STUDIES OF THE 3C 345 QUASAR STRUCTURE AT DM-WAVELENGTHS

L.I.Matveyenko, I.I.K.Pauliny-Toth, B.Sherwood,
L.Bååth and A.Kus
Space Research Institute,Profsojuznaja 84,Moscow.
Max-Planck-Institut fur Radioastronomie,Bonn.
Onsala Space Observatory,Onsala.
Torun Radio Astronomy Observatory, Torun.

ABSTRACT. The structure of the quasar 3C 345 has been studied at 18 and 49 cm wavelengths by VLBI method. The structure has a nucleus and a jet, which changes direction with distance from the nucleus. The continuum emission of the nucleus and the jet regions correspond to a source with a large optical depth, the cut frequence goes down with increasing distance from nucleus.

Object with active nuclei are probably the galaxies at different stages of their evolution or with different activities on their nuclei. The 3C 345 quasar is one of the typical objects of this class. Extraordinary active processes occur on its nucleus which are accompanied by ejection compact clouds of relativistic particles. At the initial stage does not exeed 1 pc (Bååth et al, 1981) and the velocity reaches 15 c (Unwin et al, 1983). Observed bursts of the radio emission are associated with ejection of clouds of relativistic particles. The high-intensity of radio emission was observed from 1966 (Medd et al, 1969), which is superposition of single bursts. Beginning from 1980 the activity increased. Systematic measurements in the wide cm-dm range allowed detection of the one-direction jet twisting as it is moving away from the nucleus (Matveyenko et al, 1982), (Cohen et al, 1983), (Moore et al,1983). Along the jet there are single bright regios which correspond probably to the respective epochs of the high activity, Fig. 1 b. As is followed from observations at 6 cm wavelength the large-scale structure consists of halo with sizes of 15" • 20" and bright regions located NE, NW and southernly relative to the nucleus, Fig. 1 a , (Schilizzi, Bruyn, 1983). However, as compared with another objects here we do not find distinctly the correlation between the large-scale structure and the jet.

E. Ye. Khachikian et al. (eds.), Observational Evidence of Activity in Galaxies, 301–304.

The quasar 3C 345 was observed at 49-cm wavelength in November, 1983 using the VLBI network with telescopes located in Simeiz, Torun, Westerbork, Jodrell Bank and Haystack. The baseline overlap is equal $(0.7\text{-}15).10^6\lambda$. The brightness distribution determined under assumption that a number of gaussian components is finite. Table 1 presents the flux density of components - F, relative position - R, and direction - Q, the major axis and position angle - φ, the ratio of axes.

The nucleus radioemission at 49 cm is neglible < 20 mJy (Matveyenko et al, 1985). The compact component No 1 corresponds to a compact feature observed at 18 cm between the nucleus and the jet. The flux density of it is equal 0.67 Jy. The brightness part of the jet corresponds to the feature No 2, the flux density is equal 1.94 Jy. The spectrum has bend and optical thickness in this part of jet $\tau > 1$. The spectral index of those fortion which moves away at a distance of about 25 masec , features No 3, 4 is flat, i.e. $\tau < 1$, at frequencies 18 and 49 cm. At great distances respective to 200, 500 and 3300 mas components No 6, 8 and 9 are observed. The components correspond to bright regions (Browne et al, 1982).

The results of 18 cm observations of the 3C 345 in February, 1981 (Matveyenko et al, 1982) were additionally processed and the hybrid map was compiled, Fig. 1 c. The beam is equal to 3 mas, (Matveyenko et al, 1986). Fig. 1 e and f show the brightness distribution for the central part of jet at 18 cm and 49 cm respectively. Fig. 1 g presents the brightness distribution at 18 cm along the jet axis. The higher emissia of the quasar 3C 345 at the dm-mm range is explained by the activity of its nucleus, i.e. the ejections of relativistic particles. The particles are ejected at the same direction at an angle of -135^o. The jet forms from these particles , which expands up to 30 kpc. As removing from the nucleus the jet is twisted and at a distance of 30 kpc its direction is adequate to -30^o. The twisting is probably associated with a precession of the nucleus rotation axis. The nucleus is surrounded by the dense ionized medium therefore we cannot observe its intrinsic radioemission at dm-wavelengths.

