The odd-looking GPS quasar 0858-279

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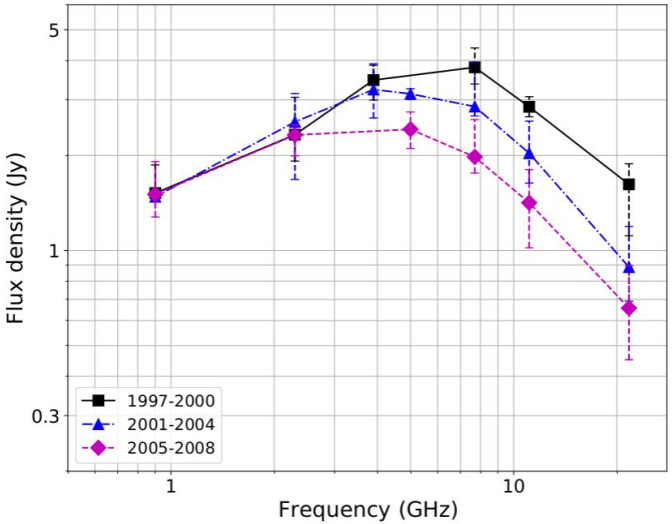
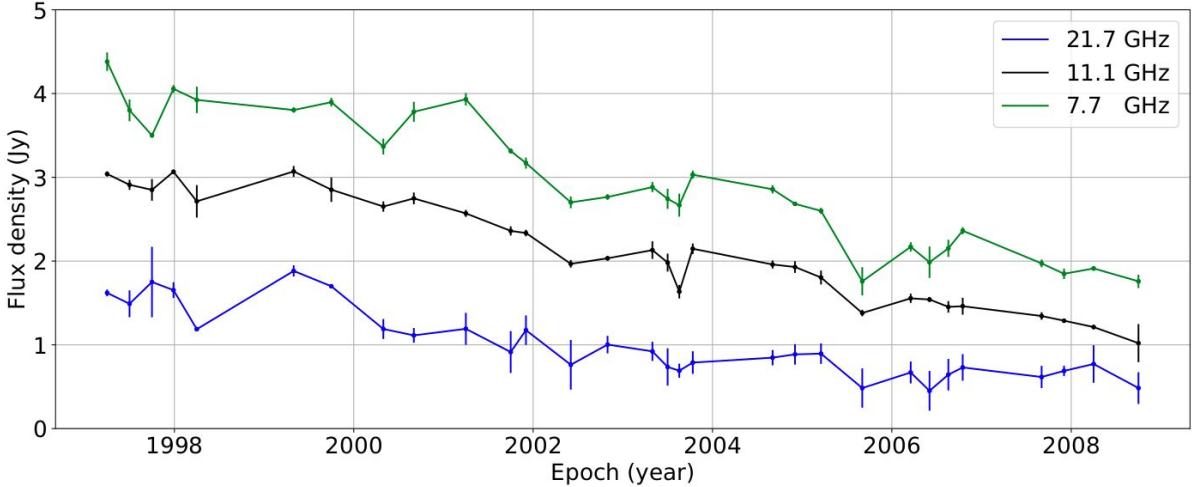
0858–279 spectrum and light curve



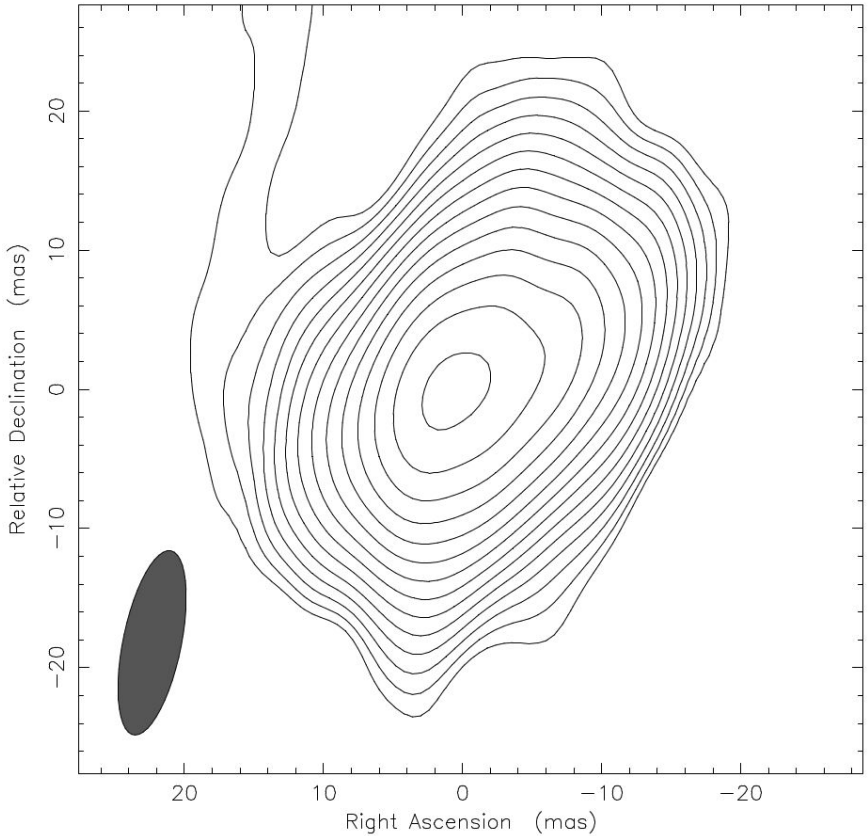


Multi-epoch radio spectrum (on the left) and multi-frequency light curve (on the right), RATAN-600 data.

