MERLIN AND HST OBSERVATIONS OF THE JET IN 3C273

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The jet of 3C273 is the only quasar jet visible at both radio and optical wavelengths. Investigations using ground-based observations suggest that the optical emission, like the radio, is produced by the synchrotron process. We present here a new radio map at 18 cm wavelength made with the improved MERLIN array (Fig. 1b) and compare it with a new optical image obtained with WFPC2 on the Hubble Space Telescope (Fig. 1a) This work has been carried out in collaboration with colleagues from Princeton, Pennsylvania State University and Caltech and is being published by Bahcall et al. (1995).

Both the radio and optical images represent significant advances over those previously available (Thomson et al 1993), due to the recent upgrades to MERLIN and the HST. Furthermore, the images can be accurately aligned because they both include the quasar itself. This allows a detailed comparison of the optical and radio jets at a resolution of approximately 0.15 arcsec.

The HST image shows that the optical jet consists of a series of knots, linked by fainter emission, and tightly confined with a FWHM of 0.3 arcsec. The first feature in the main jet (knot A) is elongated along the main axis. Subsequent knots (B,C,D) lie oblique to the jet axis. The radio jet is broader with width 1.0 arcsec, and the new map reveals considerable structure within the jet. In particular, there are a number of oblique features about 0.5 arcsec long and separated by 1.4 arcsec. Direct comparison of the radio and optical images shows that the oblique radio features all coincide with optical knots.

Because of the difference in radiative lifetimes, the optical emission traces the present location of the active jet, while the radio emission can provide information on its history during the past 1 Myr. We suggest that what has hitherto been called the 'radio jet' is actually two components su-

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perposed, firstly the fast-moving jet proper, shown by the coincident oblique radio and optical features, and secondly emission from a surrounding, slow-moving 'cocoon'.

Detailed inspection of the images suggest that the jet may have a helical form. If the velocity is relativistic, the emission will appear brightest where the velocity vector is closest to the line of sight, the enhancement being independent of wavelength. This would explain the close correspondence between the optical and radio knots. We have modelled the projected brightness distribution of a simple relativistic helical jet. Using the velocity and angle to the line of sight implied by the superluminal motion of the VLBI jet (Unwin et al. 1985), the model matches the observed pattern. However, the dynamic range of the present maps does not rule out somewhat slower speeds and larger angles to the line of sight.

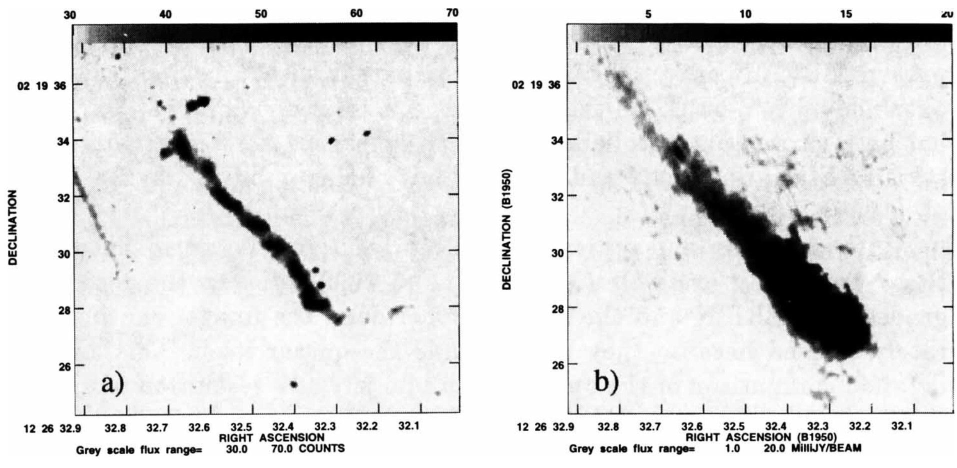

Figure 1. *a:)* **WFPC2 image of 3C273 at $\lambda 5940 \mathring{A}$. The resolution is limited by the pixel size of 0.1 arcsec.** *b):* **MERLIN image of 3C273 at λ 18 cm with resolution of 0.14×0.18 arcsec.**

References

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