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A new identification for the giant radiosource 3C326

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SUMMARY

We report the discovery of a compact radio component at the centre of a galaxy 25 arcsec north of the currently assumed identification of the giant radiosource 3C326. We propose this northern companion as the correct identification: the stellar luminosity and, most significantly, the narrow-line luminosity of 3C326 are then typical of those FRII radiogalaxies with similar extended radio luminosities.

1 INTRODUCTION

The object 3C326 (Willis & Strom 1978) is apparently highly unusual amongst FRII radiosources in that the galaxy with which it is currently identified produces no detectable optical emission lines (Hine & Longair 1979). Indeed 3C326 is a prominent outlier in the recently established correlations between narrow-line and radio luminosities (Saunders *et al.* 1989; Rawlings *et al.* 1989), and is a particular embarrassment to the physical models that seek to explain these correlations (Rawlings & Saunders 1989, and in preparation). Its identification has been based on a WSRT map (Willis & Strom 1978), which revealed a bright 'central' component coincident with a giant elliptical galaxy (hereafter galaxy A). This map, however, lacks the necessary angular resolution in the north–south direction to detect a weaker radio

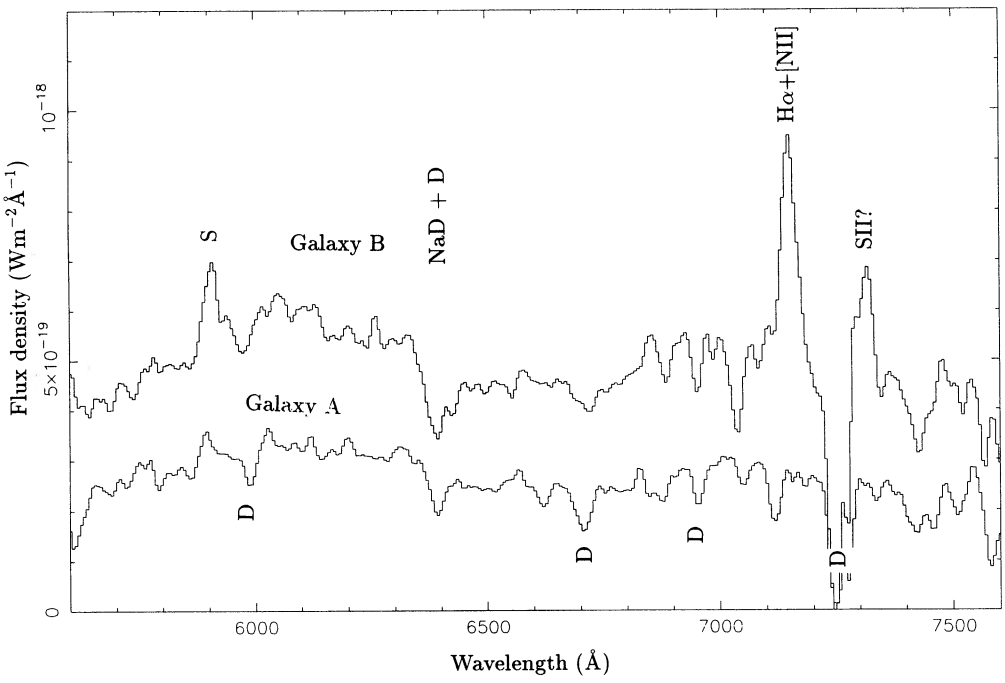

Figure 1. Optical spectra of galaxies A and B resulting from co-adding two 300-s exposures. Identified emission and absorption lines are marked. Spurious features (see Rawlings *et al.* 1989) are identified as follows: 'D', a feature resulting from a loss of sensitivity in a band of CCD columns; 'S' a feature arising from imperfect sky subtraction.

component coincident with an optically brighter companion galaxy 25 arcsec north (galaxy B). Smith & Spinrod (1980) found narrow emission lines in the spectrum of galaxy B while that of galaxy A has absorption lines only (Saunders *et al.* 1989). This paper describes optical and radio observations designed to determine which of the galaxies, A or B, is the more likely identification for 3C326.