0858–279 peculiarities

Extended structure (12 mas, 95 pc)

Short variability timescale (~months)



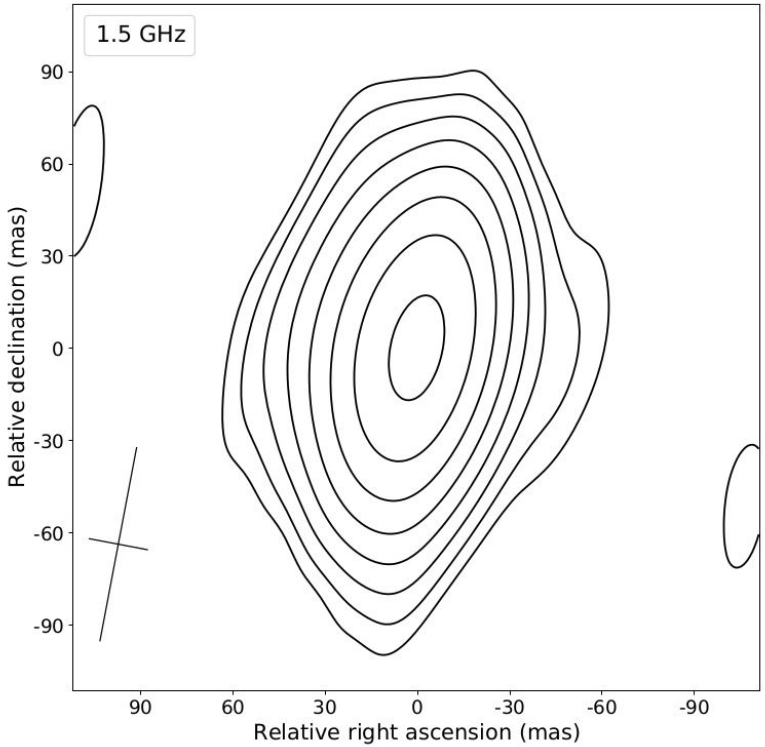
VLBA Calibrator Search program image at 2.2 GHz

