THE 3C303 SYSTEM

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La combinaison des cartes radio en synthèse d'ouverture à haute résolution de 3C 303 et de plaques optiques montre que les principales composantes de la radio source peuvent être identifiées respectivement avec une galaxie de magnitude 17 et un objet de magnitude 22 possédant un excès d'U-V, la coïncidence se faisant à mieux d'une seconde près. L'objet de magnitude 22 a un compagnon plus brillant de $m_V \sim 20$ et de décalage vers le rouge 1.57. Les principales composantes radio sont seulement séparées de 17". Ce système montre le meilleur cas (non prouvé à 100%) d'une association physique d'objets possédant des décalages vers le rouge différents.

https://doi.org/10.1017/S0252921100053641 Published online by Cambridge University Press

I have mapped 3C303 at 3.7 and 11 cm. (resolution ∿2.2" and 7" respectively) with the NRAO interferometer, and more recently at λ6 cm. at Westerbork together with R.G. Strom. An accurate radio-optical comparison using deep Polamar 48 inch IIIaJ plates by S. van den Bergh has shown that the core of both radio components lies with ∿1" arc of optical objects (Kronberg, 1976). These are a 17^m N-galaxy, and a $21^m.7$ object which is one of a cluster of 3 which Lelièvre and Wlérick (1975) have independently studied, and found to have u-v excess. The brightest of the three (object "C" of Kronberg, 1976) also lies within the radio boundaries. In a collaborative optical study of 3C303, E.M. Burbidge and H.E. Smith have used the Wampler-Robinson scanner on the 3 metre Lick telescope to obtain a spectrum of object "C", which has $m_v \sim 20$. They find it to have a redshift of 1.57, which compares with z=0.141 (Sandage, 1973) for the 17^m galaxy. What is more curious is that 2 other faint u-v excess objects be within 5" of object "C" and one of these coincides to within <1" with the core of the tadpole-like western component. This suggests *prima facie* that the radio source has 2 identifications, a 17^m galaxy, and at least one faint u-v excess object at a different redshift. It is the northernmost of the trio of u-v excess objects (Object G of Kronberg 1976, and u of Lelièvre and Wlérick 1975) which coincides within 1" of the compact ($\lesssim$1"), bright southern end of the western component.

In Figure 1 we show the locations of the various optical objects relative to the radio map at 8.1 GHz and 2" resolution which was made with the NRAO interferometer. There is some weak radio emission between the two main radio components. This is also confirmed by the NRAO 11 cm and WSRT 6 cm maps, which have lower resolution (∿7") and therefore higher sensitivity to low-surface brightness emission. The maps at 7" resolution also show weak emission to the southeast of the N-galaxy nucleus. This is strong evidence that the two main radio components in Fig. 1 are part of a single radio system.

The fact of the double coincidence with 2 optical systems is unusual, as is the trio of faint, u-v excess objects whose brightest member has a large redshift. In considering whether or not the association of objects G and/or C with the N-galaxy (B) is genuine, it is important to realize that very few radio systems have been studied at such a combination of high radio resolution (2") and high sensitivity in both the radio and optical bands. Because we have so few comparable data on other radio systems, it is dif-

