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OPTICAL IDENTIFICATION OF THE RADIO SOURCE NEAR NGC 5444

G. W. Brandie, A. H. Bridle

Queen's University at Kingston, Ontario K7L 3N6, Canada

and E. B. Fomalont

National Radio Astronomy Observatory,* Green Bank, West Virginia 24944, USA

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SUMMARY

We report an accurate position, radio structure and new optical identification for the radio source previously identified with the 13^m galaxy NGC 5444.

The radio source B2 1401+35A = 4C 35.32 = OQ 302 has been identified (Aizu 1966; Caswell & Wills 1967; Hazard, Jauncey & Backer 1970; Heeschen 1970a, b; Fanti *et al.* 1973; Wardle & Sramek 1974) with the 13^m elliptical galaxy NGC 5444. We have observed the source with the NRAO four-element interferometer at 2·7 and 8·1 GHz with baselines between 0·1 and 35·3 km over a position angle range of $-20°$ to 110°. The baselines from 0·1 to 2·7 km were obtained with three 85-ft (26-m) antennas at Green Bank as described by Hogg *et al.* (1969) and Coe (1973). Three long baselines of 33·1, 33·8 and 35·3 km were obtained by correlating the signals from the 85-ft antennas with those from a 45-ft (14-m) antenna on a site about 35 km south-west of Green Bank, as described by Fomalont & Miley (1975).

The total flux density detected at 2·7 GHz was 320 ± 20 mJy, in good agreement with the 340 ± 10 mJy measured using a 4·7 arcmin beam with the NRAO 300-ft telescope by Bridle, Kesteven & Brandie (in preparation). Our observations therefore refer to at least 90 per cent of the source intensity, although we cannot exclude the presence of ~30 mJy in a larger-scale component (or confusion) as suggested by Heeschen (1970a, b). The total flux density detected at 8·1 GHz was 100 ± 15 mJy, in good agreement with the spectrum of the source at lower frequencies (Table I).

The source structure was unresolved on all but the longest baselines. Fig. 1 shows a ' Clean ' (Högbom 1974) map at 0·5 × 0·3 arcsec resolution obtained using the 2·7-km and longer-baseline data at 2·7 GHz. The source is extended by ≈0·7 arcsec in position angle ≈70°, and its centroid position (1950·0) is $\alpha = 14^h\,01^m\,09^s{\cdot}45 \pm 0^s{\cdot}04$, $\delta = +35°\,22'\,35''{\cdot}1 \pm 0''{\cdot}4$.

The optical position of the centre of NGC 5444 (Wills, Wills & Douglas 1973) is $\alpha = 14^h\,01^m\,14^s{\cdot}38 \pm 0^s{\cdot}04$, $\delta = 35°\,22'\,19''{\cdot}2 \pm 0''{\cdot}5$. Although the discrepancy in RA between the radio position and the galaxy has been noted in the literature (Hazard *et al.* 1970; Heeschen 1970a, b; Colla *et al.* 1975), the identification with

* Operated by Association Universities Inc., under contract with the National Science Foundation.

TABLE I

Flux densities of B2 1401+35A below 10 GHz

Frequency (MHz)	Flux density (Jy)	Reference
178	3·9±1·0	Pilkington & Scott (1965)[1]
408	1·87	Colla *et al.* (1973)
430	1·6±0·2	Hazard *et al.* (1970)
611	1·3±0·1	Lang & Terzian (1969)
750	1·2	Heeschen & Wade (1964)
1400	0·8	Heeschen & Wade (1964)
2695	0·34±0·01	Bridle *et al.* (in preparation)
2695	0·32±0·02	This paper
2695	0·31±0·03	De Jong (1967)
4995	0·11±0·07	Heeschen (1970a)
8085	0·10±0·01	This paper
8085	0·11	Wardle & Sramek (1974)

Note

[1]. Flux-density scale adjusted to that of Bridle *et al.* (1972).

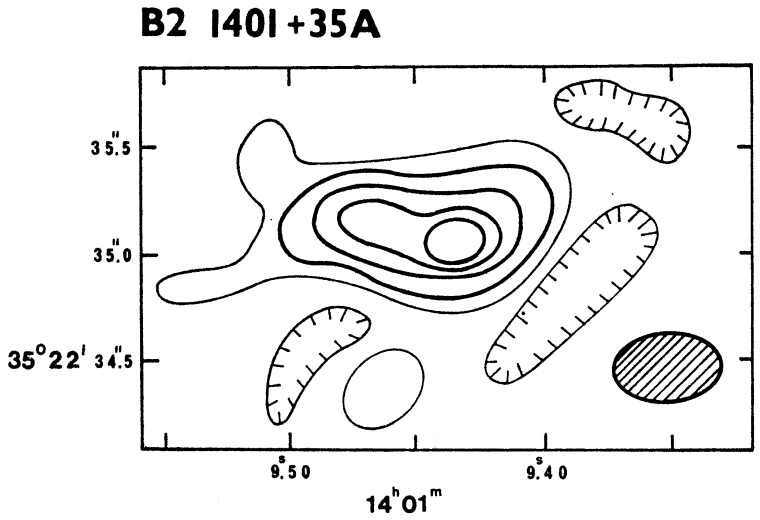

FIG. 1. *2·7-GHz map of B2 1401+35A with a beam (hatched ellipse) 0·55×0·28 arcsec in position angle 100°. The contours are at −17, +17, 35, 70, 104 and 140 mJy per beam. The absolute positional uncertainty is ≈0·4 arcsec in both coordinates.*

