Nuclear structures in 2-Jy radio galaxies

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We present the results of VLBI observations of six radio galaxies belonging to the 2-Jy sample. The selected objects are 3C17, PKS 0620−52, PKS 0625−35, PKS 1318−43, PKS 1333−33 and 3C317. The analysis of our images in the light of unification models for radio loud AGNs suggests that they are characterised by at least mildly relativistic speeds and are viewed at intermediate to large angles to the line of sight. 3C17 and 3C317 will be presented in greater detail.

1. Introduction

Radio sources in the 2-Jy catalogue (Wall & Peacock 1985) are potentially a very powerful tool for the understanding of the nuclear properties of radio galaxies. Thanks to its selection criteria ($S_{2.7GHz} \geq 2$ Jy, z $<$ 0.7, $\delta \leq 10°$), the sample includes radio sources of different classes, i.e. FRIs, FRIIs, CSS, compact flat spectrum sources and core-halo sources. Furthermore the sample is studied in a wide range of bands, from radio (Morganti et al. 1993 and 1999), to optical (Tadhunter et al. 1993), up to X–ray energies (Siebert et al. 1996). This allows comparative studies, which are crucial to understand the physics of the inner parsec-scale regions in AGN, to test unified models and evolutionary scenarios for radio galaxies.

From the 2-Jy sample we selected six radio galaxies lacking information on their parsec-scale morphology and with arcsecond core flux density $S_{5GHz} \geq 200$ mJy, and observed them with different VLBI arrays (i.e. EVN+MERLIN, LBA, VLBA) in different bands (18, 13 and 6 cm). The selected objects are 3C17, PKS 0620−52, PKS 0625−35, PKS 1318−43, PKS 1333−33 and 3C317. The first is an intermediate FRI/FRII object, while all the others are FRIs located in optically dense environments. In particular, 3C317 is associated with the cD galaxy UGC 9799, at the centre of the cooling flow cluster A2052. This source was extensively studied at arcsecond resolution by Zhao et al. (1993) Details on the observations and data reduction can be found in Venturi et al. (2000).

2. Images and Results

The resolution in our images ranges from a few mas for 3C17 and 3C317, observed respectively with the VLBA (6 cm) and EVN+MERLIN (6 cm and 18 cm) to $\sim$ 30 mas for all the remaining sources, observed with the LBA at 13 cm. The rms ranges from $\sim$ 0.3 to 1.3 mJy/b.

In agreement with the results found in the literature for low and intermediate power radio galaxies, the six objects presented here are either unresolved, i.e. PKS 0620−52 and PKS 1333−33, or characterised by asymmetric parsec-scale emission, with a dominant core and one-sided jet. In Figure 1 we show the 6 cm radio image of the arcsecond and parsec-scale radio emission for 3C17.

Assuming that the observed morphologies are due to Doppler boosting in an intrinsically symmetric source, we derived some estimates for the viewing angle θ and the intrinsic speed β_{intr} of the radio emitting plasma using two beaming indicators, i.e. the

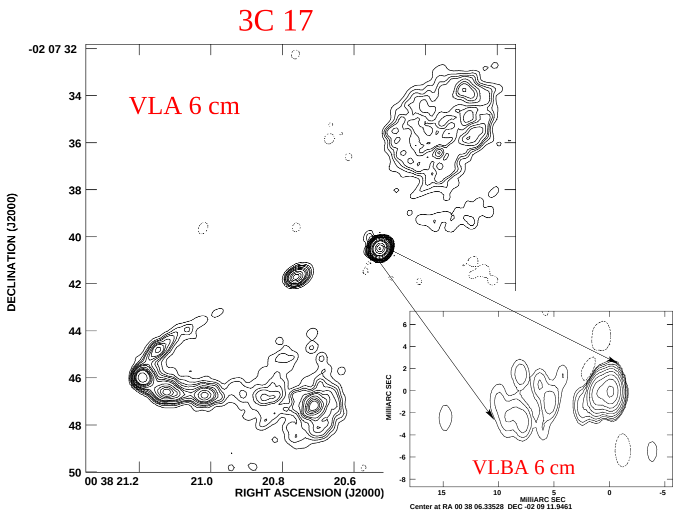

FIGURE 1. 6 cm arcsec- and milliarcsec-scale emission of 3C17. The arcsecond scale image is taken from Morganti et al. 1999. The rms of the VLBA image is 0.38 mJy/b and the restoring beam is 5×2 mas. Contours are 0.9 × -1, 1, 2, 4, 8, 16, 32, 64, 128, 256 mJy/b.

jet to counterjet brightness ratio and the 5 GHz arcsecond scale core dominance with respect to the source total power at 408 MHz. The results obtained with these two independent methods are in good agreement with each other.
We can summarise our results as follows (see Venturi et al. (2000) for a more detailed discussion).
- For the FRI sources we found mildly relativistic speeds for the radio plasma, i.e. $\beta_{intr} \geq 0.4$, and viewing angles θ in the range $\sim 45° - 70°$, in agreement with unification. Interestingly enough, the core dominance in PKS 1333−33 suggests that the source is oriented exactly at 60° to the line of sight.
- For 3C17 we found $33° \leq \theta \leq 49°$, consistent with the fact that it is a broad line radio galaxy.
- Our detailed study on 3C317 shows that the source is characterised by a bent morphology, with collimated parsec-scale jets which disrupt on the sub-kiloparsec region, possibly as consequence of the cooling flow at the centre of the galaxy. Our spectral analysis of the source core region suggests that the source is very young.

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