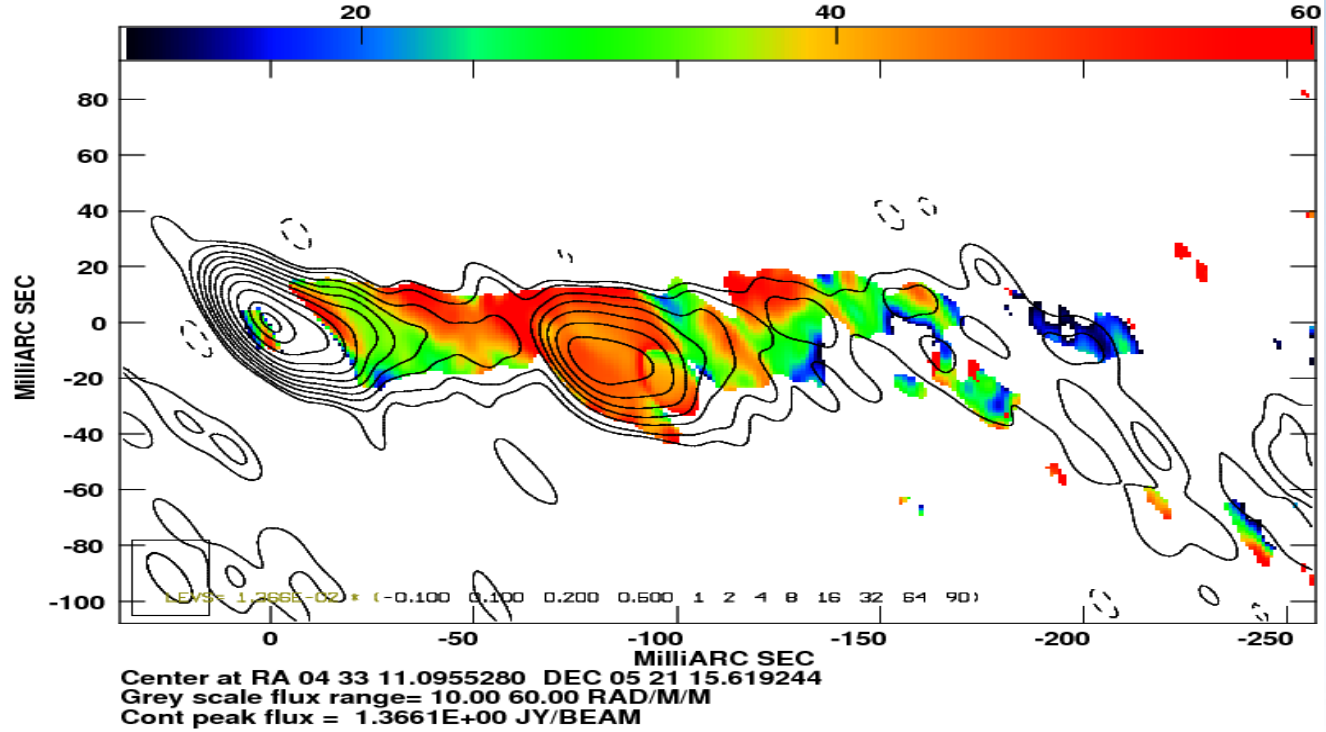












Faraday corrected polarisation Map of 3C120

- The direction of the polarised flux is perpendicular to the magnetic field

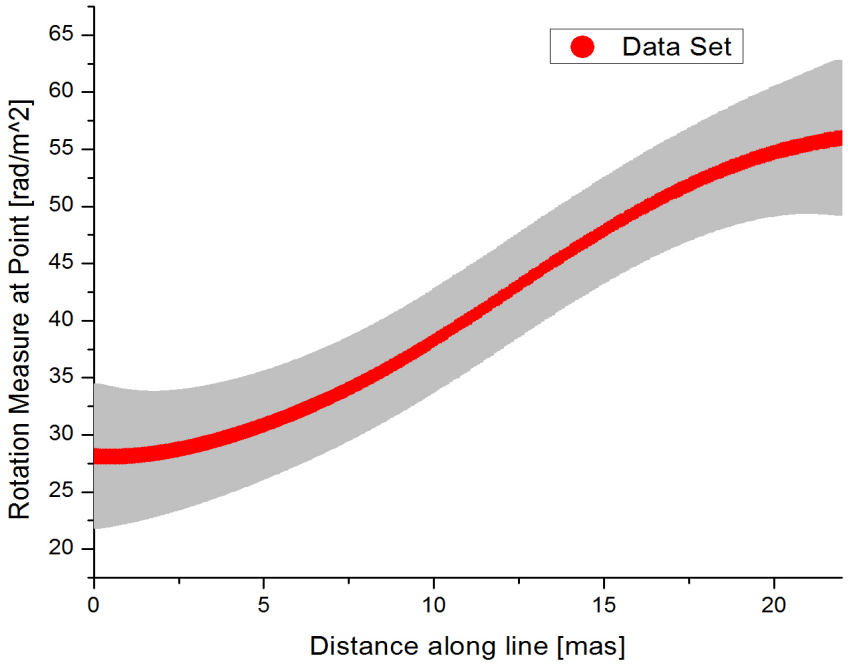
Rotation Measure Map of 3C120

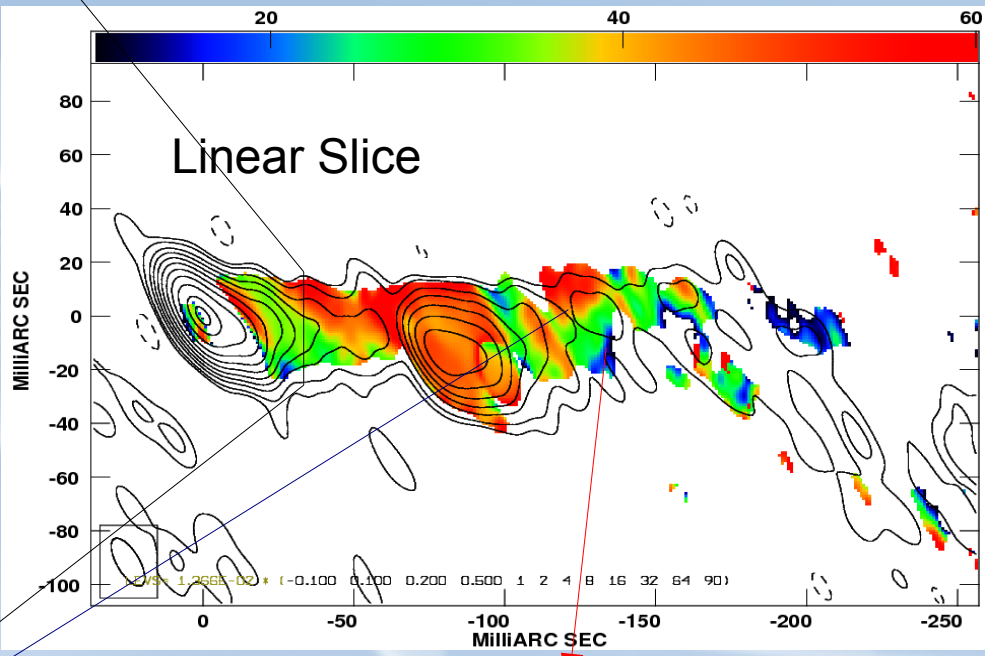