TABLE 1

No	F, Jy	R, mas	Q	M.axis mas	Rat.	φ
1	0.67	0.0	0.0	1.0	1.0	0.0
2	1.94	5.0	-49.6	5.9	0.2	-57.0
3	1.17	9.3	-49.0	10.5	0.2	-48.9
4	1.02	20.6	-52.2	23.3	0.35	-38.3
5	0.24	92.3	-37.7	116.0	0.27	-27.0
6	1.07	500.0	-15.7	366.0	1.0	-13.0
7	0.27	54.8	-42.0	62.0	0.05	-27.0
8	0.05	3300.0	-27.9	25.0	1.0	0.0
9	0.05	200.0	-45.0	20.0	1.0	0.0
10	0.37	0.0	60.0	200.0	0.5	60.0

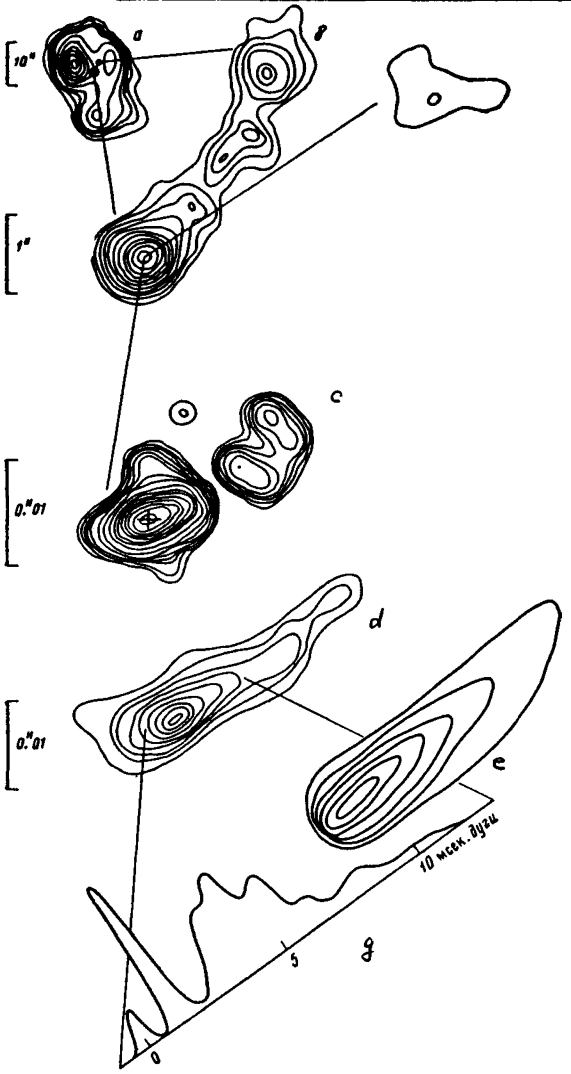

Figure 1. The 3C 345 quasar structure:
a - λ =6 cm, (Schilizzi et al, 1983)
b - λ =18 cm, (Browne et al, 1982)
c - a fine structure 18 at 18 cm
d - a jet at 18 cm, main part
e - a jet at 49 cm
g - a brightness distribution at 18 cm along the jet

https://doi.org/10.1017/S0074180900155263 Published online by Cambridge University Press

References

Baath L.B. et al, Astroph.J., 1981, L23, 243.
Browne I.W.A., et al, Nature, 1982, 299, 788.
Cohen M.H., et al, Astroh.J., 1983, 269, L1.
Matveyenko L.I., et al., Proc.VLBITTechniques Symp., Ed. Biraud F., Tolouse, 1982, 347.
Matveyenko L.I., et al, Sov.Astron.Lett.,1985, 11, 420.
Matveyenko L.I., et al, Sov.Astron.Lett.,1986, 2, 156.
Medd W.J. et al, Mon.Not.Roy.Astr.Soc.,1969,146,381.
Moore R.L. et al, Symp. No 110 IAU, VLBI and Compact Radio Sources/Eds Fanti R., Kellermann K.,Setti S., Dordrecht: D.Reidel, 1983, 109.
Schilizzi et al, Nature, 1983, 303, 27.
Unwin S.C. et al, Astroph.J., 1983, 271, 536.

https://doi.org/10.1017/S0074180900155263 Published online by Cambridge University Press