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Global and EVN observations of the CSS 2147+145

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Abstract. We have recently re-analysed MERLIN observations at 5 GHz, Global VLBI Mk3B observations at 1.6 GHz and EVN Mk3B observations at 5 GHz of the Compact Steep-spectrum Source (CSS) 2145+147. The images put new light on the source structure. A new component has been found on the opposite side, respect to the brightest knot, of the previously observed strongly bent jet. The new images allow us to reconsider the interpretation of the source and suggest 2145+147 as a Compact Symmetric Object candidate.

1. Introduction

The source 2145+147 is a CSS; it shows a steep spectral index which flattens at about 200 MHz, has a linear size ∼ 2.6 kpc, and is associated with an unusually-faint optical object (Cotton 1989). Observed with the VLA A-array at 1.4, 5 and 15 GHz (Cotton 1983), it appears as a single elongated source with a size of 50×30 mas in PA 159°. More recent VLA observations at 8.4 and 15 GHz (Mantovani et al. 1997) showed both an increase in the total flux density of ∼ 13% and a new component north to the core separated by 0.35 arcsec in PA −40°. The new component lies in a direction which differs by more than 80° from that found for the jet axis in the λ18 cm VLBI map of Cotton et al. (1984). Since the components in the mas-scale jet lie along a path which bends smoothly towards north, it is reasonable to expect that the jet will continue to bend northwards towards the component. Follow-up Mk3B observations with 4 EVN telescopes (Mantovani et al. 1998) show that a sharp bend in the jet occurs at ∼23 mas, far from the brightest component at the origin of the jet emission. This bending was interpreted as due to the interaction between the jet and a dense gas cloud in the Narrow Line Region.

We have recently re-analysed the data sets from MERLIN observations at 5 GHz, Global VLBI Mk3B observations at 1.6 GHz and EVN Mk3B observations at 5 GHz of 2145+147, and we present here the results.

2. Results

The previous finding of a weak component ∼350 mas north to the bright one is confirmed by the MERLIN image at 5 GHz shown in Fig. 1. With the higher resolution of this image compared to previous VLA images, we see a jet-like feature emerging from the bright component and connecting the two. This jet-like feature lies in the same direction of the mas-scale jet axis after it bends.

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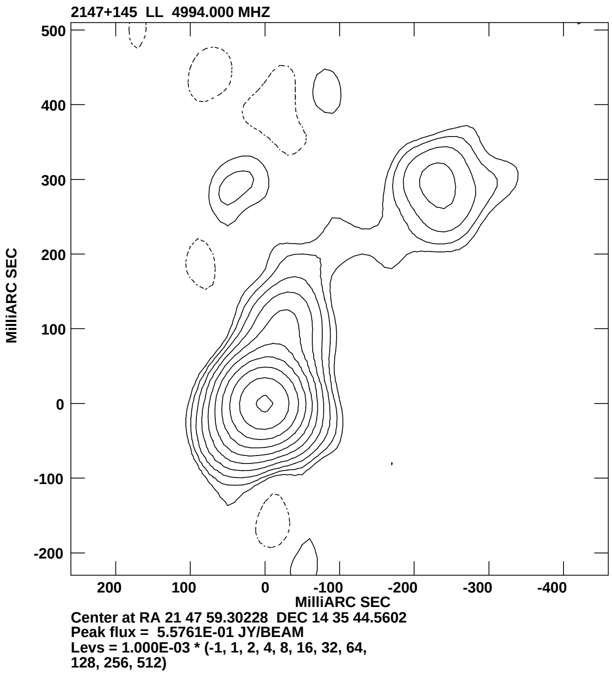

Fig. 1. MERLIN image at 5 GHz of 2147+145 from the February 12th 1998 observations. The beam is 60 mas.

The image obtained from Global observations at 1.6 GHz (Fig. 2) clearly shows that the sharp bend in the jet occurs at 25 mas from the brightest component. After the bend, the jet seems to maintain its direction, pointing straight to the northern component. Such a behaviour was, in some sense, predictable from the existing images. On the other hand, we did not expect to detect emission south of the bright component opposite to the jet. A new component, was in fact detected about 35 mas apart. The detection of the southern component was later confirmed by EVN observations at 5 GHz (Fig. 3). We have convolved the two images with a 8 mas circular beam for a

Table 1. Physical parameters derived from the VLBI images

C.	bmaj mas	bmin mas	PA deg	$S_{1.6\,peak}$ mJy/b	$S_{1.6\,tot}$ mJy	$S_{5\,peak}$ mJy/b	$S_{5\,tot}$ mJy	S.I. α_p	(S$\propto \nu^{-\alpha}$) α_t
A	6.9	5.1	110	23.1	58.9	14.1	21.1	0.85	0.93
B	11.2	6.7	170	24.7	50.6	11.8	24.2	0.67	0.67
C	11.2	2.5	22	123.8	152.1	38.7	66.0	1.05	0.76
D	6.5	4.9	3	736.8	1123.2	242.3	355.0	1.00	1.04
E	13.4	5.4	140	43.9	91.4	9.6	19.9	1.38	1.38

