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VLBA and MERLIN Polarization Observations of Compact Steep-Spectrum Sources

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Abstract. A few compact steep-spectrum sources (CSSs) have been observed with the VLBA at 8.4 GHz and MERLIN at 5 GHz to study the possible dynamical interaction between jets and the ambient media suggested by previous measurements of the rotation measures.

1. Introduction

Radio polarization observations of CSSs show that several sources are significantly polarized and display strong depolarization at lower frequencies (Saikia 1991). The median polarization, however, increases with frequency (Saikia 1995) suggesting that this is due to Faraday depolarization. A number of sources have very large rotation measure (RM $>$ 1000rad/m^2; Taylor et al. 1992, Mantovani et al. 1994) strongly suggesting the presence of dense, ionized gas. Subarcsecond scale and milli-arcsecond scale images have also revealed that CSSs often show strongly distorted structures with recognizable jet-like features (Fanti et al. 1986; Spencer et al. 1991) consistent with strong dynamical interactions between the jet and the ambient media. In addition, an increased asymmetry in the location of the outer components also suggests that the components are evolving through a dense asymmetric environment in the central region of the host galaxies (Sanghera et al. 1995; Saikia et al. 1995).

2. Observations and Preliminary Results

To study these interactions in greater detail we have made VLBA and MERLIN polarimetric observations of a few CSSs from a list of objects with reasonable degrees of polarized emission, decreasing polarization percentages towards lower frequencies and high values of RM. The sources 0114–211, 3C 43, 0548+165, OQ 172, 1524–136, have been observed with the VLBA+VLA1 at 8.4 GHz in the basic recording mode 128-8-1. Two of them, namely 0114–211 and 1524–136, were also observed with MERLIN at 5 GHz. The data analysis has been performed in the *AIPS* package.

The majority of the source structures are dominated by jet emission. Most of the polarized emission also comes from the jets. The polarized features have fractional polarizations as high as 20%. The distribution of the magnetic field in general nicely follows the jet axis. The source 0114–211, which is the only source with a lobe-dominated structure, was detected on the VLBA shortest baselines only. The jet emission might be brightened either by Doppler boosting or by such an interaction. These observations support a model in which there is an interaction between the jet and the ambient gas. In a complete sample of CSSs, $\sim$ 30% of the objects are jet-dominated (Fanti et al. 1995). Since few CSSs are known as superluminal sources, the interaction is required to account for jet-dominated objects. Moreover, most of these CSSs show large bends in the jet. This also might be the result of an interaction with dense gas clouds. Statistical considerations do show that there is a reasonably-high probability (1–10%) of a collision between a jet and a NLR cloud (Mantovani et al. 1996).

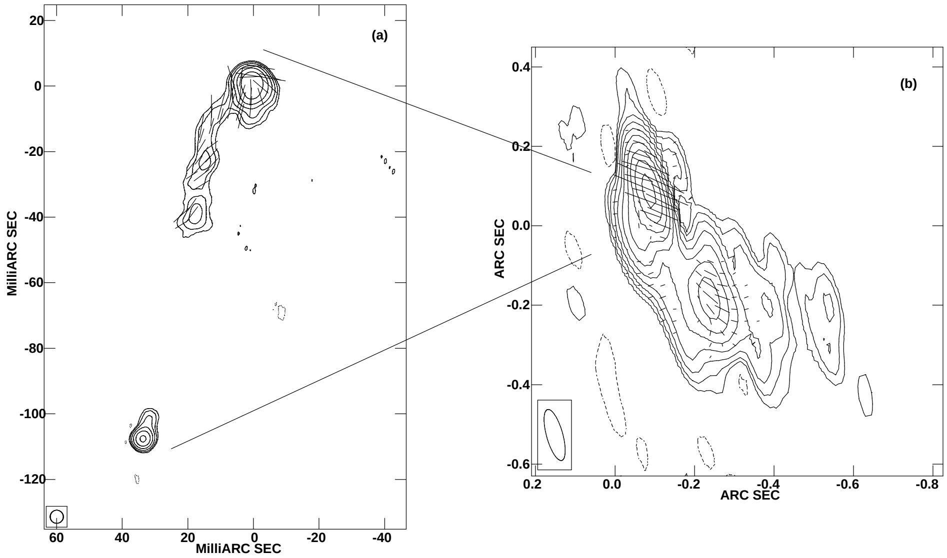

Figure 1. *a)* VLBA image at 8.4 GHz and *b)* MERLIN image at 5 GHz of 1524–136.

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References

Fanti, C., et al. 1995. *A&A*, **302**, 317–326.

Fanti, C., et al. 1986. *A&A*, **170**, 10–19.

Mantovani, F., et al. 1994. *A&A*, **292**, 59–66.

Mantovani, F., et al. 1996. in *The Second Workshop on CSSs and GPSs*, eds. I. A. G. Snellen, R. T. Schilizzi, H. J. A. Röttgering, & M. N. Bremer (Leiden: JIVE), 216–221.

Saikia, D. J. 1991. in *CSSs and GPSs*, eds. C. Fanti, R. Fanti, C. P. O'Dea, & R. T. Schilizzi (CNR–Ist. di Radioastronomia), 12–16.

Saikia, D. J. 1995. *Proc. National Academy of Sciences*, vol.**92**, 11417–11421.

Saikia, D. J. 1995. *MNRAS*, **276**, 1215–1223.

Sanghera, H. S. et al. 1995. *A&A*, **295**, 629–645.

Spencer, R. E. et al. 1991. *MNRAS*, **250**, 225–240.

Taylor, G. B., Inoue, M., & Tabara, H. 1992. *A&A*, **264**, 421–427.