- By studying the angle through which the polarisation has been rotated though across 4 frequencies, the Rotation Measure at each point can be found

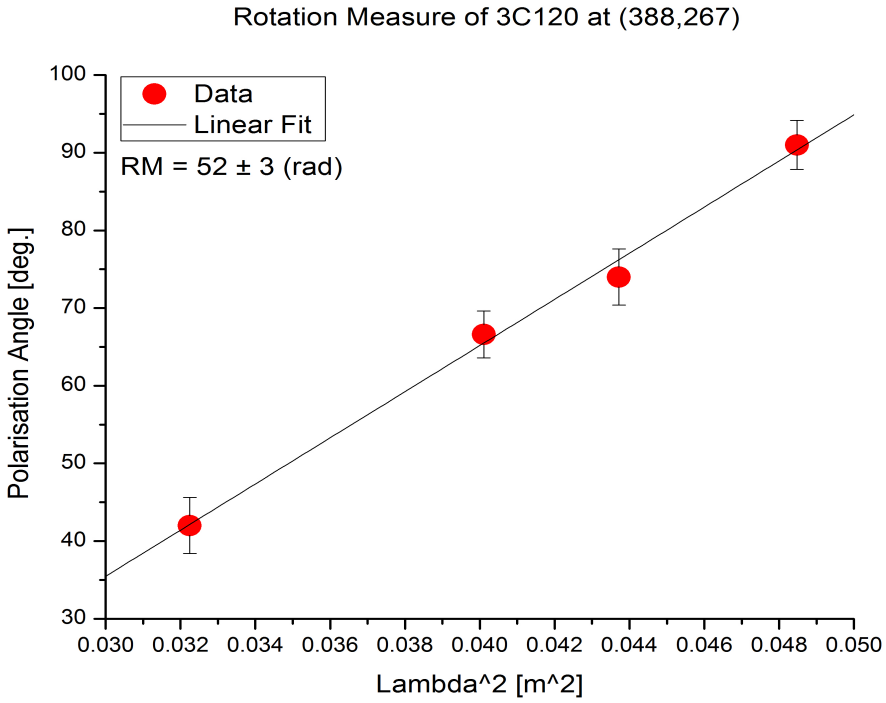
$$\chi_{observed} = \chi_{intrinsic} + RM\lambda^2$$

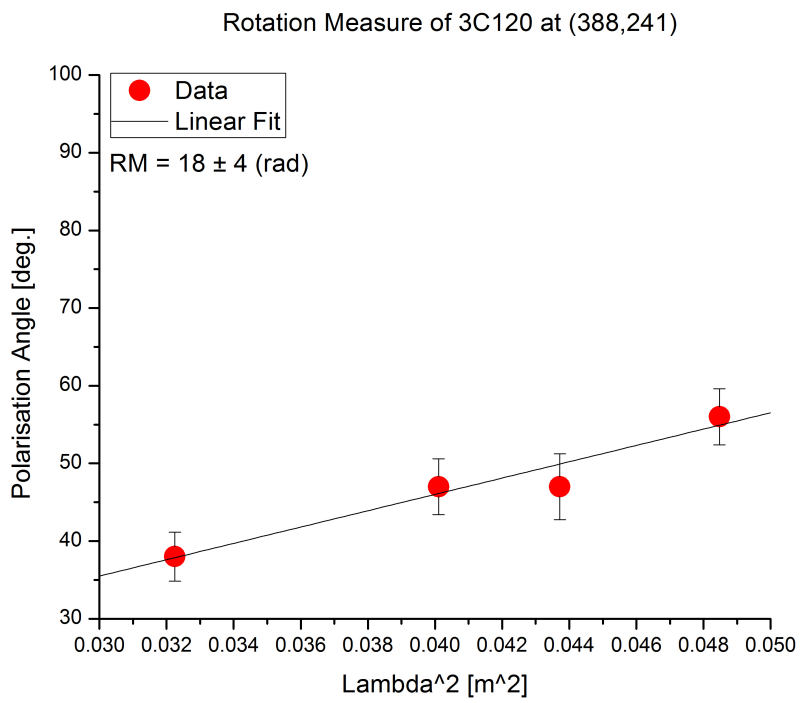
$$RM \propto \int n_e \vec{B} \cdot d\vec{l}$$

