HELICAL MOTION IN THE BL LAC OBJECT OJ287 ?

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The structural evolution of the BL Lac object OJ287 has been studied with milliarcsecond resolution by using 8.4 GHz geodetic VLBI data from the Crustal Dynamics Program. Such data provide valuable maps which are useful to track superluminal components on short time scales (Charlot 1992). We have mapped and model-fitted OJ287 at ten epochs separated by intervals of a few months between 1985.4 and 1988.1 (Fig. 1a). The structure of OJ287 over this time span consists of two components, one of which is the source core, while the other one is identified with the knot K3, ejected during the 1983–1984 optical outburst. Our models indicate that the knot K3 moves along a non-radial path, with evidence for an apparent deceleration by mid-1986 and a reacceleration afterwards (Fig. 1b). We explain this peculiar motion by a projection effect due to a helical morphology of the jet. Our proposed helical model, estimated by considering the sky positions of K3 together with those of the earlier knots K1 and K2 (Roberts *et al.* 1987, Gabuzda *et al.* 1989), corresponds to a helix with a pitch angle of 20° on a narrow cone of half opening angle 3.4°, and central axis inclined at 17° relative to the line of sight. Ejection of VLBI components appears to occur simultaneously with optical outbursts and at mid-time between them. This finding is consistent with the supermassive binary black hole model previously proposed to explain those periodical outbursts (Sillanpää *et al.* 1988). Comparison of our helical fit with hydrodynamical models (Hardee *et al.* 1994) provides estimates of the radius ($R \simeq 0.015$ pc at a distance of 5 pc from the core), opening angle ($\psi \simeq 0.1°$), and Mach number ($M \simeq 60$) of the jet, and shows that the orbital 9.0 yr period of the binary black hole system is adequate to drive the helical perturbation if the jet propagates in a hot ambient medium with an external sound speed of 5000 km/s.

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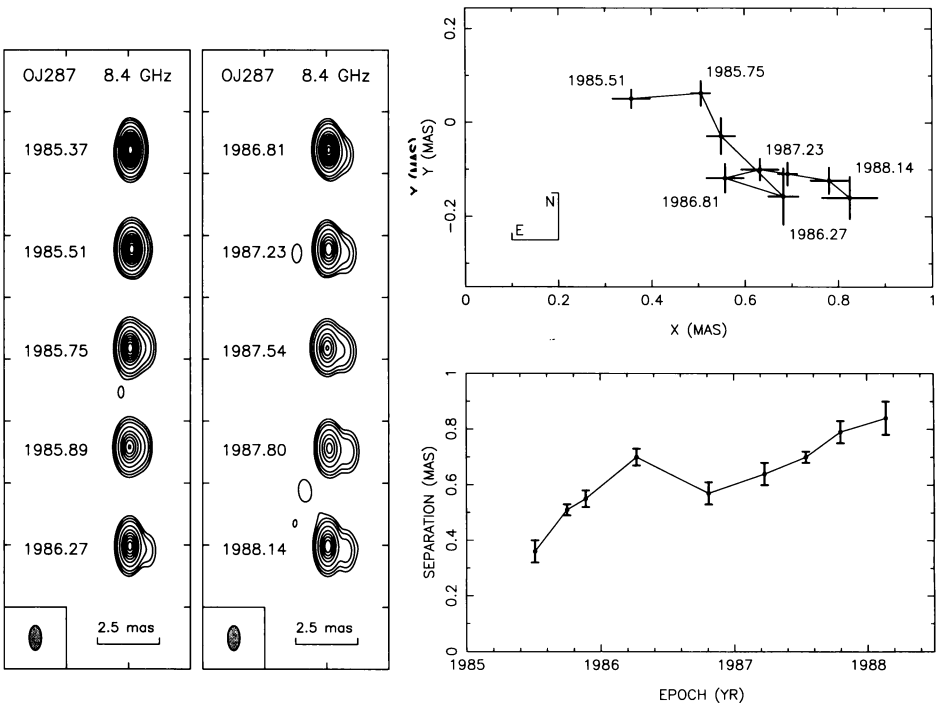

Figure 1. Left (a): 8.4 GHz VLBI maps of OJ287 at ten epochs. The main component is the core, while the western extension represents the knot K3. Contour levels are ± 0.05, 0.1, 0.2, 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5 and 5.5 Jy/beam (1×0.5 mas^2 at PA = 0°). Right (b): sky positions (top) and separations (bottom) of K3 from 1985.51 to 1988.14. The successive positions are connected with straight lines to indicate the time evolution.

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