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HIGH RESOLUTION OBSERVATIONS OF THE EXTRAGALACTIC RADIO SOURCES 3C 52 AND 3C 192

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SUMMARY

3C 52 and 3C 192 have been mapped at 2·7 and 5 GHz with the Cambridge One-Mile telescope. 3C 52 is a double source with evidence of misaligned structure in the components; with lower resolution 3C 192 appeared to have complex structure but the present observations show two compact components linked by extensive regions of low brightness.

The Cambridge One-Mile telescope has recently been used to map a number of extragalactic radio sources at 2·7 GHz and 5 GHz with angular resolution up to $6''\cdot5$ in right ascension and $6''\cdot5$ cosec δ in declination (Branson *et al.* 1972 and references therein; Riley & Branson 1973). This paper presents results on two further sources, 3C 52 and 3C 192, providing more detailed information about the structures of these than has previously been available.

(*a*) 3*C* 52

The 5 GHz map is shown in Fig. 1, and some of the parameters of the source and its components are summarized in Table I. The source comprises two relatively compact radio components, each with a faint extension directed nearly along the line towards the other component. These extensions appear significantly displaced from the axis defined by the peaks of emission; this displacement is confirmed by the lower resolution observations at 2·7 GHz, and also at 1·4 GHz (Macdonald, Kenderdine & Neville 1968). Although the source is at galactic latitude $b = -8°$, a large number of red galaxies are visible on the Palomar Observatory Sky Survey prints. A very red galaxy with $m_V = 18\cdot5$ lies between the radio components, rather nearer to the fainter one, and is almost certainly the correct identification as suggested by Wyndham (1966).

The properties of 3C 52 are similar to those of many other double sources observed with the One-Mile telescope; 3C 323·1 and 3C 381, for example, have comparable physical dimensions and radio luminosities (Branson *et al.* 1972). The deviations of the lower-brightness regions from the source axis are examples of a general phenomenon (Harris 1973, in preparation).

(b) 3*C* 192

The 2·7 GHz and 5 GHz maps are shown in Figs 2 and 3, and the source parameters are listed in Table I.

Earlier maps of lower resolution (Taylor & De Jong 1968; Mackay 1969)

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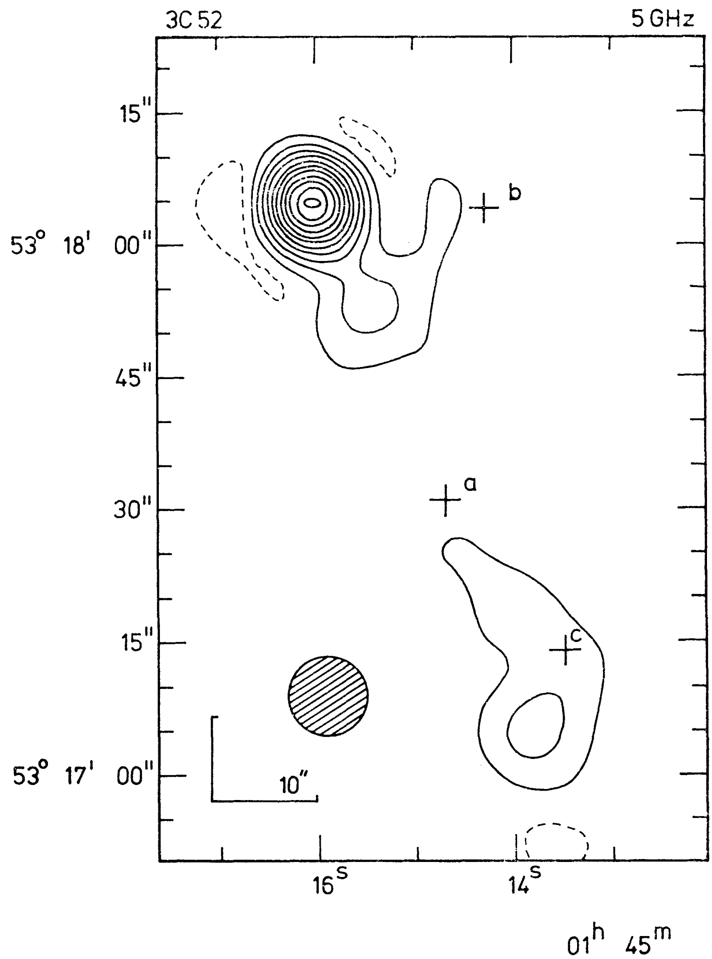