Observations

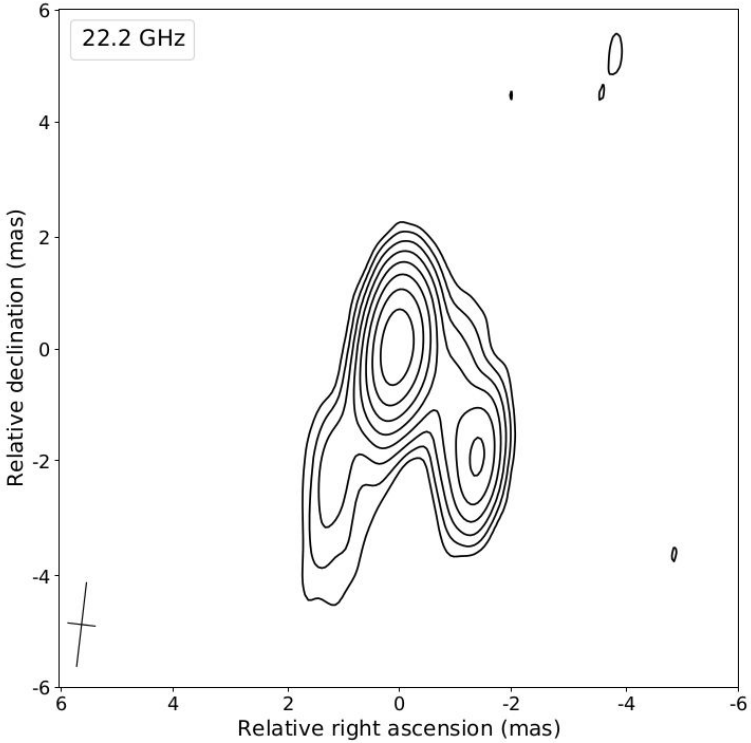
RATAN-600, 8 frequencies, 1997-2020

VLBA, 6 frequencies, 2005 Nov

Stokes I maps

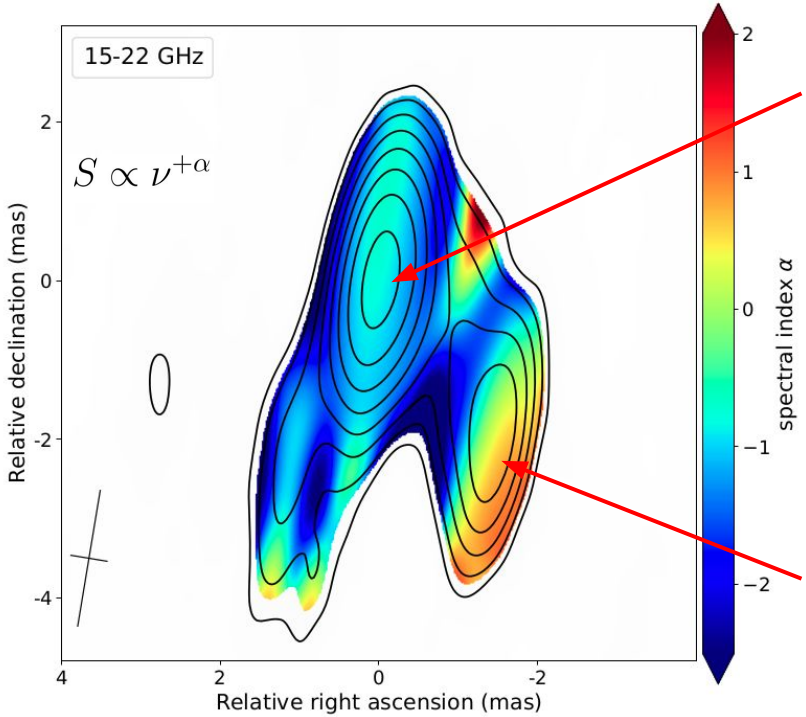


Total intensity map at 1.5 GHz

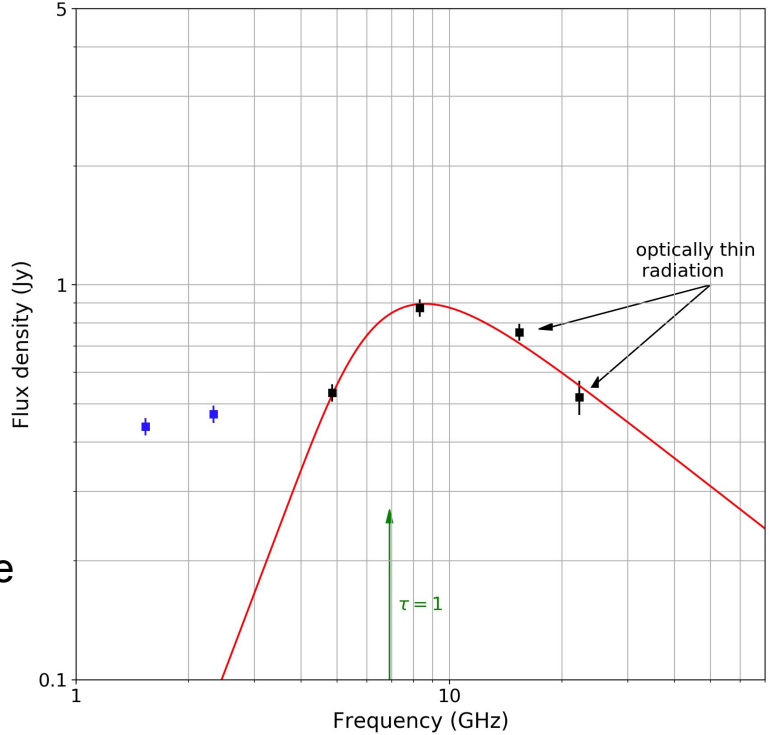


Total intensity map at 22.2 GHz

Parsec-scale spectral properties and magnetic field estimation