Searching for transverse gradients in The rotation measure map of 3C120

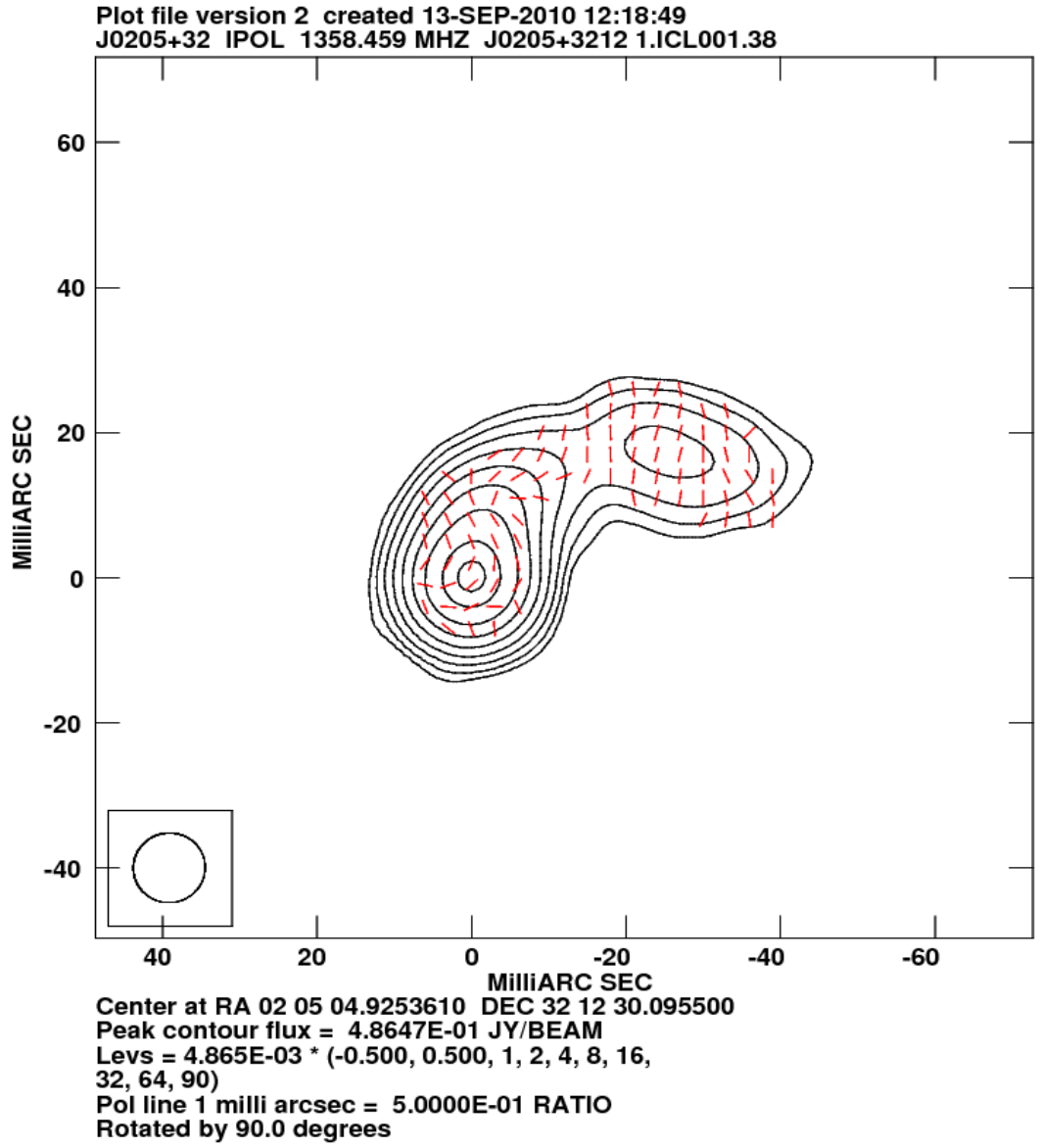


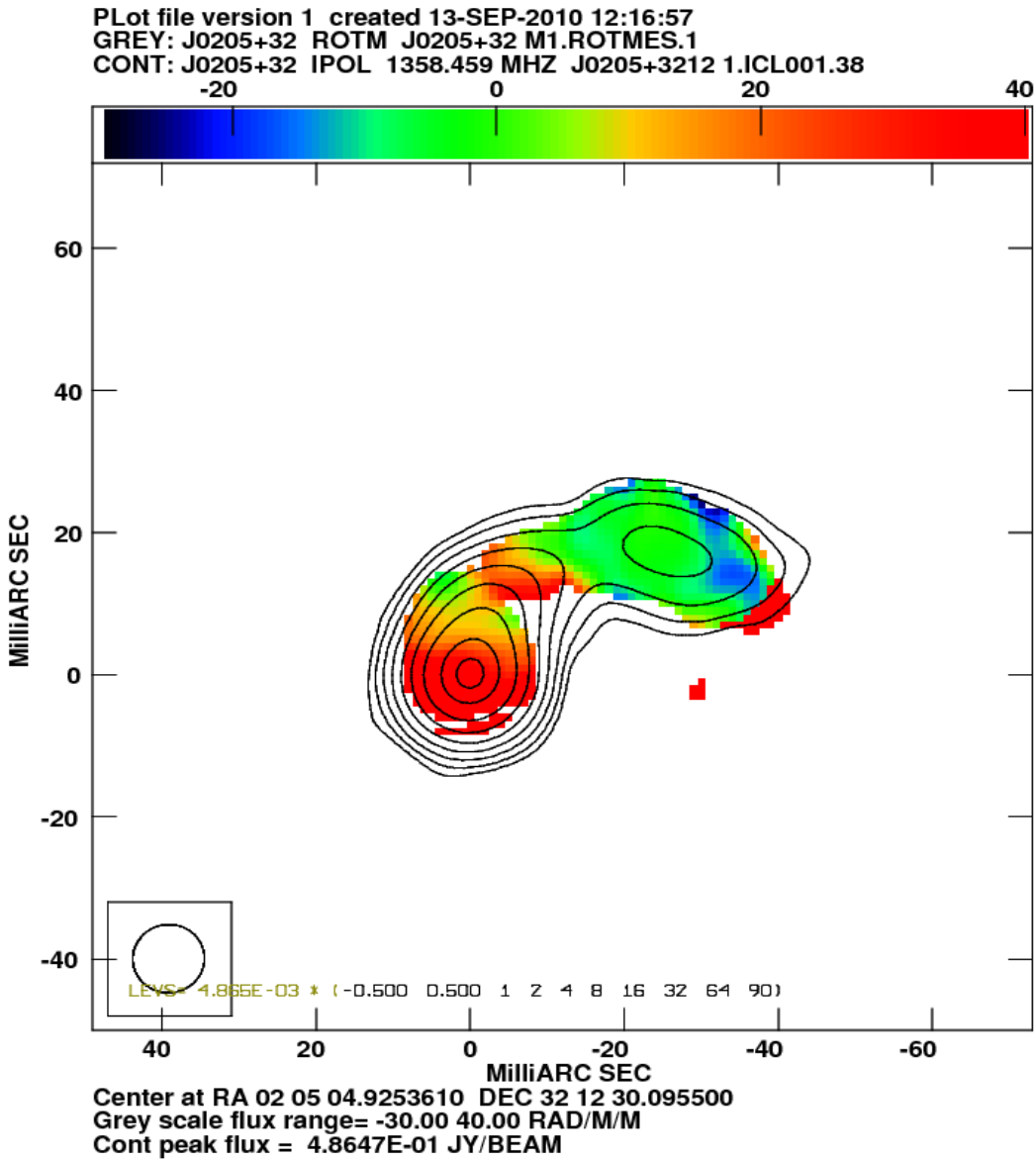






Polarisation structure of J0205+3212

