THE JETS IN FRII RADIO GALAXIES WITH $Z < 0.3$

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1. Introduction

If we believe that jets trace the energy transport in radio sources, we might in principle expect to see them in every classical double radio galaxy with compact hot spots. Until recently the detection rate of jets in FRII radio galaxies has been low, although most FRII quasars have bright one-sided jets. However, it seems likely that this is due to lack of sensitivity. Black *et al.* (1992) found jets in up to 70% of a sample of FRII galaxies with $z < 0.15$. We have observed the FRII sources in Laing *et al.* (1983) with $0.15 < z < 0.3$ and discuss results from the combined samples.

2. Observations and results

The sources in the $z < 0.15$ sample were observed at 8 GHz with the VLA as described in Black *et al.*. The sources in the $0.15 < z < 0.3$ were also observed at 8 GHz with the VLA; this choice of frequency gives high sensitivity and resolution. Multi-configuration observations were made.

The jet fraction in the combined sample is high: slightly over half have definite jets and a further 20% have probable jets. As figure 1 (left) shows, there is no significant tendency for the jet flux fraction to fall off as a function of luminosity. This confirms that the result of Black *et al.* was not due to the proximity of his sample to the FRI/FRII luminosity boundary. When jet luminosity is plotted against source luminosity, the correlation is significant at the 99% level. There is clearly a large degree of scatter in the relationship, however. Jets are one-sided; there are only two objects in the sample whose jet and counterjet are of similar luminosity, although several fainter counterjets are detected. It appears to be impossible to generate a strong jet without a strong core, but not all sources with strong cores have strong jets (figure 1, right). There is no significant tendency for broad-line

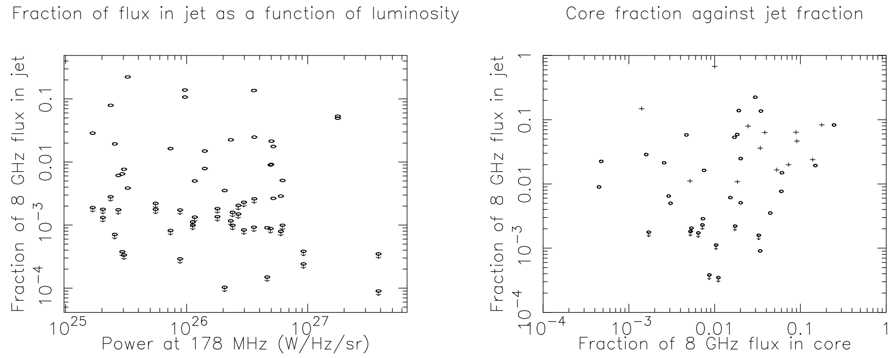

Figure 1. Left: fraction of flux in jet as a function of source luminosity (each lobe plotted individually). Right: fraction of flux in jet as a function of fraction of flux in core (only brightest jet or upper limit plotted). Crosses mark the Bridle *et al.* quasars on the same scale.

radio galaxies to have stronger jets: the very strongest jets in fact come from 'dull' low-emission-line sources (Hine and Longair 1979's class B). If the core is the self-absorbed base of a jet, we would expect core fraction to be an orientation indicator: it is interesting that the thirteen FRII quasars of Bridle *et al.* (1994) lie in the top right of figure 1 (right). Some of the brightly jetted 'dull' FRIIs in the sample may be at small angles to the line of sight in spite of not being identified as quasars.

3. Conclusions

Jets are common in radio galaxies and the luminosity of a jet is broadly correlated with that of the radio source as a whole: thus the jet power is directly related to the power in the beam. The degree of scatter in this relationship must be attributed to some combination of differences in source age, different orientation angles (leading to different effects of relativistic beaming) or large variations in the efficiency of jets. The variation of source age in the sample is probably small. The almost universal one-sidedness of jets suggests that beaming must be significant; however, it is clear that the efficiency of the jet is affected strongly by its environment in particular sources. Work on the statistics of jet sidedness and information on the host galaxies are necessary to allow us to draw quantitative conclusions.

References

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