

SUPERLUMINAL MOTION IN CTA 102

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Sholomitskii (1965) discovered that the flux density of the quasar CTA 102 varies at low frequencies on a timescale of a few months. Low-frequency variability can be explained by “superluminal flux variation” (Romney *et al.* 1984): If the intrinsic brightness of a component moving in a relativistically beamed source varies by only a few percent, the observer sees its flux density change by a much larger factor $\delta^{3-\alpha}$ when the optically thin blob moves almost directly toward the observer. Such a relativistically beamed source is likely to exhibit superluminal motion if studied with sufficient resolution and sensitivity. Superluminal motion in CTA 102 was discovered by Bååth (1987) who concluded on the basis of maps made at three epochs at a frequency of 932 MHz that two components were separating at a rate of 0.65 milliarcseconds (mas) per year. Using a redshift $z = 1.037$ and $H_0 = 100 \text{ km s}^{-1} \text{ Mpc}^{-1}$, $q_0 = 0.5$, this expansion speed corresponds to $(18 \pm 4)h^{-1}c$. The extraordinarily high speed led us to make VLBI images of the source at a higher frequency in order to increase the resolution and make a more precise determination of the speed.

The observations were conducted at 5 GHz with 11 antennas of the United States and European VLBI Networks with the addition of an antenna in Hartebeesthoek, South Africa. The observations occurred in June 1987 and in June 1988. The data were processed on the Caltech/JPL correlator. The highest resolution achieved was 1 mas.

A preliminary image of CTA 102 is shown in the figure. The source displays very unusual complex morphology: at least four components, enveloped by a low-surface-brightness “cocoon”, form a curved structure. We expect to identify the core when similar data at 1.7 GHz are reduced.

CTA 102 contains the fastest superluminal component of any VLBI source known to date (Bååth 1987). The components may be whirling along a helix or sliding along a straight path until they hit a “brick wall”. Twisted motion of components in a jet has been convincingly demonstrated in 3C 273 (Zensus *et al.* 1988), and in 3C 345 (the Caltech group, in preparation). If the superluminal speed derived by Bååth is correct for the 6-cm components, we should be able to observe signs of this “twisted” motion in just a few years. Monitoring the source for a few years and modelling the components as several planar or conical shocks moving in a jet may clarify the ejection orientation and gamma factor of the relativistically beamed source.

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References

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PRELIMINARY IMAGE OF CTA 102: JUNE 1988

CTA 102

4.990 GHz 06/11/88