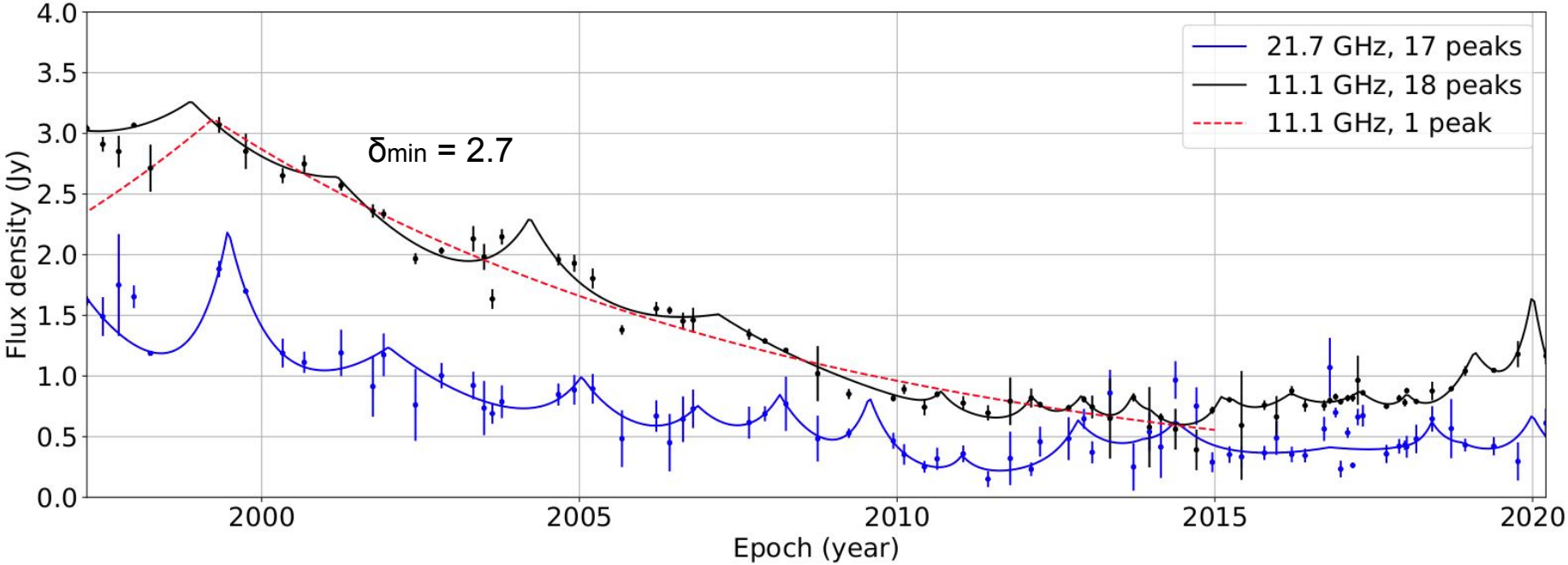


Spectral index maps for 15 and 22 GHz



Homogeneous synchrotron source model B = (0.55 ± 0.37)δ G

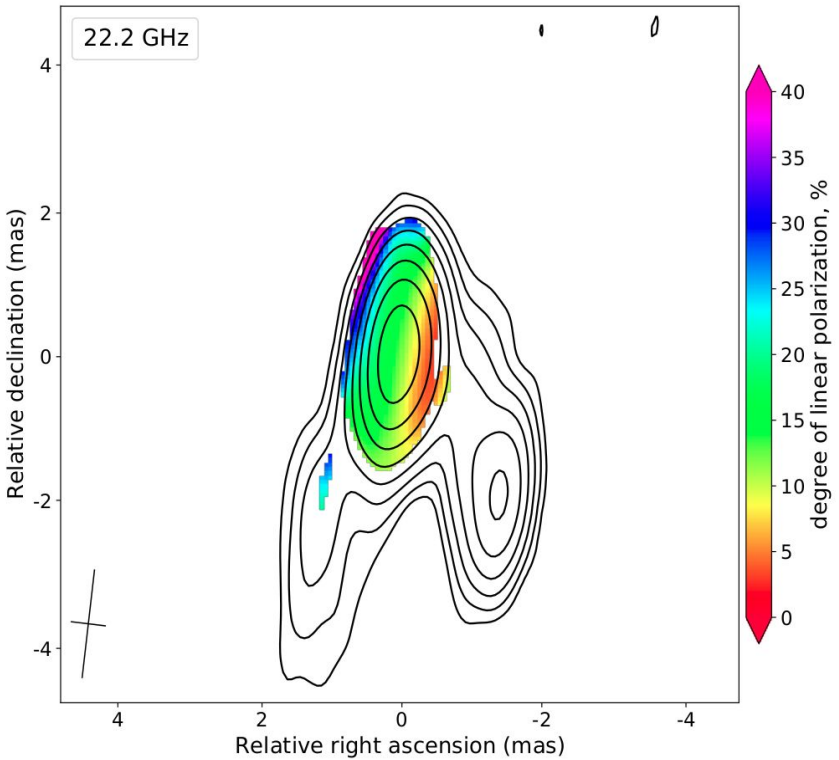
Variability Doppler factor

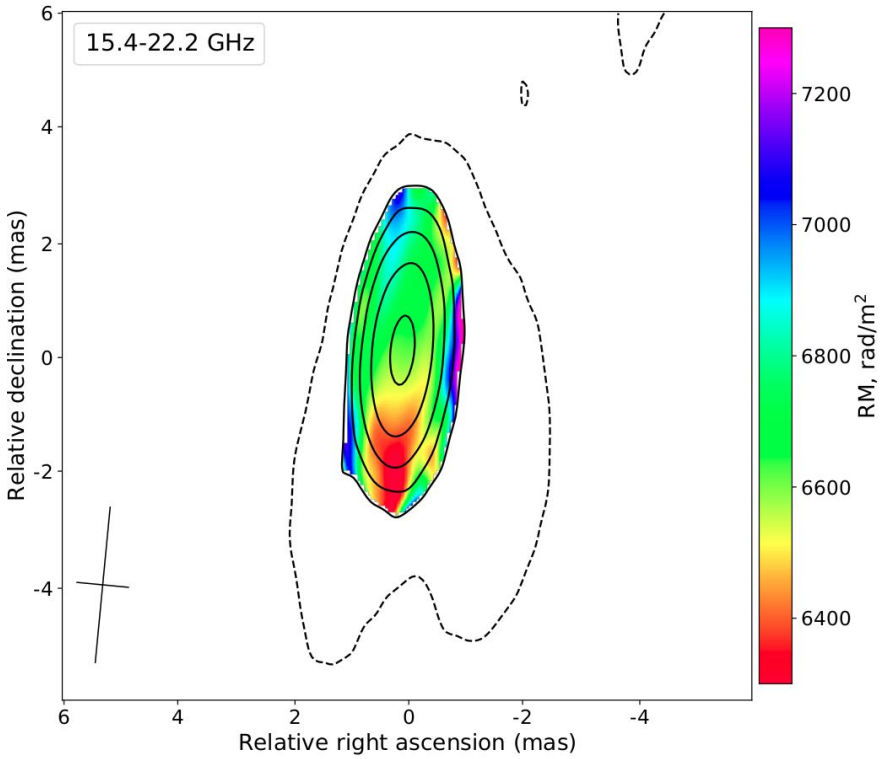


Flares were modeled using the exponential form (e.g., Valtaoja et al. 1999)

