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VLBA $\lambda\lambda 6, 4$ cm Polarimetry of Vir A

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Abstract.
The results of polarimetric $\lambda\lambda 6, 4$ cm VLBA observations of the inner 5 pc of the jet and core of Vir A (3C274, J1230+1223) are reported. At $\lambda 4$ cm, the core and the inner parsec are unpolarized and there is evidence for ordered magnetic fields and large RM gradients at larger distances.

1. Introduction

The nearby (D= 14.7 Mpc), E0p galaxy M87 is the host for the bright radio source Virgo A ($\equiv$ 3C274). This galaxy contains the prototypical extragalactic jet which appears to be formed within a few tens of Schwarzchild radii (Junor & Biretta, 1995; Junor, Biretta & Livio, 1999) of the $3 \times 10^9\, M_\odot$ black hole (Harms et al. 1994). Collimation of the jet occurs over a 10^3 range of scales and is not complete until a few parsecs from the central "engine". Centimetric VLBI images show a ≈ 200 mas-long jet (≈ 20 pc) in a well-defined position angle of 290.5° (N through E). There are several knots of emission and clear evidence of limb-brightening along the length of the VLBI jet (Biretta & Junor, 1995; Junor et al., 2000).

2. Observations and Results

3C274 was observed with the VLBA at X-band (8.4 GHz) on 22 November 1995 and C-band on 9 December 1995 for $\approx$11 hours at each band. VLBA observing mode 128-8-1 was used. In each of the 4 discrete, 8 MHz wide, sub-bands, 2 BBCs handled RCP, LCP signals separately. The sub-band centers were at 8106.5, 8204.5, 8424.5 and 8594.5 MHz at X band and 4706.5, 4764.5, 4894.5 and 4994.5 MHz at C band. 1-bit (2-level) sampling was employed. The total recorded bandwidth is 64 MHz.

Naturally-weighted images in all 4 Stokes' parameters in each IF in each band were constructed from calibrated data. No linearly-polarized emission was

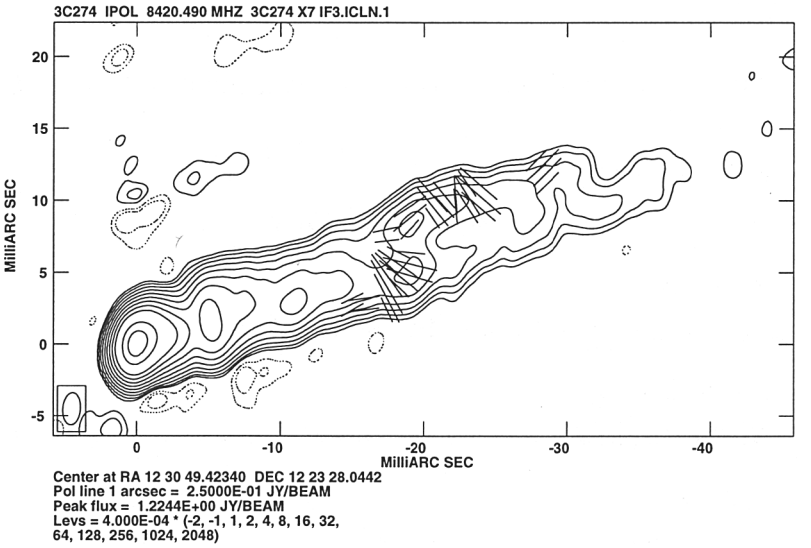

Figure 1. Naturally-weighted image of the inner 3 pc of 3C274 at 8.420 GHz. The restoring beam is 2.25 mas×1.23 mas in PA= −4.61°. The noise floor is at 100 μ Jy beam^{-1}. Unrotated, linear polarization **E** vectors are superimposed on the contour images.

seen in any of the C band images. The Figure shows the linear polarization image for X band IF3. Polarization is distributed unevenly; this may be evidence for a patchy foreground screen. The jet is limb-brightened and emission is detected to ≈42 mas from the core. The average value of the fractional polarization in the signal areas is 11.5 %. Fractional polarization of the core is < 0.1%.

There is a broad range of rotation measures — between −2000 and −12000 rad m^{-2} — with an average of −4380 rad m^{-2}. The rotation is intrinsic to M87 since the Galactic contribution is ≈ 10 rad m^{-2} in this direction. There is no obvious trend of rotation measure with increasing distance from the core. There may be a rotation measure gradient across the jet of ∼ 10^4 rad m^{-2} parsec^{-1}.

The rotation appears to follow a λ^2-law over the limited range in wavelength. However, the limited nature of the sampling makes it difficult to determine the location of the magneto-ionic screen. The current analysis of recent VLBA U band data will likely help us understand the physics better.

References

Biretta, J.A. and Junor, W. 1995, Proc.Nat.Acad.Sci. USA, 92, 11364

Harms, R.J. et al. 1995, ApJ, 435, L27

Junor, W. and Biretta, J.A. 1995, AJ, 109, 500

Junor, W., Biretta, J.A. and Livio, M. 1999, Nature, 401, 891

Junor, W. et al., 2000, in *Astrophysical Phenomena as Revealed by Space VLBI, eds.*, Hirabayashi, H., Edwards, P.G., and Murphy, D.W., (Tokyo: ISAS), 13

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