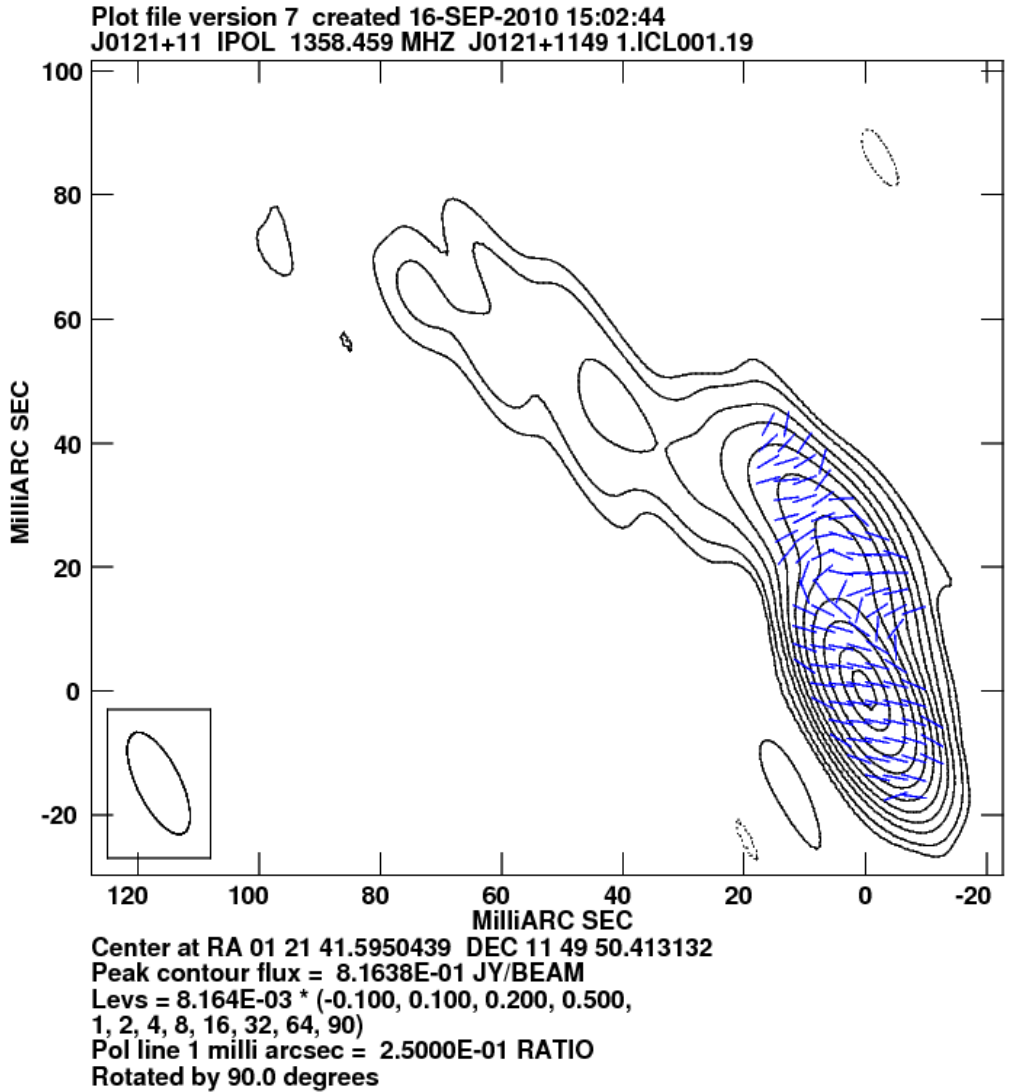




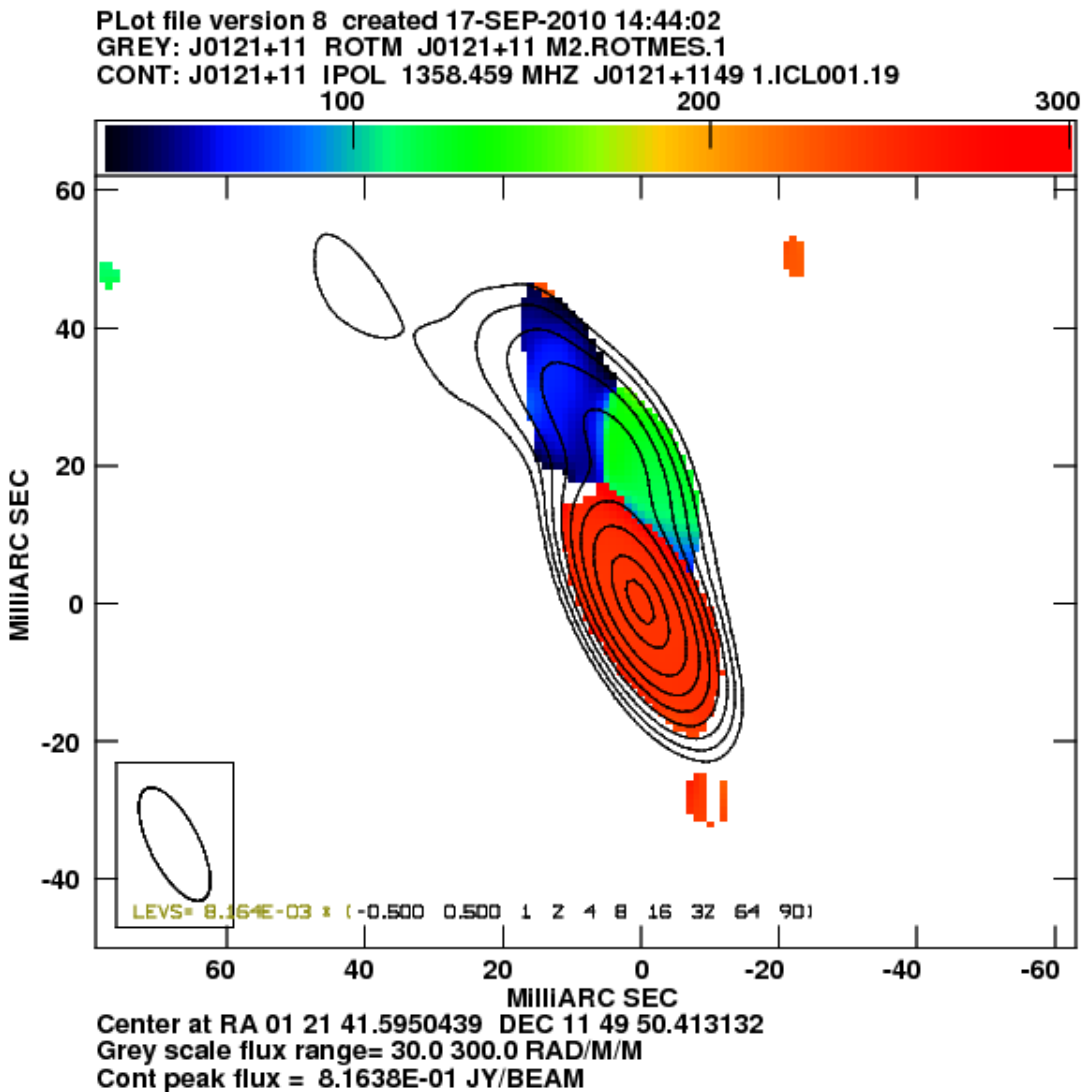
Unusual Behaviour in J0121+1149

Sudden changes in polarisation angle

Faraday correction Polarisation Map

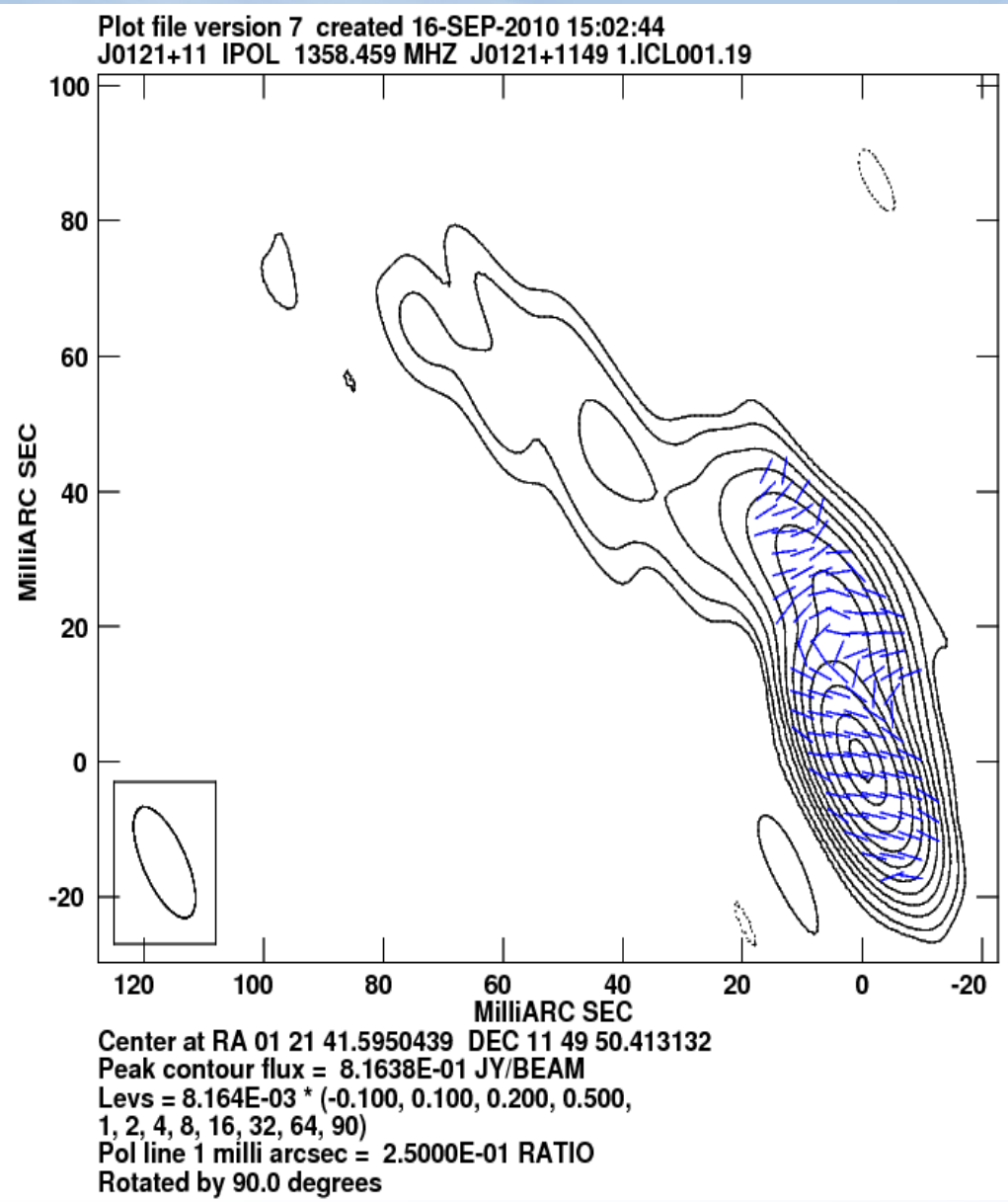