$\delta = 5.8 \pm 3.4$ → $B \approx 3$ G

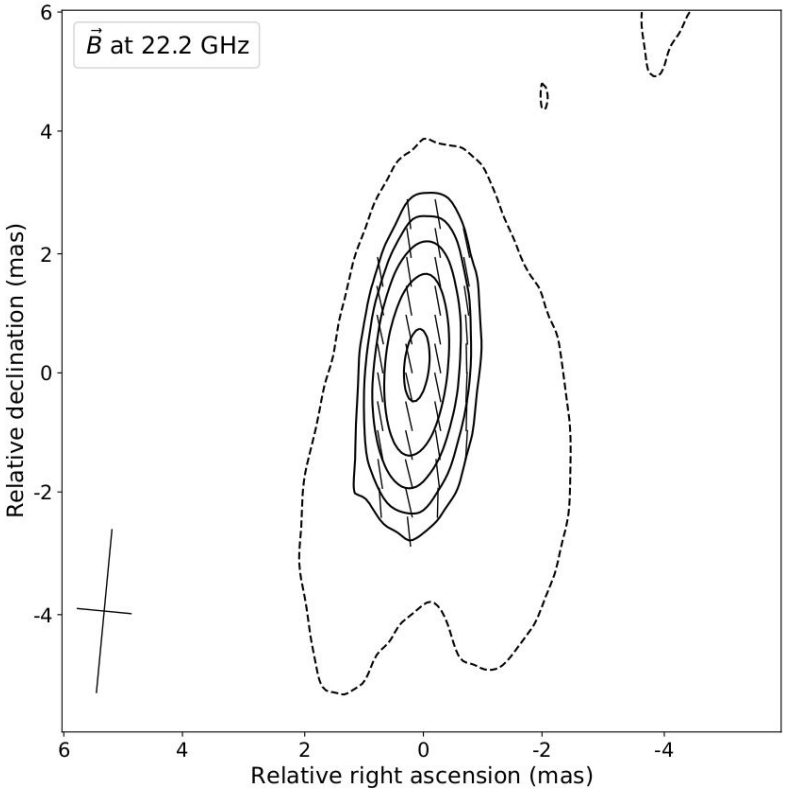
Polarization properties





Fractional polarization map at 22.2 GHz (on the left) and rotation measure map for 15.4-22.2 GHz (on the right)

Magnetic field structure



Magnetic field direction at 22.2 GHz

- Corrected for Faraday rotation
- Corrected by 90° at 22 and 15 GHz due to opacity
- Coincided at lowest and highest frequencies within the errors
- Perpendicular to the jet propagation

Core magnetic field estimation

Standing shock wave

⇩

Magnetic field behind the shock front

⇩

Magnetic flux conservation

⇩

$B_{core} \approx 0.3$ G

Core-shift approach

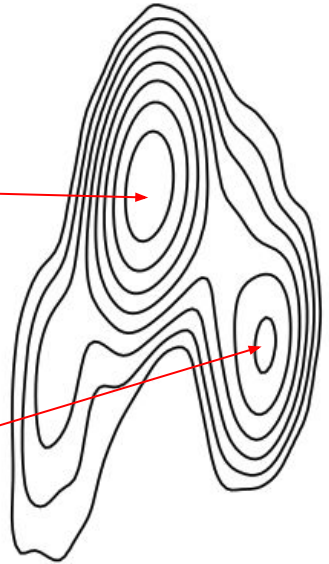
$\Delta r_{15\text{-}22GHz} = 0.06 \pm 0.03$ mas

⇩

$B_{core} \approx 0.2$ G

$B_{jet} \approx 3$ G

B_{core}



Summary

Magnetic field structure

Observed bend

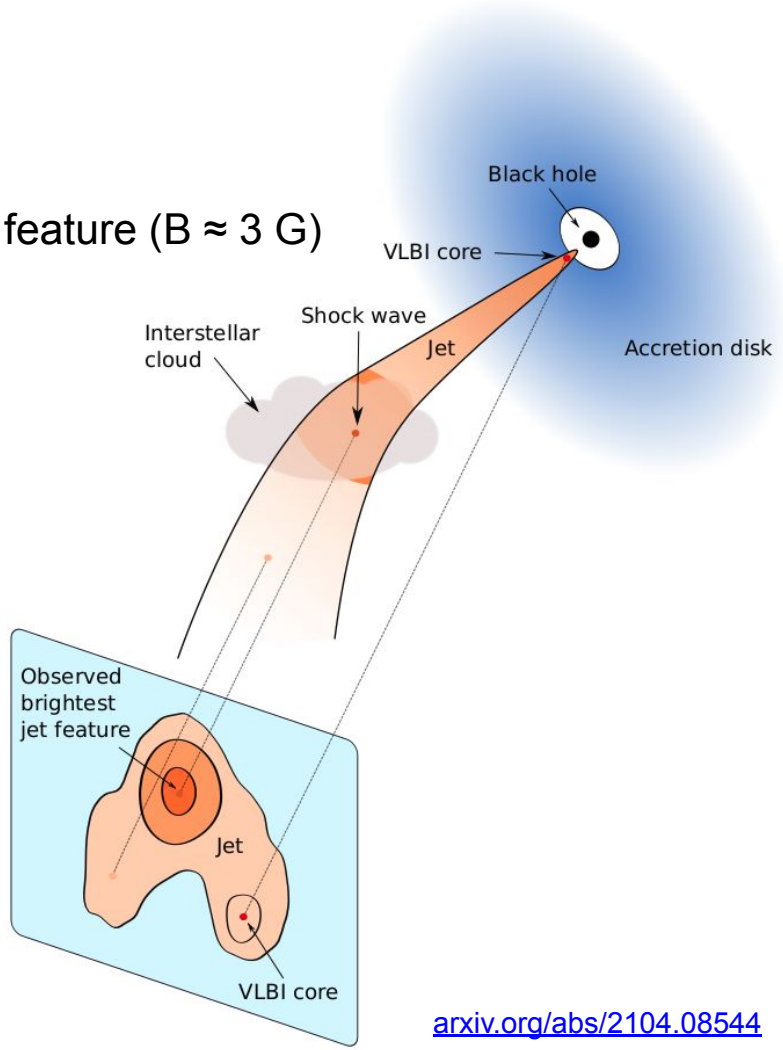
Magnetic field in the brightest jet feature (B ≈ 3 G)