FIG. 1. 3*C* 52. *Map of the total radio emission at* 5 *GHz* (1950·0 *coordinates*). *The scale in declination is compressed by cosec δ so that the synthesized beam appears circular. Each arm of the 'L' is* 10″ *arc in length. The half-power beam is indicated by the shaded circle. The contour interval of* 85 *K in brightness temperature is about four times the rms noise level. The zero level of intensity lies approximately midway between two contours, and contours below this level are drawn dashed. The source lies in a cluster of galaxies; at the positions marked are* (*a*) *an* 18^{m}·5 *very red galaxy*, (*b*) *an* 18^{m}·0 *red galaxy*, (*c*) *a* 19^{m}·0 *red galaxy* (*Wyndham* 1966).

showed two peaks of emission to the west of the optical galaxy and a ridge of emission to the east, but the new maps reveal two compact peaks of emission at the extreme outer edges with a diffuse and irregular ridge of lower brightness between them. The diffuse regions contribute about three-quarters of the total radio flux. When these high frequency observations are smoothed to a resolution of 23″ arc, the structure is seen to be very similar to that found at 1·4 GHz by Mackay (1969) and at 256 MHz by Taylor & De Jong (1968). An analysis of all the available structural data reveals no evidence for variation of spectral index across the source.

A red DE1 galaxy (m_V = 15·4) with a redshift of 0·0598 (Sandage 1966; Burbidge & Strittmatter 1972) is situated near the centre of the source (Longair 1965; Wyndham 1966; Véron 1966). No radio emission is observed from the optical galaxy, but in other respects the structure of 3C 192 is very similar to those of 3C 382 and 3C 452 (Riley & Branson 1973). The extensive, irregular areas of low brightness are responsible for most of the radio emission from these

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TABLE I

Source	Right ascension (1950·0)	Declination (1950·0)	Total size (″ arc)	Component size (″ arc)	Flux density (10^{-26} W m^{-1} Hz^{-1}) 2·7 GHz	5 GHz	Distance* (Mpc)	Total size (kpc)	Radio luminosity† (10^{34} W)
3C 52	$01^h45^m13^s·8$	53°17′05″	64	~20 × <5	0·5	0·4	~900	240	90
	01 45 16·0	53 18 05		~20 × <3	1·8	1·3			300
optical	01 45 14·7	53 17 31				<0·05			<10
3C 192	08 02 29·2	24 19 24	185	<3 × <7	0·4	0·3	340	290	9
	08 02 40·8	24 17 46		12 × <10	0·3	0·2			6
	diffuse regions			~150 × ~50	2·5	1·6			45
optical	08 02 35·51	24 18 28·2				<0·02			<0·6

* The distances have been estimated from the optical magnitude of the galaxy identified with 3C 52, assuming $M_V = -23·1$, and from the redshift of that identified with 3C 192 assuming an Einstein–de Sitter universe with $H = 50$ km s^{-1} Mpc^{-1}.

† The radio luminosity is integrated over the range 10–10 000 MHz.