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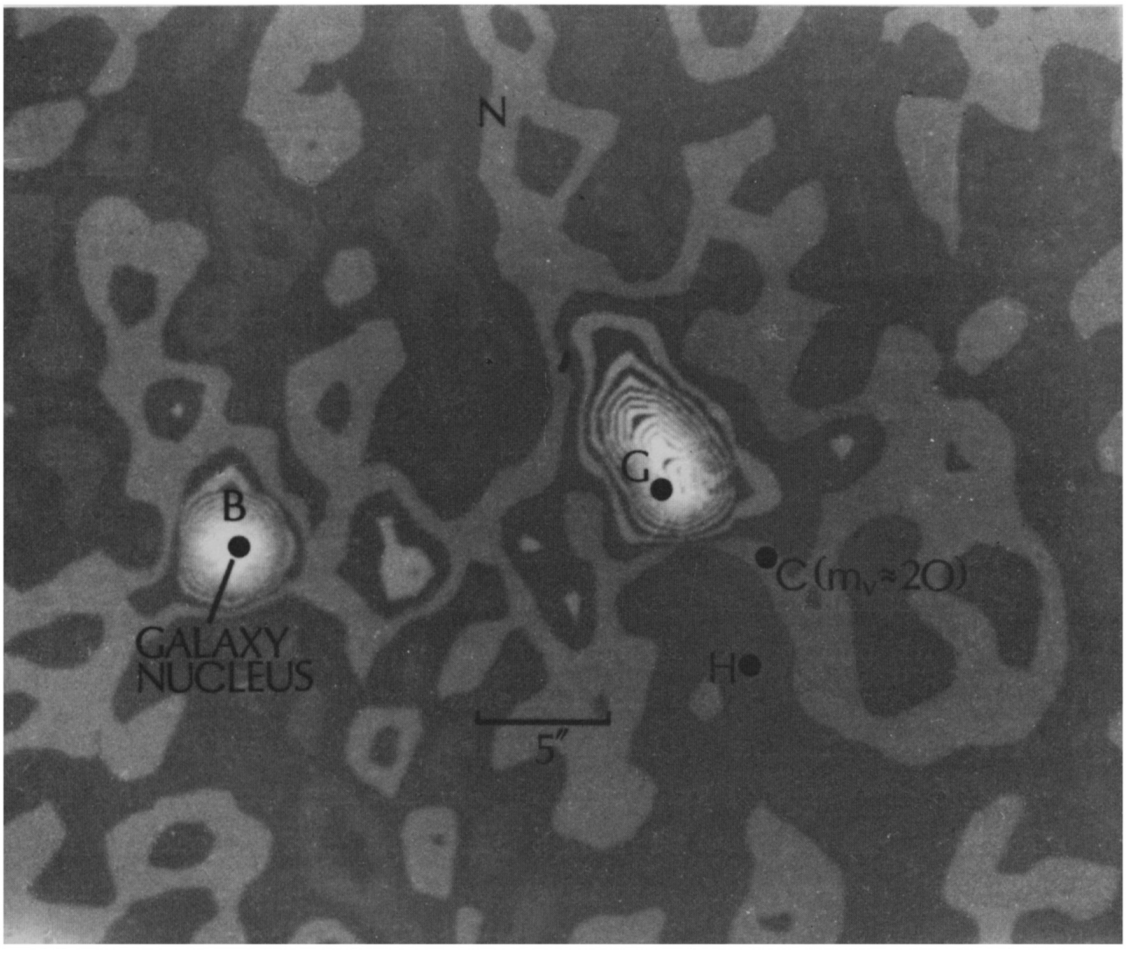

Figure 1 The 8.1 GHz NRAO interferometer map of 3C303, restored with a resolution of 2".2 x 2".2. Black dots show the positions of peak brightness for the various optical objects. B is the nucleus of the 17^m N-galaxy, C is the 20^m QSO with redshift z=1.57, and G and H are the objects at 22^m.

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ficult to decide finally whether this improbable coincidence of identifications is just the "unlucky case" which won't occur again, or whether the physical association of the two optical systems is genuine. If the latter proves true, it would cast strong doubt on the "all-Doppler" interpretation of the large redshift of object "C". A more detailed multi-frequency radio and optical study is in progress (Kronberg, Burbidge, Smith and Strom, in preparation).

Support from the National Research Council of Canada and the Alexander von Humboldt Foundation (West Germany) is gratefully acknowledged. I also thank Dr. D.S. Heeschen and the staff of the U.S. National Radio Astronomy Observatory for their hospitality and support.

References

Lehièvre A. and Wlérick, Astron. and Astrophys. 42, 293, 1975.

Kronberg, P.P. Ap. J. (Lett.) 203, L47, 1976.

Kronberg, P.P., Burbidge, E.M., Smith, H.E. and Strom R.G. (1977, in preparation).

Sandage, A. 1973, Ap. J. 180, 687.

DISCUSSION

D.B. SHAFFER: I do not believe that the quasar near 3C 303 is related to the other nearby radio source. Rather the radio source should be identified with the coincident faint object, for which there is yet no spectrum.

P. KRONBERG: That is quite so, in fact if object C did not have its 2 uv-excess companions, the case for its association with the western radio component would be much weaker. We are hoping to get a spectrum for the coinciding object (G), but at 22^m it will not be easy!

B. PETERSON: What is the error between your radio and optical position calibrations.

P. KRONBERG: The combined (radio-optical) position error has a standard deviation of $\sim$ 0.7 arc seconds.