Bull. Astr. Soc. India (2003) **31**, 441–442

Polarization Asymmetry in CSS Sources

D.J. Saikia, Neeraj Gupta
National Centre for Radio Astrophysics, TIFR, Pune 411 007, India

Abstract. We show that the compact steep spectrum sources are more asymmetric in the polarization of the outer lobes compared with the more extended ones. This could be due to interaction of the jets with infalling material, which fuels the radio source. The CSS sources show no dependence of the polarization asymmetry on redshift, suggesting that the environments on the CSS scales are similar at different redshifts. However, the polarization asymmetry of the oppositely-directed lobes is larger at higher redshifts for the more extended sources, possibly reflecting the higher incidence of interactions in the past.

Keywords : galaxies: active – galaxies: nuclei – radio continuum: galaxies

1. Introduction

Compact steep-spectrum sources (CSSs) defined to be $\lesssim$20 kpc in a Universe with q_0=0 and H_0=100 km s^{-1} Mpc^{-1}, are believed to be young objects with ages $\lesssim 10^6$ yr. They are the progenitors of the standard FRII radio sources. However, CSSs tend to be more asymmetric in both brightness and location of the outer radio components compared with the larger sources (Saikia et al. 2002 and references therein). These authors have speculated that these asymmetries might be due to interaction of the oppositely-directed radio lobes with the infalling gas. We attempt to probe this infalling gas which fuels the AGN using λ2-6cm polarimetric measurements of a sample of CSSs.

2. Results and Discussion

The radio images of some of the CSSs used in this study are shown in Fig. 1. The ratio of the degree of polarization of the oppositely-directed lobes, r_m, is higher for the CSSs compared with the larger sources at a significance level of >99.9% (Fig. 2). The median value of r_m for the CSSs is ~5 compared with ~1.5 for the larger objects. The higher degree of polarization asymmetry could be caused by Faraday depolarization, as well as compression of magnetic fields as the jets interact with the infalling gas.

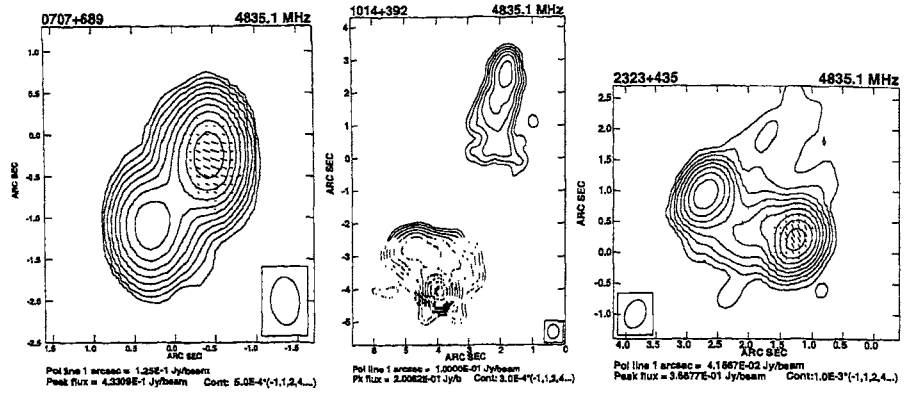

Figure 1. The CSS sources at 4835 MHz with the polarization E-vectors superimposed on the total-intensity contours. The peak brightness and contour levels are given below each image.

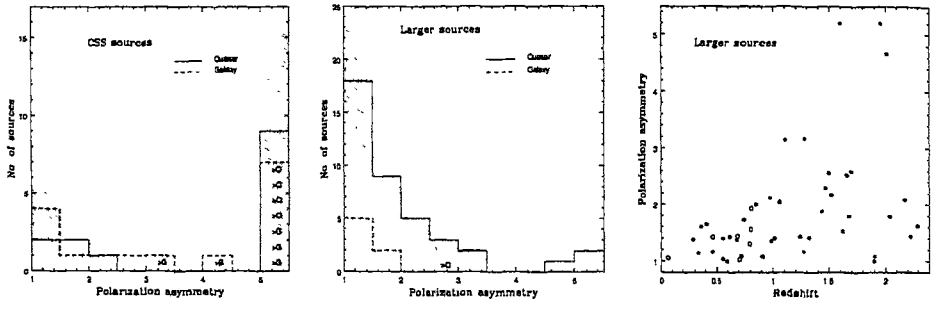

Figure 2. The distributions of r_m for the CSS and larger sources. All the sources with r_m >5 have been placed in the last bin. The distributions for the entire sample are shown shaded. The r_m-redshift diagram for the large sources is shown in the right panel.

HST studies of distant galaxies suggest a larger incidence of interactions and mergers in the past. We examine evidence of this from our observations of polarization asymmetry. The r_m values for the CSS sources, which are on subgalactic scales, show no significant dependence on redshift. However, for the sources >20 kpc, r_m tends to be significantly larger at higher redshifts. The median value of r_m is ~1.4 for the low-redshift (z<1) sources and ~2 for the high-redshift (z>1) objects (Fig. 2). A Kolmogorov-Smirnov test shows the low- and high-redshift distributions to be different at a significance level of >99 per cent (see Saikia & Gupta 2003).

References

Saikia, D.J., et al. 2002, *A&A*, **391**, 149.
Saikia, D.J. and Gupta, N., 2003, *A&A*, **405**, 499 (astro-ph/0304532).