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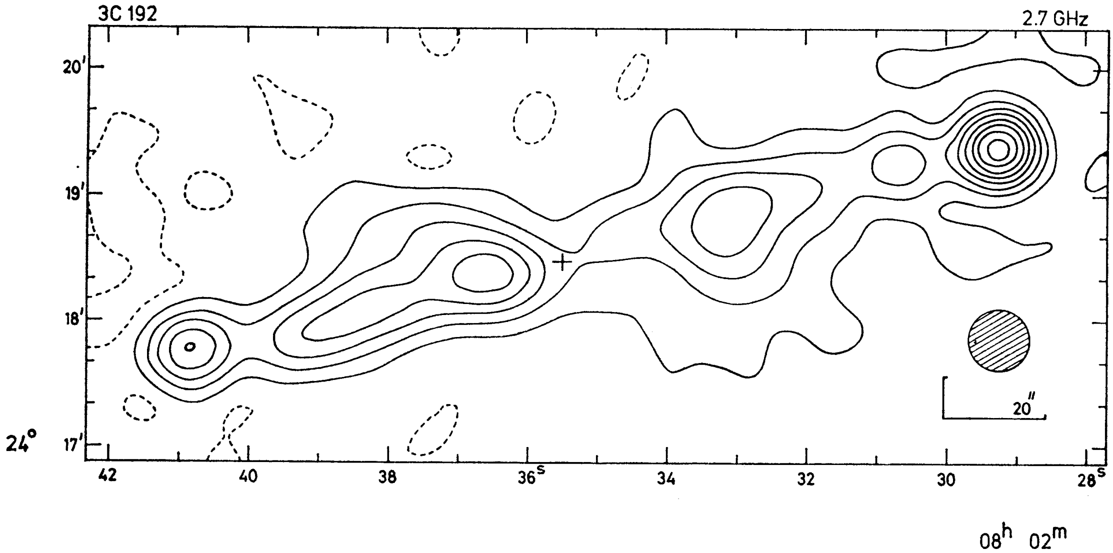

FIG. 2. 3C 192. *Map of the total radio emission at 2·7 GHz. The contour interval of 22 K in brightness temperature is about four times the noise level. The cross marks the position of a red DE1 galaxy* ($m_V = 15{\cdot}0$) *in a cluster* (*Wyndham* 1966; *Véron* 1966).

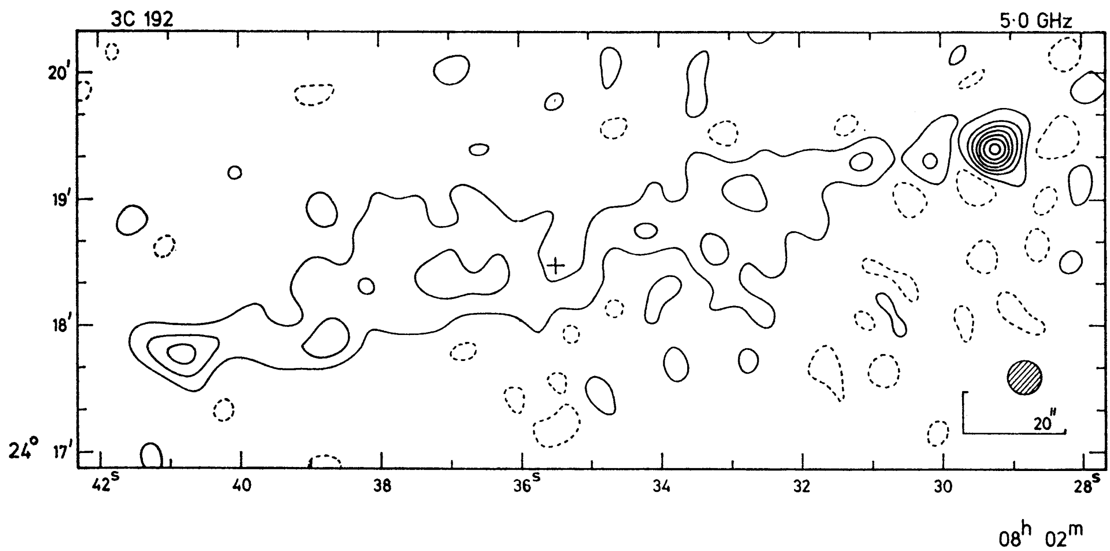

FIG. 3. *Map of the total radio emission from* 3C 192 *at* 5 *GHz. The contour interval of* 15 *K is about twice the noise level on the map.*

sources and contain much the greater part of the energy in the form of relativistic particles and magnetic fields. The discussion by Riley & Branson (1973) of the origins of these diffuse emission regions is also relevant to 3C 192.

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