TESTS FOR A RELATIVISTIC BEAMING MODEL USING A VLBI SURVEY

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ABSTRACT: We have examined a relativistic beaming model using a VLBI survey by Preston *et al.* (1985). Our statistical study of a ratio R of the flux density for the beamed compact core to that for unbeamed components of a source shows Lorentz factor γ to be $\cong$ 6 and R_T (R at transverse alignment) to be $\cong 10^{-2}$ for a sample of 222 QSO's. In addition, we find that a sample of 60 radio galaxies show the beaming effect with $\gamma \cong 4$. It should be emphasized here that the beaming effect strongly affects the source counts (Log N - Log S) especially at high frequencies.

Orr and Browne (1982) studied a statistical distribution of R and derived $\gamma \cong 5$ and $R_T = 0.024$. They showed that the distribution of R ranges $R_T \leq R \leq 2\gamma^4 R_T$. We can thus estimate R_T from the lower limit of R and γ from the range of R distribution.

In order to remove contribution of extended (unbeamed) component and to improve statistical accuracy, we used 222 QSO's (and probable QSO's) and 60 galaxies (and probable Galaxies) from a VLBI survey at 2.3 GHz (Preston *et al.* 1985), which covers entire sky except $|b| \leq 10°$ with a completeness of the sample for $S \geq 1.0$ Jy. Although its U-V coverage is limited, the baseline length of several tens of $10^6\lambda$ gives us the benefit of the study.

A distribution of R for QSO's (Figure 1 (a)) gives $\gamma \cong 6$ and $R_T \cong 10^{-2}$, which is consistent with the previous result by Orr and Browne (1982). The range of R for the steep spectrum ($\alpha < -0.5$; $S \propto \nu^{\alpha}$) QSO's (SSQ's) is one order of magnitude smaller than that of flat spectrum ($\alpha \geq -0.5$) QSO's (FSQ's), while R_T seems to be the same with each other. This can be understood if SSQ's are a subset of QSO's which have smaller beaming effects with a common R_T for the other subset of FSQ's. Furthermore, Figure 1 (b) gives an evidence that galaxies also behave in a similar manner to QSO's; almost the same R_T as that of QSO's with $\gamma \cong 4$.

Figures 2 show that the source counts for total intensities (S_T) are flat for both QSO's and galaxies. On the other hand, they rapidly

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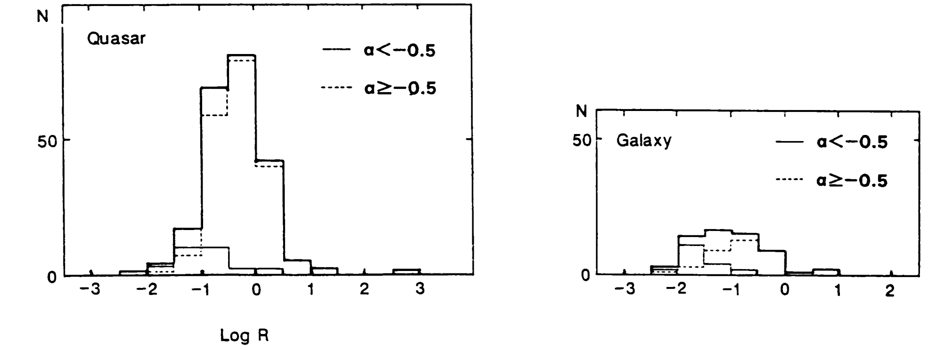

Figure 1. The R distribution for QSO's ((a); left) and for galaxies ((b); right).

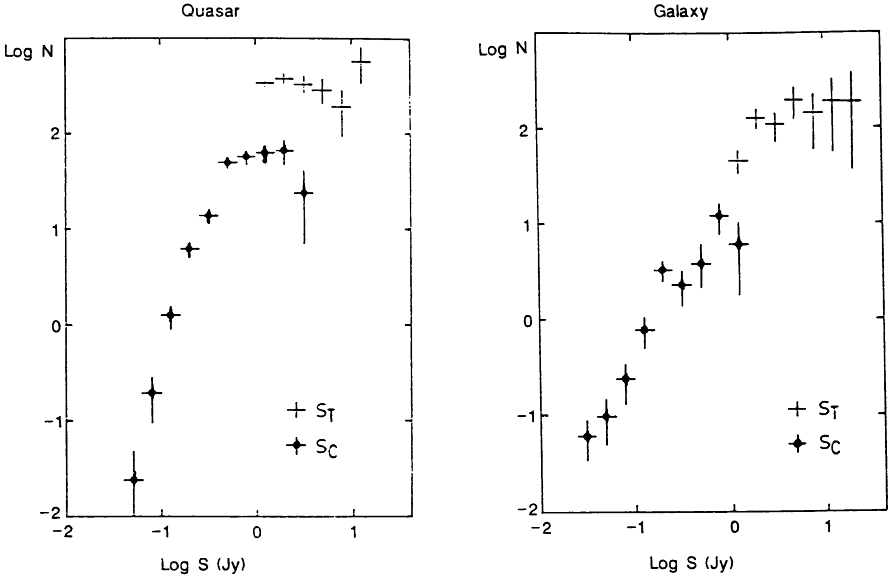

Figure 2. Same as Figure 1 but for the differential source counts.

decrease with decreasing correlated fluxes (S_C). Because of the beaming effect, the number of weaker S_C decreases and consequently that of stronger one increases. Thus Figures 2 (a) and (b) give another evidence for the beaming effect of both QSO's and galaxies. The difference of the inclination in Figures 2 again indicates the difference of γ. This effect will become dominant for high frequency (core-dominant) source counts.

REFERENCES

Orr, M.J.L. and Browne, I.W.A. 1986, *Mon. Not. R. astr. Soc.*, 200, 1067.
Preston, R.A. *et al.* 1985, *Astron. J.*, 90, 1599.