High RM values (>6000 rad/m^2)

Shock wave

Core magnetic field (B ≈ 0.2 G)

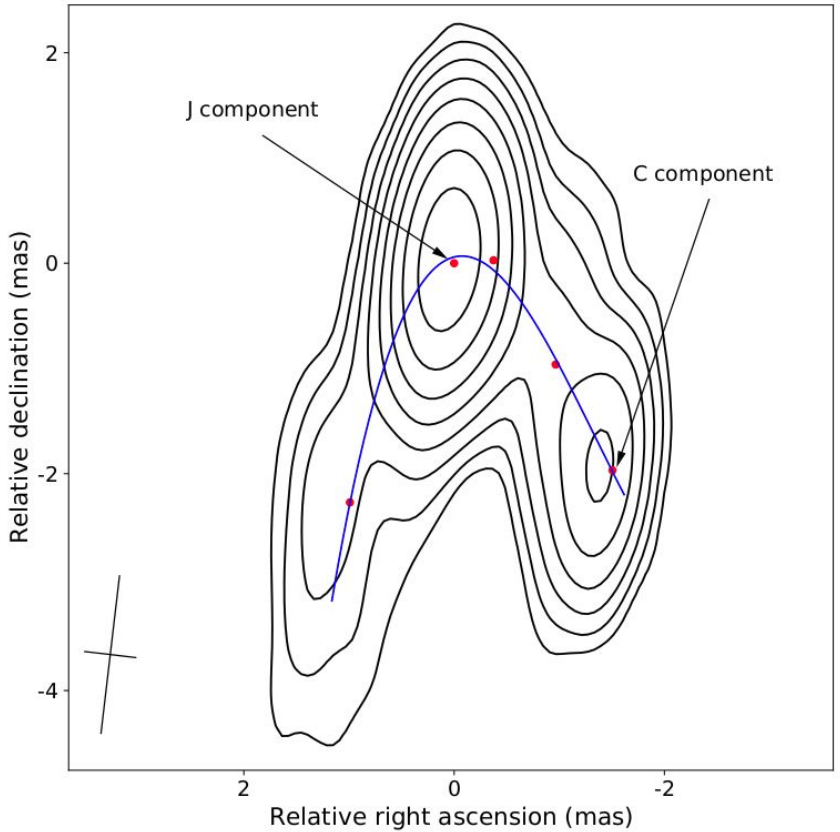
Core-shift approach



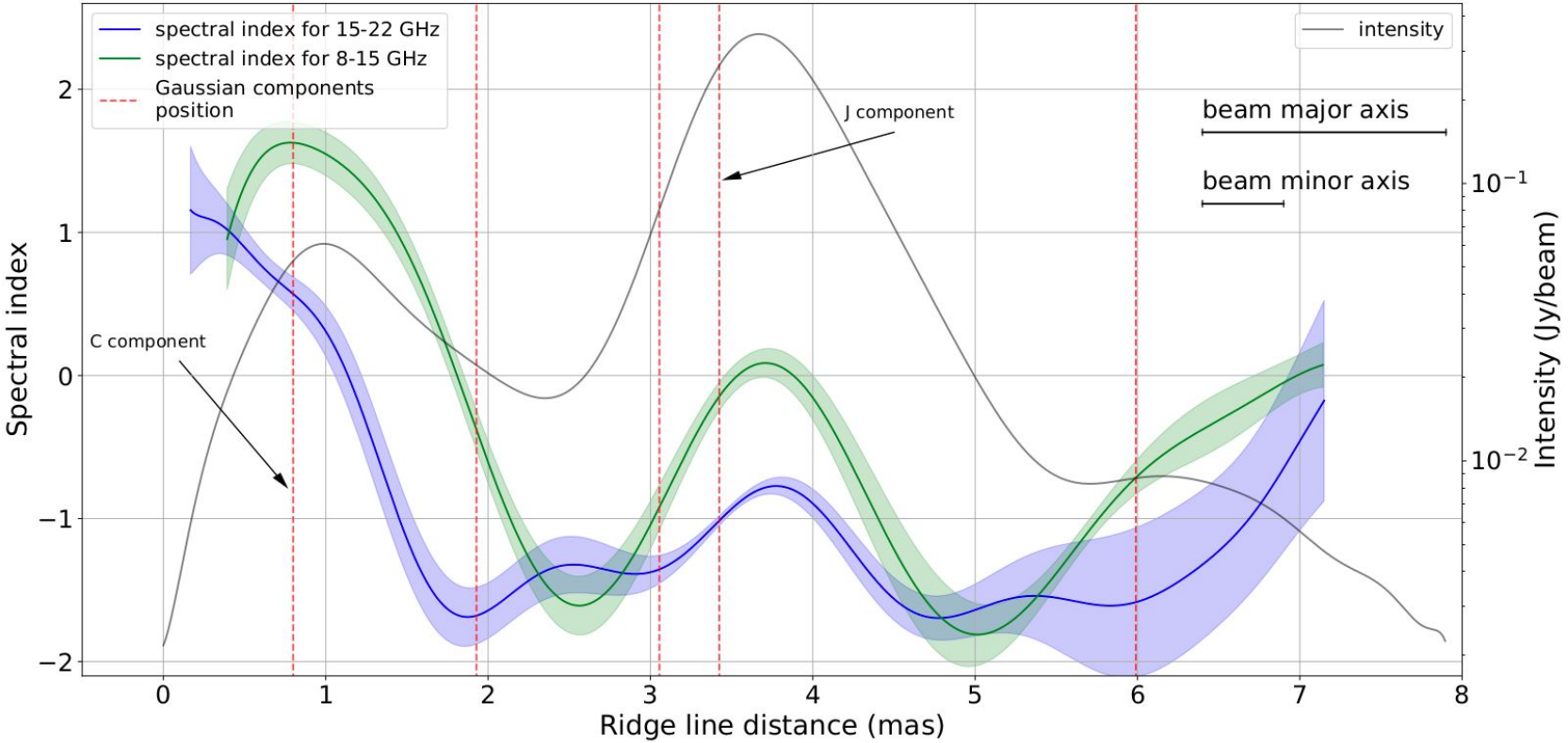
arxiv.org/abs/2104.08544

Ridge line