NGC 5444 has persisted. Plate I is a reproduction of the red print of the Palomar Sky Survey indicating the $\approx 20^{m}$ object which lies at our radio position to within the overlay accuracy of ≈3 arcsec; this object appears more sharply defined on the blue print than on the red but is too faint to be classifiable. We suggest that this faint object is the optical counterpart of the radio source.

If the radio source is assumed to be at the 80-Mpc distance corresponding to the redshift of NGC 5444 ($z = 0{\cdot}0133$, Colla *et al.* 1975), its radio luminosity (assuming the power-law spectrum to extend between 10 and 10 000 MHz) would be $\approx 4\times 10^{33}$ W, and its linear extent ≈260 pc. Such a combination of parameters would be most unusual for a radio source in the outer envelope of an elliptical galaxy.

If, however, the faint object were interpreted as the image of a distant radio galaxy with a redshift of 0·4 in an Einstein–de Sitter cosmology with $H = 50$ km

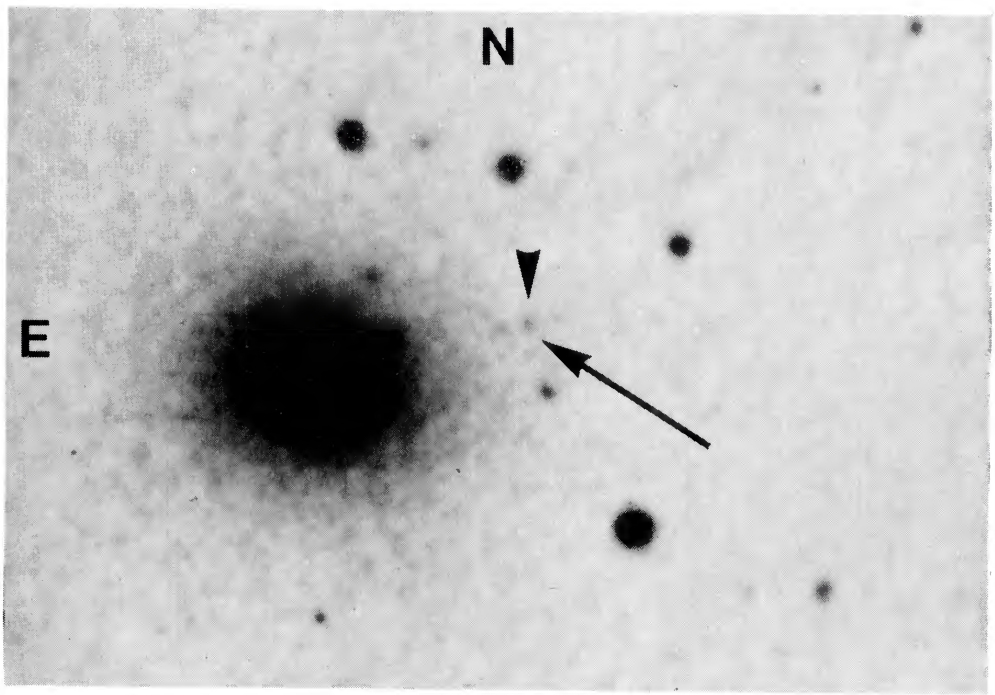

PLATE I. *Enlargement of the red print of the Palomar Sky Survey showing a field 4·7 × 3·2 arcmin near NGC 5444. The suggested identification is marked. © Copyright National Geographic Society—Palomar Observatory Sky Survey, reproduced by courtesy Hale Observatories.*

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s^{-1} Mpc^{-1}, the radio luminosity and size would be 6×10^{36} W and 4·5 kpc respectively. Such parameters are not uncommon for the more powerful small radio galaxies. Interpretation of the object as a QSO with large cosmological redshift would lead to equally plausible parameters.

The probability of finding a radio source $\geq 0{\cdot}3$ Jy at 2·7 GHz randomly within about 1 arcmin of a galaxy brighter than 13^m is such that several coincidences are expected over the whole sky. We therefore suggest that B2 1401+35A = 4C 35·32 = OQ 302 should not be identified with NGC 5444, but that it is probably a distant background system.

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