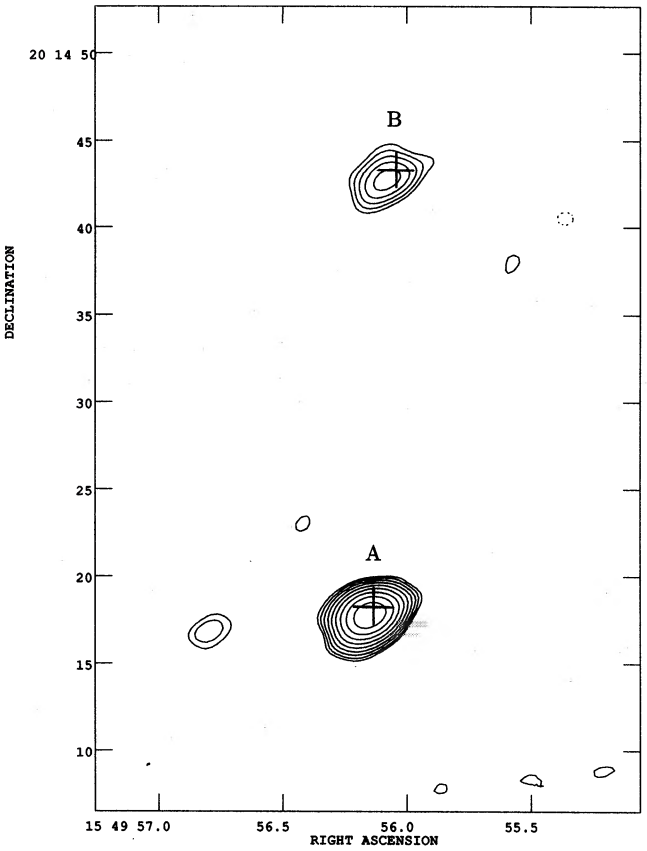

Figure 2. Map of the region containing galaxies A and B at 3.6 cm. The synthesized beam is 2.9×2 arcsec^2 at PA $-63°.4$; the weak feature to the east of the brightest component is the result of poor UV coverage in the single 410-s snapshot observation. The formal noise level is approximately 0.1 mJy synthesized beam^{-1}. Logarithmic contours, lowest positive contour 0.3 mJy beam^{-1}, highest 4.8 mJy beam^{-1}, factor 1.414. Dashed negative contour -0.3 mJy beam^{-1}. The crosses indicate the optical positions of the galaxies. The large-scale radio lobes of 3C326 lie to the east and west of this map and have an overall angular size of 20 arcmin.

2 NEW OBSERVATIONS OF 3C326

To compare the redshifts and narrow-line luminosities of galaxies A and B, we obtained simultaneous long-slit spectra of the objects using the University of Hawaii's 2.2-m telescope on the night 1986 February 2. These spectra are presented in Fig. 1; full details of the observing system and the method of data reduction are given by Rawlings *et al.* (1989). The galaxies were found to have indistinguishable redshifts ($z = 0.0885 \pm 0.001$); narrow-line emission associated with Hα+[N II]6548/6583, and possibly with [S II]6716/6731, was found only in the spectrum of galaxy B.

Analysis of archival Cambridge 5-km telescope data at 2.7 GHz produced evidence for an unresolved radio component coincident with galaxy B; the tentative radio detection had a peak flux density of 3 mJy beam^{-1} in the presence of a noise level of 1.5 mJy beam^{-1}. To confirm this result, we obtained on 1989 March 6 a service observation of the field with the VLA in A/B-array and operating at 8415/8456 MHz (with 50-MHz bandwidth); the primary flux calibrator was 3C286 and the phase calibrator OR103. The CLEANed map is presented in Fig. 2. To provide more information on the spectra of the two radio components, we observed 3C326 for 12 hr on 1990 February 19 with the Ryle Telescope (the enhanced 5-km telescope) at 4.9 GHz. As this observation was made during commissioning, the available bandwidth was only 160 MHz; 13 baselines, ranging from 288 to 2160 m, were available and gave a resolution of 6×17 arcsec^2. Both components were clearly detected; a summary of their radio properties and the optical properties of their associated identifications (galaxies A and B) is given in Table 1.

3 CONCLUDING REMARKS

On the basis of their positions with respect to the Mpc-scale radio structure and their radio spectra, both A and B are equally good candidates for the identification of 3C326. Similarly, they each produce values of core/total radio luminosity typical for this class of source (e.g. Rawlings *et al.* 1989). Both have radio luminosities characteristic of elliptical galaxies in groups and clusters (Bijleveld 1984). However, if A is the identification, its optical magnitude implies a stellar luminosity that is among the lowest found for FRII radiogalaxies with $z < 0.5$ (see Lilly & Longair 1984), whereas if B is the identification the stellar luminosity is typical. Of greater significance is the striking difference in the

Table 1. Optical and radio data for galaxies A and B.

	Galaxy A	Galaxy B	References
Optical position (1950.0) RA	15 49 56.13	15 49 56.04	POSS
Optical position (1950.0) DEC	20 14 18.2	20 14 43.3	POSS
K magnitude	13.60	12.95*	Lilly & Longair (1984), * see Fig. 1
Redshift	0.0885	0.0885	Saunders *et al.* (1989), this paper
Hα+[NII] flux (Wm^{-2})	$< 2 \times 10^{-18}$	1.5×10^{-17}	this paper
Radio position (1950.0) RA	15 49 56.15	15 49 56.08	this paper
Radio position (1950.0) DEC	20 14 17.9	20 14 42.8	this paper
Radio flux density (mJy) at 8 GHz	6.5 ± 0.2	1.5 ± 0.2	this paper
5 GHz	10.5 ± 0.4	3.5 ± 0.4	this paper
2.7 GHz	11 ± 1.5	3 ± 1.5	this paper
1.4 GHz	18.5 ± 1	(in beam)	Willis & Strom (1978)
610 MHz	24 ± 3	(in beam)	Willis & Strom (1978)

emission-line strengths of A and B; if B is the correct identification, then 3C326 will no longer be an outlier on plots of narrow-line luminosity versus total radio luminosity for FRII radiogalaxies (e.g. Rawlings *et al.* 1989). We conclude that galaxy B is the correct identification of 3C326.

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