THE STRUCTURE OF 4C39.25 ON INTERMEDIATE SCALES

S. Y. Wu (*)
I. I. K. Pauliny-Toth and R. W. Porcas (**)
(*) Beijing Astronomical Observatory
Academia Sinica
Beijing 100080, P. R. China
(**) Max-Planck-Institute for Radio Astronomy
Auf dem Huegel 69
D-5300 Bonn 1, F. R. Germany

ABSTRACT. VLBI observations at 18 and 6 cm with European baselines of lengths up to 15 and 23 million wavelengths respectively have been used to search for structure in the quasar 4C39.25 on scales of 10 to 100 milliarcsec. No significant structure on these scales brighter than 5 percent of the peak brightness has been detected. The core itself, however appears to be extended on a scale of 2 to 4 milliarcsec and variable in flux density.

1. INTRODUCTION AND OBSERVATIONS

4C39.25, a quasar with redshift 0.698, is one of the ten strongest compact sources at centimetre wavelengths. Recent observations (Marcaide et al. 1985, Shaffer and Marcher 1985) have revealed a weak, probably superluminal feature E between 2 stationary components with flux density increasing year by year. A larger component B with a size of about 3 mas beside the strong double was suggested by Baath et al. (1980).

VLBI observations at 18 and 6 cm with European baselines have been made to search for structure in the quasar on scales of 10 to 100 mas between March 30 and April 8, 1984. The calibration has been checked by using observations of the unresolved sources OQ208 (6 cm) and DA193 (18 cm). The calibration was less accurate than expected, owing to the poor weather conditions during the observations, and the error in fringe amplitude is estimated to be less than 10 percent.

2. RESULTS AND DISCUSSION

The hybrid maps at two frequencies show that the emission originates mostly in a bright, nearly unresolved core. The fringe amplitudes show peak-to-peak variations of about 20 percent on the longest baseline, indicating that the core is slightly resolved, and is more compact at

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6 cm than at 18 cm. There is evidence for a weak extension to the north-west, although this is at a level of only 5 percent of the peak brightness. It is also present (at level of 1%) at 5 GHz and is thus probably real. There are no other extended features stronger than 2 percent of the maximum in the maps.

The parameters of the features obtained from model fitting are shown in Table I. The core appears to be elongated in directions consistent with that of the compact double (-81 deg.) and of the arcsec structure (-100 deg.; Browne et al. 1982) respectively. The results imply a steep-spectrum feature with a size of 3.6 mas at 18 cm, elongated in P.A.=-105 deg. surrounding the core. It seems to be component B suggested by Baath et al..

The weak extended feature with 16 and 18 mas separation to the core and P.A.=-26 deg. has a spectral index of about -0.63, and a size of about 10 mas. It perhaps is only structure on the intermediate scales revealed in these observations.

Table I. Structural parameters deduced from the model fitting

Frequency (GHz)	Total flux density (Jy)	Parameters of the features (1984.25)					
		Flux density (Jy)	Separ. from core (mas)	P.A. of separ. (deg.)	Major axis (mas)	Axial ratio	P.A. of major axis (deg.)
5	5.9	5.1	0	0	2.0	0.2	-81
		0.1	16	-26	7	0.4	-33
1.66	3.3	2.7	0	0	3.6	0.5	-105
		0.2	18	-26	11	0.5	-95

4C39.25 shows slow variations in its flux density at centimetre wavelengths, on a time-scale of years. At 5 GHz, the flux density has decreased from 9.0 Jy at epoch 1974.1 (Pauliny-Toth et al. 1981) to 5.9 Jy at 1984.25. At 1.66 GHz, however, the flux density has remained constant at about 3.3 Jy over the same interval (Baath et al. and our data). The fact that there has been no significant change at 1.66 GHz in spite of the considerable decrease at 5 GHz also supports the existence of feature B. As Baath et al. indicated that about 80 percent of the emission at 1.66 GHz should arise from component B and the arcsec structure. The observed variation of flux density arises mostly from the compact triplex.

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