Rotation Measure Map

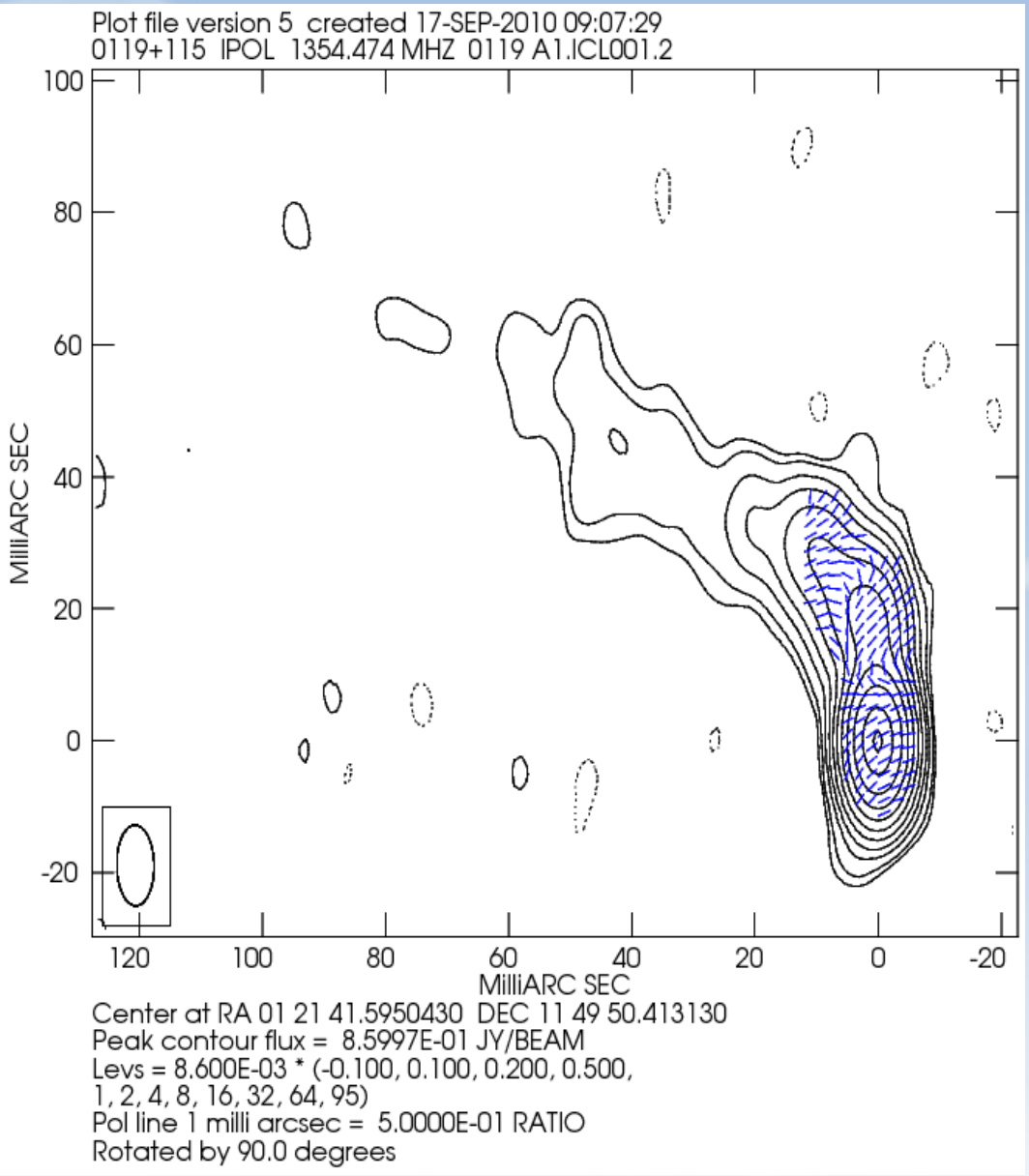


Unusual Behaviour in J0121+1149

Compare to previous observations



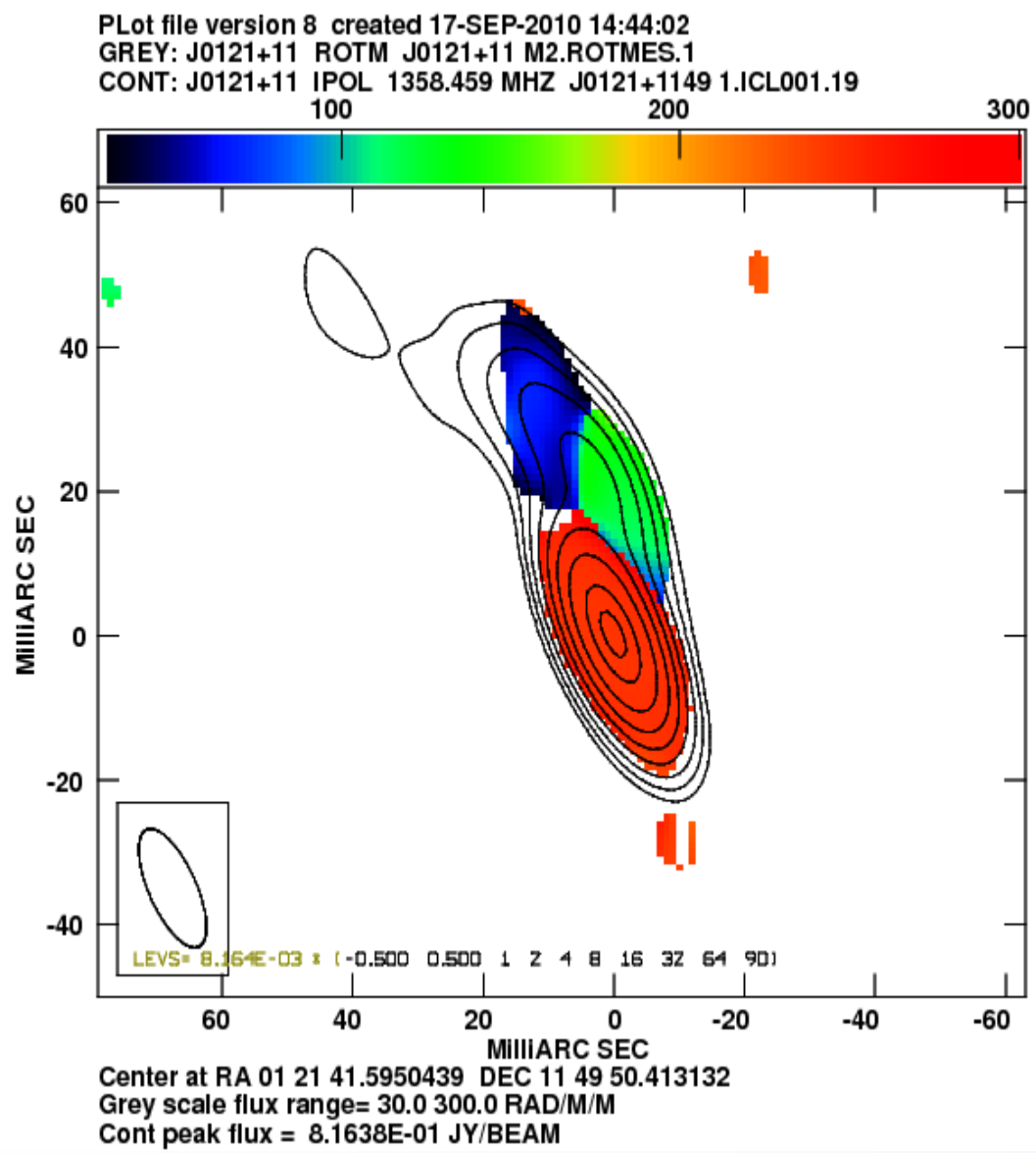
May 2010

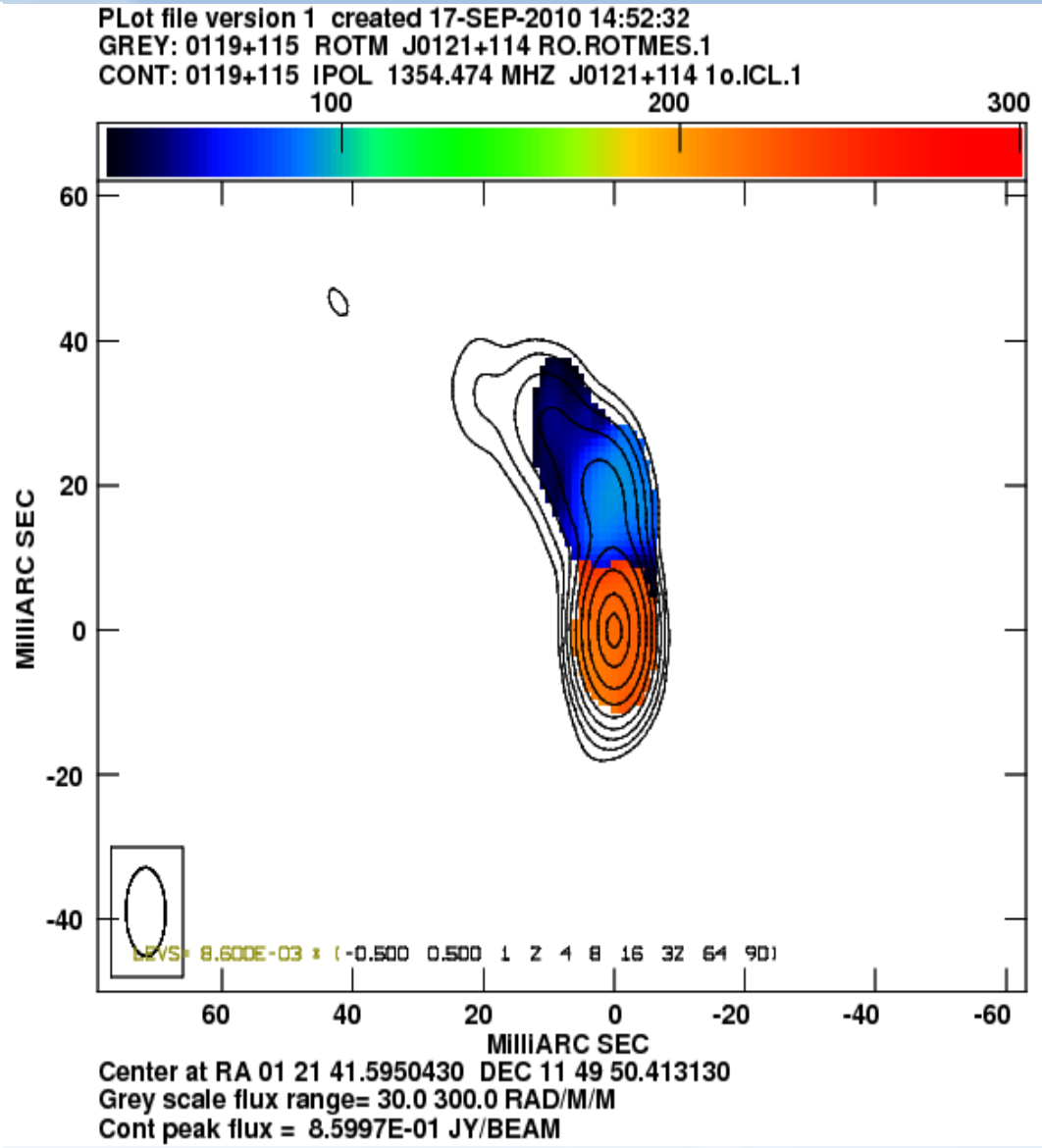


Jan 2004

Unusual Behaviour in J0121+1149

Compare to previous observations





May 2010

Jan 2004

Summary

- 18-22cm VLBA observations well suited to AGN jets on scales out to 10s or 100s of parsecs
- First 3 epochs of 9 observed, calibrated and imaged; data are healthy; analysis for some interesting sources begun
- Plan is to provide calibrated data and images to the community within 1.5 years after last observations are taken, via the MOJAVE website:

https://www.physics.purdue.edu/astro/mojave/

- Webpage for this project:

http://www.physics.ucc.ie/gabuzda/webpage.html

Thanks for listening

Questions?

Comments?