THE JETS IN 3C 449 REVISITED

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Introduction: Bridle (this volume) has summarized the overall characteristics of the jets found in numerous low-luminosity and some high-luminosity radio sources. Previous observations made with the partially completed VLA at wavelengths of 6 and 20 cm indicated that 3C449 was an archetypal radio source obeying all the "rules" summarized by Bridle. New observations with the VLA of the polarization structure at 6 and 20 cm have destroyed this simple picture and identify 3C449 as a "rogue" jet source.

Intensity Structure: The new observations indicate several interesting facets of the intensity structure of the radio jets:

1. The jets are very symmetrical at both wavelengths, the ratio of the total flux being less than 1.8 at 6 cm.

2. The spectrum of the jets is fairly constant over their whole length, the northern jet being slightly steeper ($\alpha = 0.67$) than the southern jet ($\alpha = 0.62$).

3. The collimation data is consistent with two regimes of simple linear expansion, first an opening angle of about 20 degrees then at about 6 degrees.

4. Profiles of total intensity are almost Gaussian with no signs of limb-brightening.

5. Both peak flux and total flux across the jet show no signs of decreasing along the jet as rapidly as adiabatic expansion predicts.

Polarization Structure: Both jets show unusual features in the polarization at 6 and 20 cm.

1. 6 cm: Both jets possess a region, relatively weak in total intensity and close to the core, where the inferred magnetic field direction is parallel to the jet axis before twisting off to become

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perpendicular farther away from the core. The total emission rises as the field twists to become perpendicular. Almost no shearing of the B-field at the jet boundaries is observed, the only exception being at the first turn in the northern jet.

2. 20 cm: The jets are heavily depolarized showing gradients in percentage polarization both along and across the jets. The depolarization ratio (6cm/20cm) varies from as low as 1 to greater than 10, in some places over a distance of less than a jet diameter.

What Does It All Mean? A number of interesting conclusions arise:

A. The luminosity per unit length is approximately constant along the jet as predicted for constant opening angle by the model of Henriksen, Chan and Bridle (1981) in which turbulence provides the necessary particle accelaration. However, other mechanisms to preserve the luminosity per unit length exist (see Bridle, this volume).

B. Differences in smoothness of emission between the northern and southern jets suggest that any variations are intrinsic to the jet and are not due to fluctuation in the core luminosity.

C. Two regimes of expansion are seen, consistant with collimation by a two component atmosphere (e.g. Bridle, Chan and Henriksen 1981). The region of recollimation seen in sources such as NGC 315 on the scale of >10 Kpc may have been masked by the disruption of the jets on a scale of about 20 Kpc.

D. The depolarization is quite unlike that seen in any other jet source. Any explanation, either placing it internal or external to the jet, appears extremely contrived. The unexpected complexity of the polarization structure illustrates the dangers of using a simple depolarization model to interpret low resolution data.

E. Hardee (1981) has suggested that the kinks in the large scale structure are due to helical instabilities disrupting the jets. Our observations show that the amount of thermal matter required in the lobes is too high by an order of magnitude.

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References:

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