Ridge line at 22 GHz
Red dots show the locations of peaks of Gaussian components

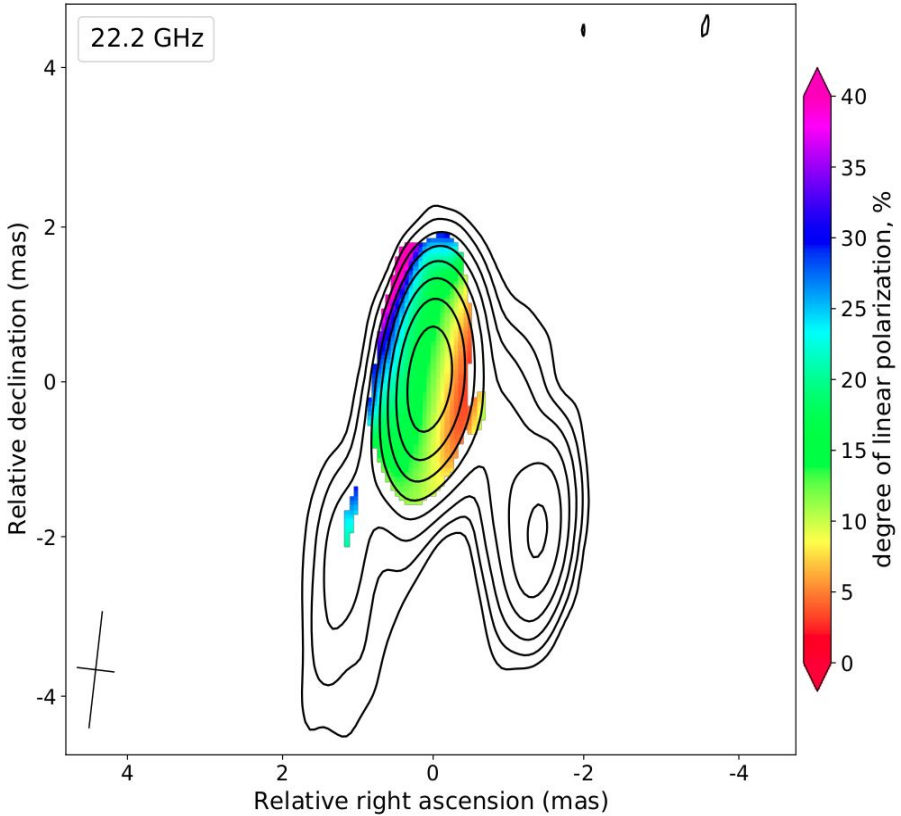


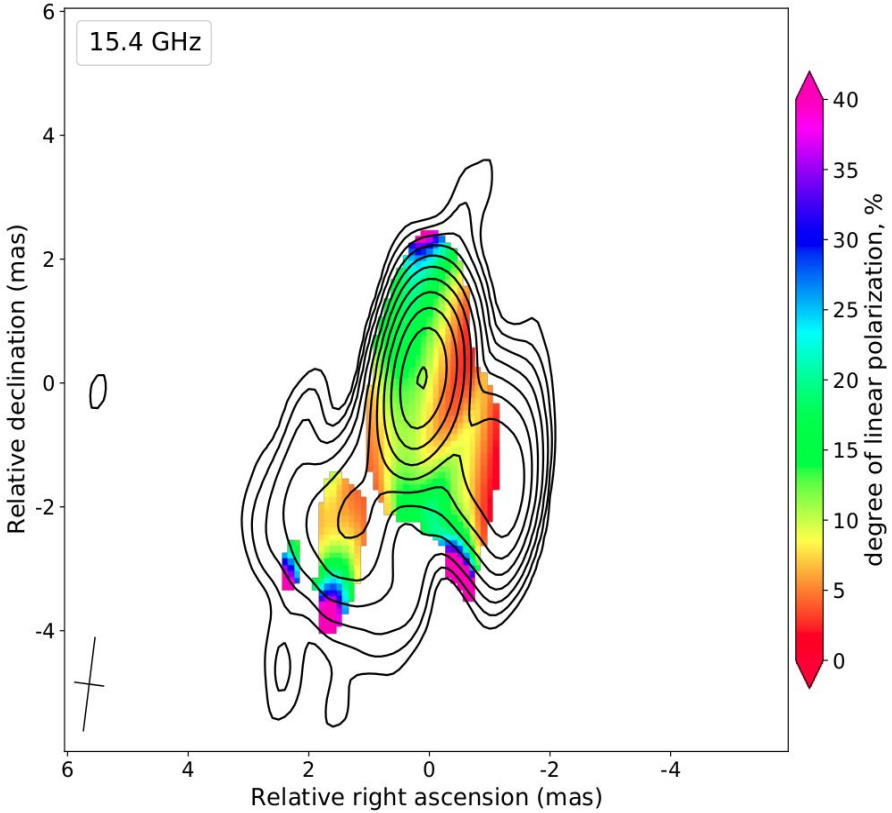
Spectral index distribution along the ridge line



