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MM-VLBI SURVEY OF SPECTRAL INDEX ON AGN

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ABSTRACT The preliminary results of an mm-VLBI survey of spectral index on active galactic nuclei (AGN) are presented which suggest that their activities are only in the central regions. The difference in central activities may correspond to their different stages of evolution. We found a strong concentration to $\alpha = 0$ for quasar and a spread distribution for HPQ.

INTRODUCTION

Transparency of electromagnetic waves in the deep center of AGN has a tendency to be optically thin at high frequencies, such as mm-waves. We tried to find a relationship between the VLBI spectral index α ($S_\nu \propto \nu^\alpha$) and types of AGN in mm-wave observations. We configured VLBI observation at frequencies of 22 and 43 GHz. Also from 2 and 8 GHz VLBI data (Morabito *et al.*, 1986), we derived a spectral index to compare our observations. In this paper, we report the preliminary results of the observations and the comparisons.

OBSERVATIONS

We observed correlated flux density S_ν of 69 extragalactic radio sources during June to November in 1990 by using KNIFE (Kashima-Nobeyama Interferometer) which makes a 197-km east to west baseline. The fringe spacing is comparable with DSN 2/8 GHz VLBI observations. We have succeeded in obtaining 20 of 69 sources in both frequency bands. We used K-3 (Mk-III compatible) and K-4 terminal. Both types of tapes were correlated on the Kashima Space Research Center K-3 VLBI processor. The 22 and 43 GHz 5-σ detection limit ($\sim$60 sec coherent integration) are $\sim$0.2 and $\sim$0.4 Jy, respectively. The detection limit can be improved to 3.7 times smaller by synthesizing 14 channels.

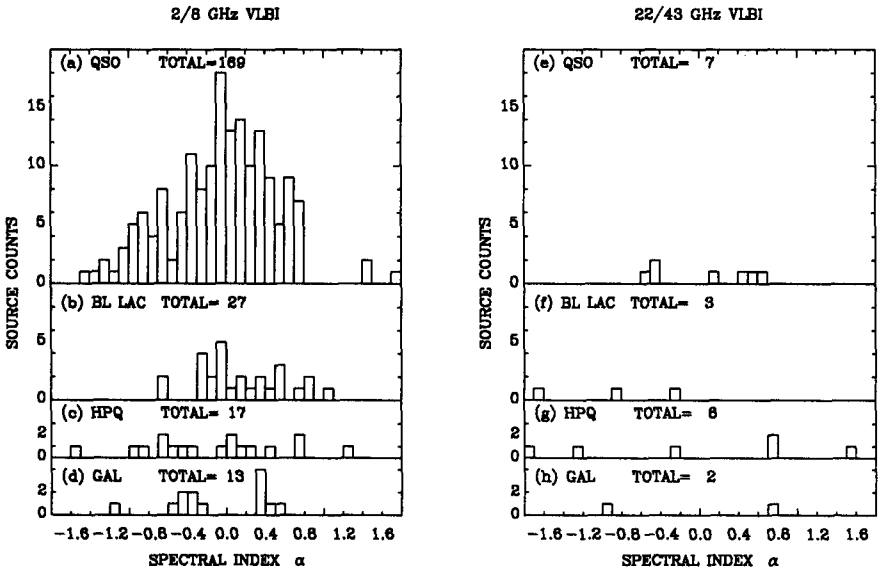

Figure 1. Spectral index obtained from 2/8 and 22/43 GHz VLBI observations. Spectral index of (a)~(d) and (e)~(h) are obtained from 2/8 and 22/43 GHz VLBI observation, respectively. Classification is (a)(e) – QSO, (b)(f) – BL LAC objects, (c)(g) – Highly Polarized Quasars and (d)(h) – Galaxy.

DISCUSSION

We compared the spectral index from our observations and from the literature. In Fig. 1, we found that the spectral index shows a distribution concentrated to $\alpha = 0$ for QSO, a widely spread distribution for HPQ, and the absence of a region near $\alpha = 0$ for GAL in both results. The difference between 2/8 and 22/43 GHz of BL LAC objects is believed due to an intrinsic difference, but this cannot be confirmed because the number of data is quite small. Interesting results from large numbers of data include the lack of $\alpha > 0.8$ in QSO at 2/8 GHz spectrum. If this profile is the result of merging jet components, we can predict a stronger concentration to $\alpha = 0$ in a small red shift.

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