KINEMATIC PROPERTIES OF THE EJECTED MATTER IN NGC 1275

J. M. Marr, D. C. Backer, M. C. H. Wright
Radio Astronomy Lab and Astronomy Department
University of California, Berkeley

A. C. S. Readhead, R. Moore
Astronomy Department
California Institute of Technology

ABSTRACT

We have mapped the nearby (z=0.018), active galaxy NGC 1275 (3C84) at 6 different epochs from 1981 to 1986 at 1.3 cm (22.3 GHz) with a global VLBI array of seven telescopes. We find a long-lived knot of emission separating from the brightest radio component with a projected velocity = 0.46±0.12 h^{-1} c. This knot moves through diffuse emission that also moves away from the main component with a slower projected velocity of 0.33±0.12 h^{-1} c. We show that the knot and diffuse emission result from two separate events that occurred around 1959 and 1968.

RESULTS

We have observed NGC 1275 at six different epochs from 1981 to 1986 at 1.3 cm (22 GHz) with a VLBI array. Our resultant maps (Fig. 1) display structure similar to that found in previous high frequency VLBI studies of this source (Romney et al. 1982, Readhead et al. 1983). The flux density distribution is dominated by a distinct component to the north which varies in structure and intensity on short time scales. Diffuse emission spreads out to the south with a relatively bright knot persisting through all epochs. We label this knot component K and focus this talk on its motion relative to the northern peak.

The overall size of the source expanded appreciably over the five year period at a rate in rough agreement with that estimated by Romney et al. (1982). We fit an expansion rate of 0.39±0.15 mas/yr (0.33 h^{-1} c) and an origin time of 1959. This time of expansion origin coincides with the start of activity in radio flux density (O'Dea, Dent, and Balonek 1984). Following Romney et al. (1984) we assume a core-jet model with the core located in the northern component. The diffuse emission to the south can then be interpretted as the result of particles ejected from the core in 1959.

The position of component K relative to the peak of the core fits a velocity of 0.55±0.15 mas/yr (0.46 h^{-1} c). This motion implies the

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knot emerged from the core in 1968±4. The flux density curves of O'Dea, Dent and Balonek (1984) display a radio flare that starts around 1970 at 90 GHz and moves to lower frequencies with time. We suggest that component K was ejected in this later event and is moving away from the nucleus independent of the diffuse emission.

Extrapolation of component K's motion backward in time suggest that the knot coincides with the central componet in the 2.8-cm images of Romney et al. (1982) between 1972 and 1977. The Romney et al. maps of 1979 and 1981 do not show this dominant central component. We suggest that the central component in the earlier maps is the same as our component K and that it has moved into the southern component by 1979.

Component K coincides in position with a region of flat or inverted spectra delineated by the spectral index map of Unwin et al. (1982). Following Miley (1980), we estimate from minimum energy arguments the magnetic field in K to be about 0.15 gauss, giving a radiative lifetime of under two years. Either the knot's internal energy is particle dominated or particle re-acceleration is needed.

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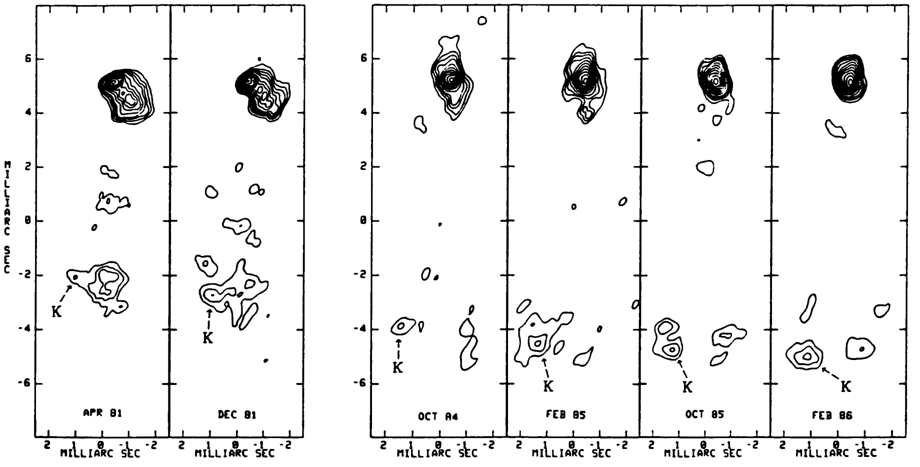

Figure 1

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