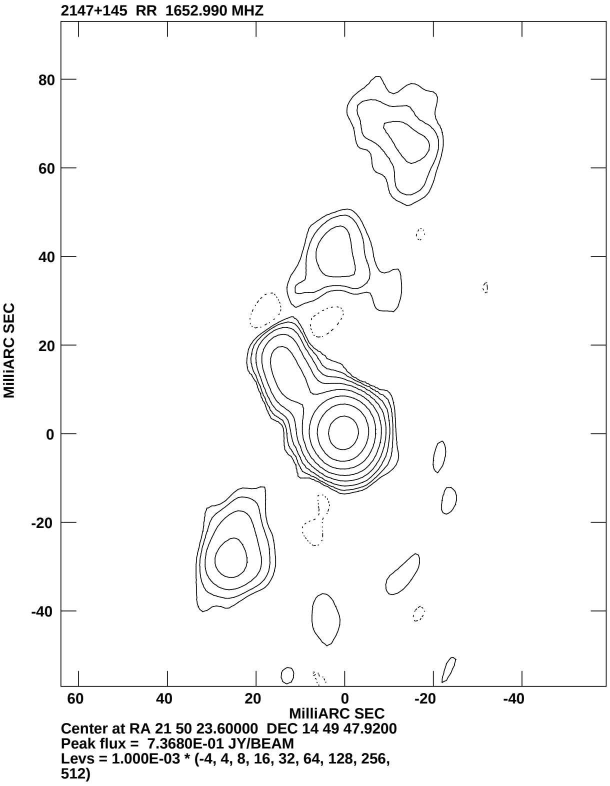

Fig. 2. Global VLBI Mk3B image at 1.6 GHz of 2147+147 from the Nov. 15th 1993 observations. The beam is 8 mas.

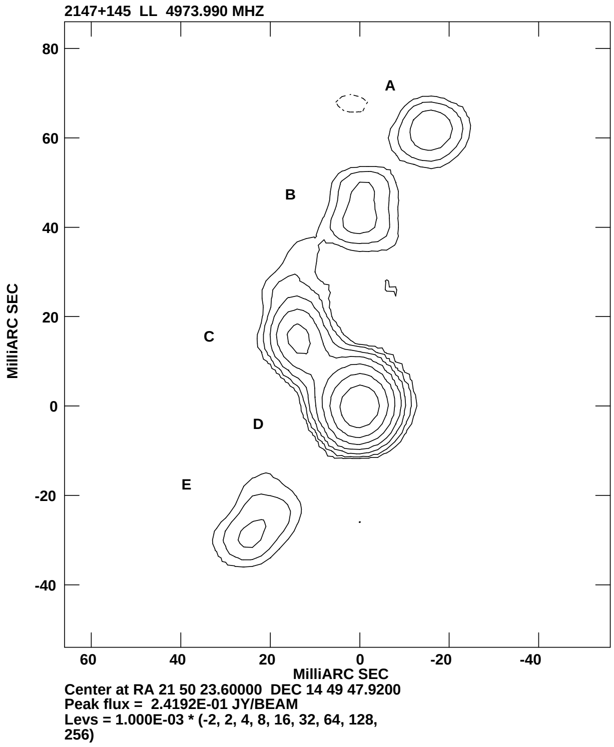

Fig. 3. EVN Mk3B image at 5 GHz of 2147+147 from the Feb. 23rd 1997 observations. The beam is 8 mas.

better comparison. The physical parameters derived from the two images are summarised in Table 1.

3. Conclusions

The values in Table 1 show that all the five components we have identified in the structure of 2145+147 have a steep spectral index. These components are also resolved by the present observations. It follows that none of them has the typical signature of the radio core, i.e. a flat or inverted spectral index and compact feature. The source shows a S-shaped structure reminiscent of those seen for several Compact Symmetric Object (see Taylor et al. 1996). If this is the case, we can infer where the location of the core may be by the fact that in CSO the jet-to-counter-jet brightness ratio is $> 10 : 1$. It follows that the site of the core should be in between components C and D. Sensitive VLBI observations at higher frequency and resolution are needed to confirm this possible interpretation. It is worth to note that since 2145+147 is optically weak (Cotton et al. 1989), the host object is probably a galaxy. However, CSSs associated with galaxies usually have double-lobed rather than distorted radio structure; 2145+147 would appear to belong to the latter class.

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