Spectral index distribution for 22-15 GHz (blue), 15-8 GHz (green), intensity distribution (grey)
Red lines show the locations of peaks of Gaussian components

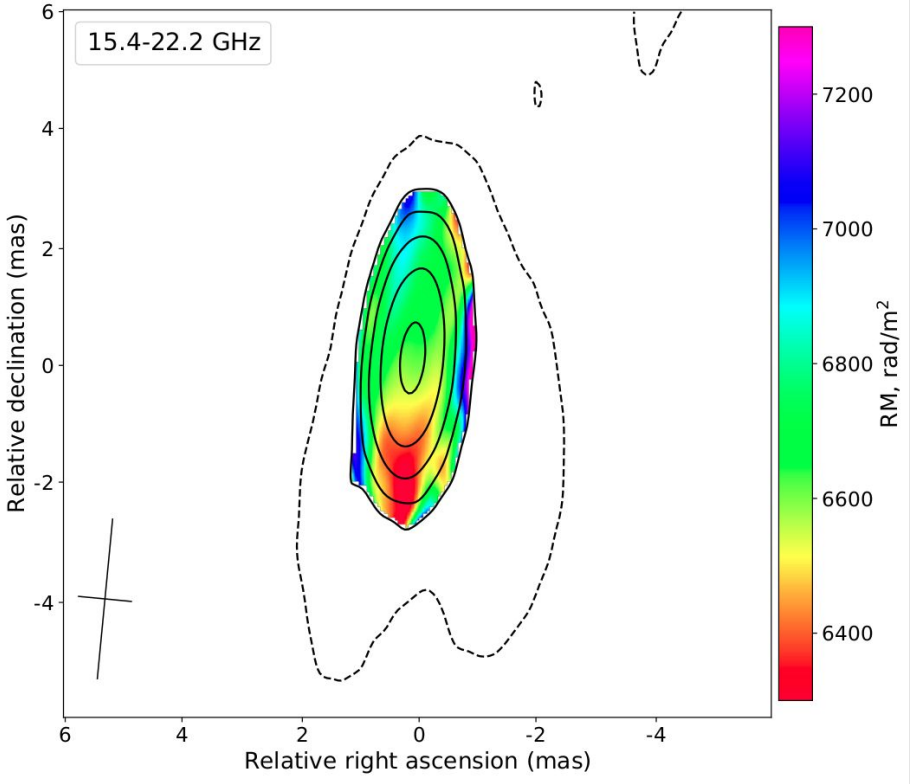
Degree of linear polarization

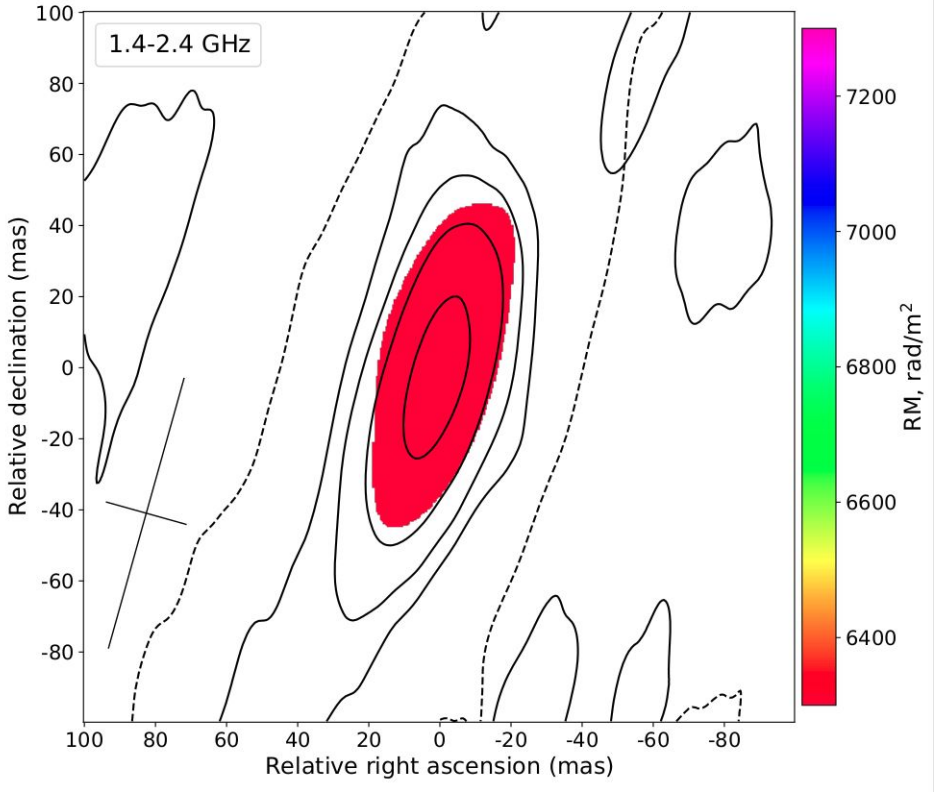




Fractional polarization maps at 22.2 GHz (on the left), 15.4 GHz (on the right)

Rotation measure





Rotation measure maps for 15.4-22.2 GHz (on the left) and 1.4-2.4 GHz (on the right)