THE RADIO JET OF 3C273

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Most radio sources are two-sided, like Cygnus A. A minority, however, are one-sided, and the first-known and brightest example is 3C273 (see Fig. 1), a high-luminosity QSO, showing 'super-luminal' proper motions in the core. The explanation of such one-sided sources may follow one of two lines (and it seems that both schools of thought are represented at the present meeting): on the one hand, the ejection of material from the central object may truly be one-sided, while on the other hand the ejection may be two-sided but at a relativistic speed, so that the receding half is hidden by Doppler beaming.

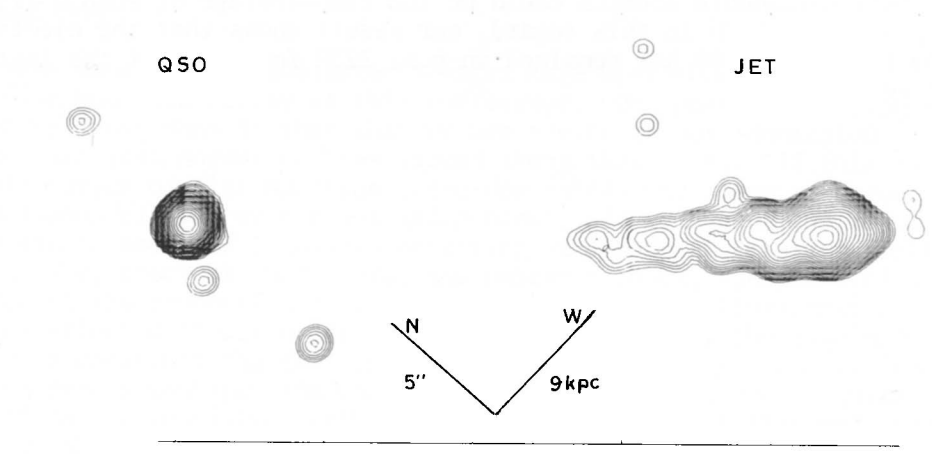

Fig. 1 Map of Radio brightness at 408 MHz of 3C273, with resolution 0.9 arc sec, tilted so that the jet in p.a. 223^{o} is shown horizontal. The contours are logarithmic, with three contours to a factor 2 in brightness. The unresolved core (centre-left) coincides with the QSO. The radio jet coincides accurately in position with the optical jet. No radiation is detected from the opposite side of the QSO.

D. S. Heeschen and C. M. Wade (eds.), Extragalactic Radio Sources, 167–168.

The radio map shown in Fig. 1, which was made with the Jodrell Bank MTRLI at 408 MHz (λ73.5 cm), and has a resolution of 0.9 arcs, enables quantitative parameters to be estimated for testing these models. Fig. 1 shows the bright core coincident with the QSO, within which are found the superluminal proper motions. Three artificial sidelobes, to North and South of the core, may be ignored. Along the radio jet, the brightness increases by more than a factor 100, reaching 240 x 10^8 K at the outer head. No radiation is detected from the opposite side, indicating that the brightness of the postulated counter-jet must be <1/100 of the brightness of the visible jet.

If this ratio is due to Doppler beaming, the whole jet must be moving quasi-relativistically, at >0.7c. A simple calculation of the ram-pressure in front of the head shows that this motion would be halted by the I.G. ambient medium unless the number density <0.7 m^{-3}. Since more than one argument suggests that such a low density (< $\frac{1}{20}$ closure density) is implausible, it appears that in 3C273 the ejection from the central object is genuinely on one side only.

Question (by anonymous participant) Have you considered whether the further radio lobe might be hidden by absorption?

Answer By straightforward free-free absorption is not possible, since the EM of the absorbing matter would then make it visible in the optical region. An idea to play with is that the ejection might be sometimes in one direction, sometimes in the other, and of course conventional double sources could be the time-average of such a flip-flop scheme. Seen in this regard, our result shows that the ejection from the centre QSO has remained in p.a. 223° for at least the last 10^6 years.

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