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The Nature of a Homogeneous Sample of Compact Radio Sources Variable at 151 MHz

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Abstract. Global VLBI snapshot observations at 1.6 GHz (5 EVN + 4 VLBA) of a sample of low-frequency variable (LFV) radio sources found using the Cambridge Low Frequency Synthesis Telescope (CLFST) are presented. Variability at 151 MHz is almost certainly due to propagation effects in our Galaxy (e. g., refractive interstellar scintillation). Theory indicates that only sources with a significant fraction of their low-frequency flux coming from components with angular sizes $\lesssim 30$ mas will show such effects. This is confirmed by the VLBI images.

1. The Sample

The sample (Riley 1993) is unbiased, having no initial spectral, angular size or optical criteria, and so contains a higher proportion of steep-spectrum sources than other samples of LFV sources. It was obtained by monitoring ~ 1100 sources with flux densities > 0.3 Jy over a period of 13 years using the CLFST. About 5% of these sources were found to be significantly variable.

The compact steep-spectrum (CSS) sources in the LFV sample are significantly different to other CSS samples (e. g., Sanghera et al. 1995) in having smaller angular sizes, flatter low-frequency spectra and steeper high-frequency spectra. The VLBI images show very complex structure in some of the sources, primarily those with steep high-frequency spectra. There are few simple double sources in the sample, in contrast to the sample of CSS sources studied by Fanti et al. (1995) which contains many such sources. The structures and spectra of the sources suggest that many of them are small due to being frustrated by a dense surrounding ISM, rather than being the precursors of large double radio sources, as appears to be the case for most of the sources in other CSS samples.

A selection of source maps is given in Figure 1.

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References

Fanti, C. et al., 1995. *A&A*, **302**, 317–326.
Riley, J. M. 1993. *MNRAS*, **260**, 893–902.
Sanghera, H. S., et al. 1995. *A&A*, **295**, 629–645.

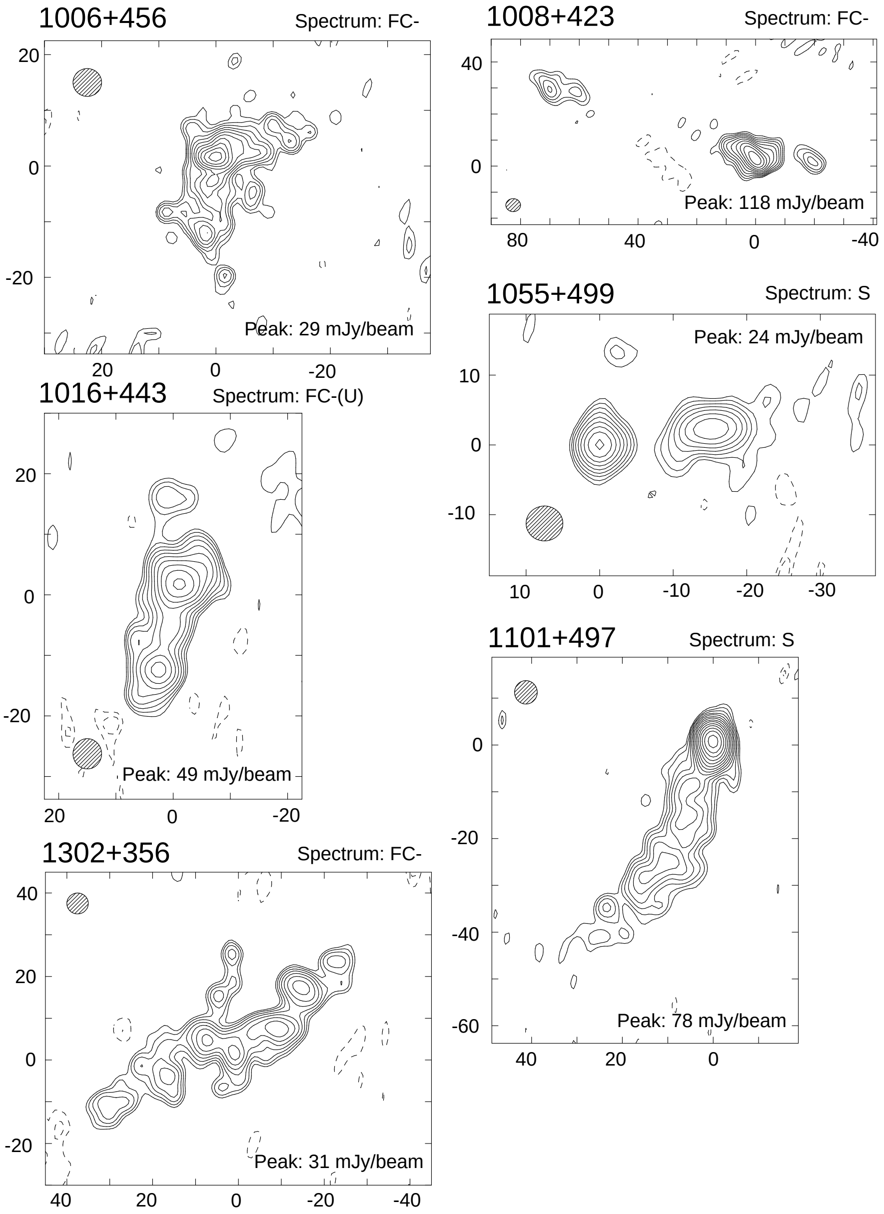

Figure 1. 1.6 GHz Global VLBI images of Low Frequency Variable sources. The angular scales are marked in milliarcseconds relative to the map centers. Contours are logarithmic, with a multiplication factor of $2^{0.5}$ between levels. Starting contours are: 1006+456: $2^{-0.5}$ mJy/beam; 1008+423: 4 mJy/beam; 1016+443: 2 mJy/beam; 1055+499: $2^{0.5}$ mJy/beam; 1101+497: $2^{-0.5}$ mJy/beam; 1302+356: $2^{1.5}$ mJy/beam. Negative contours are dashed, with the same starting level and multiplication factor as the positive contours. Hatched circles indicate the FWHM beam size. Spectral types are: F: $\alpha < 0.5$ between 151 MHz and 330 MHz; S: $\alpha > 0.5$ between 151 MHz and 330 MHz; C-: α increases by > 0.5 between 151 MHz and 15 GHz; (U): $\alpha > 1.0$ between 8.4 GHz and 15 GHz ($S \propto \nu^{-\alpha}$).