STATISTICAL PROPERTIES OF COMPACT SOURCES

J. Machalski
Jagiellonian University, Cracow, Poland.

The analysis is based on VLA 1465-MHz observations of GB and GB2 sources (Machalski et al. 1982; Machalski and Condon 1983a, 1983b). From those flux-density limited samples compact sources were selected. The following definition of source "compactness" has been used

$$C \equiv S_{1465}(\Theta<1'')/S_{1400} \geqq 0.85$$

Subjects of analysis were: (a) fraction of compact sources among radio galaxies, quasars, and "empty field" sources, (b) identification rate vs. high-frequency spectral index for compact sources, (c) spectral-index distributions for compact identified and/or EF sources, (d) flux-density ratio for double compact sources, and (e) correlation between radio and optical luminosities for compact sources.

Some conclusions from this work are:

Table 1. The fraction of compact sources vs. optical type.

Type	Flat-spectrum	Steep-spectrum	All
comp. Gal / Gal	55±15(%)	7±2(%)	12±3(%)
comp. QSO / QSO	93± 4(%)	42±8(%)	67±5(%)
comp. EF / EF	91± 9(%)	38±4(%)	41±4(%)

(a) The observed difference between the abundance of compact galaxies and quasars (Table 1) is partly due to the distance effect, however, the great differences between Gal/QSO ratios for flat- and steep-spectrum sources confirm that quasars are intrinsically much more compact. The similar fractions suggest that compact EFs are mostly quasars.

(b) The identification rate for compact steep-spectrum

R. Fanti et al. (eds.), VLBI and Compact Radio Sources, 71–72.

https://doi.org/10.1017/S0074180900077731 Published online by Cambridge University Press

sources is lower than that for extended sources suggesting that those sources have higher radio-to-optical luminosity ratio than an average source {see also par.(e)}. There is not any significant change of the identification rate vs. angular size of sources in the size range 0.1 - 100 arcsec. This confirms that statistically small angular size reflects intrinsic compactness of those sources.

(c) High-frequency, $\alpha(1400,5000)$, spectral-index distributions for both identified and EF compact sources indicate that there is a distinct correlation between the average size and spectral index. Compact sources statistically have flatter spectra.

(d) The flux-density ratio S_1/S_2 distribution for compact sources is much broader than that for extended sources. The mean from our analysis is $\langle S_1/S_2\rangle = 6.6 \pm 1.5$ and confirms that compact sources are indeed more asymmetric than extended sources.

(e) The dependence of radio-to-optical luminosity ratio on high-frequency spectral index has been noted by Condon et al. (1983). Authors conclude that steep-spectrum objects (mainly QSOs) have this ratio intrinsically higher than those with flat spectra, and suggest that the optical luminosities of radio-selected QSOs decline some time after the last ejection of relativistic plasma - then these objects become EFs. Our analysis show that (1) The effect for compact galaxies is evidently due to limited radio luminosity, thus the observed correlation is explained by the selection effect. (2)The correlation for QSOs seems to be real. The small scatter of the radio-optical spectral index in this case is a strong evidence on the correlation between radio and optical luminosities in the core region of a QSO. (3) Our data do not indicate any rapid cut-off of identification for the steep-spectrum objects. Oppositely, there are very compact EF sources with flat high-frequency spectra. These sources might be "EF" because of the thirty-year period between radio and optical observations. Until a series of simultaneous radio and optical observations of these sources is made there is no observational evidence for any recognizable decline of the optical luminosity for steep-spectrum QSOs.

REFERENCES:

Condon, J.J., Condon, M.A., Broderick, J.J., and Davis, M.M. 1983, Astron. J. (in press).
Machalski, J., Maslowski, J., Condon, J.J., and Condon, M.A. 1982, Astron. J. 87, 1150.
Machalski, J., and Condon, J.J. 1983a, Astron. J. 88, 143.
ibid 1983b, Astron. J. (in press).