EXTREME DEPOLARIZATION IN COMPACT STEEP SPECTRUM SOURCES

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Compact steep spectrum (CSS) sources show all the features of the powerful extended radio galaxies and quasars but on a scale at least ten times smaller. The debate continues over whether this is primarily due to a difference in age or the result of denser gas surrounding CSS sources (Fanti et al. 1990); although two of the most recent investigations favour the view that CSS sources are young (Readhead et al. and Fanti et al., these proceedings)

Radio polarization observations offer a powerful probe of the environments of radio sources and there have been several suggestions that Faraday effects in CSS sources may be particularly strong (eg van Breugel et al. 1984, Kato et al. 1987). We have observed almost all of the CSS sources in the 3C sample with the VLA at 8.4 GHz (Akujor and Garrington 1995). We find that the degree of polarization of the CSS components is very low (median value 2 – 3%) compared with more extended sources (eg Garrington et al 1991). By combining new and published observations at 15 GHz (eg van Breugel et al. 1992) we find that about half of the components show significant Faraday depolarization between 8 and 15 GHz. About one quarter of the components are unpolarized at both 8.4 and 15 GHz. New observations at 22 GHz reveal higher polarization in most cases, confirming that these are indeed cases of extreme depolarization.

CSS sources show some of the most striking examples of depolarization asymmetry. In the radio galaxy 3C67, the northern lobe depolarizes slowly between 8.4 and 1.5 GHz, while the southern lobe is completely depolarized at all frequencies below 22 GHz (Figure 1). The CSS sources follow the trends first established in more extended sources for the depolarization to be stronger in the lobe which is closer to the radio nucleus and/or opposite a

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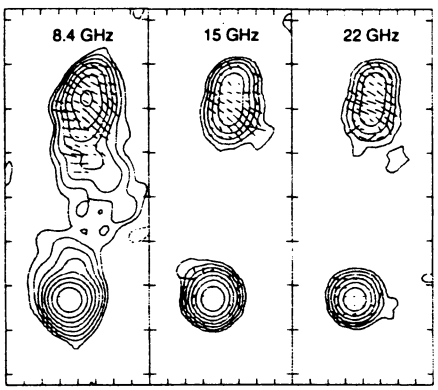
one-sided radio jet (see Laing, these proceedings, for a review). This implies that the CSS sources are not deeply embedded in the depolarizing gas.

In the CSS sources the Faraday dispersion $\Delta \sim 2500$ cm$^{-3}\mu$Gpc, roughly 30 times larger than typical extended sources (Garrington and Conway 1991) From the estimates of Δ we estimate the product of the thermal electron density and magnetic field strength $nB \sim 1$ cm$^{-3}\mu$G surrounding the CSS sources. The CSS sources lie on the established trend for smaller sources to show stronger depolarization. If CSS sources are simply young then we would expect all sources to have intrinsically similar environments. In this case Figure 2 may simply represent the radial decline of the density of this environment; we estimate $n(r) \propto r^{(-1.1\pm0.1)}$ following Garrington and Conway (1991). This is similar to the radial density decline required in the models of Readhead et al. to explain the high incidence of CSS sources by their increased luminosities while they are expanding through denser gas.



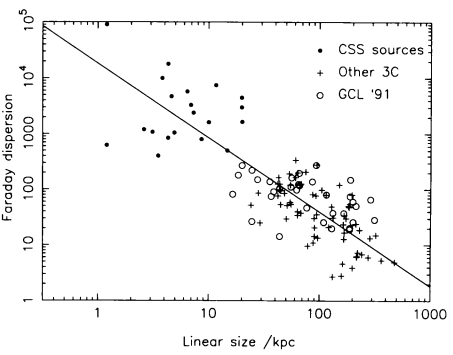


Figure 1. Left: the radio galaxy 3C67: Vectors show the fractional polarization (1 arcsec = 100%)

Figure 2. Right: plot of average Faraday dispersion in cm$^{-3}\mu$Gpc against source linear size for CSS and extended sources.

References

Akujor, C.E. & Garrington, S.T. 1995, *A&AS*, **112**, 235
Garrington, S.T. & Conway, R.G. 1991, *MNRAS*, **250**, 198
Garrington, S.T. et al. 1991, *MNRAS*, **250**, 171
Kato, T. et al. 1987, *Nature*, **329**, 223
van Breugel, W.M.J., Miley, G. & Heckman, T. 1984, *AJ*, 5
van Breugel, W.M.J. et al. 1992, *A&A*, **256**, 56

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