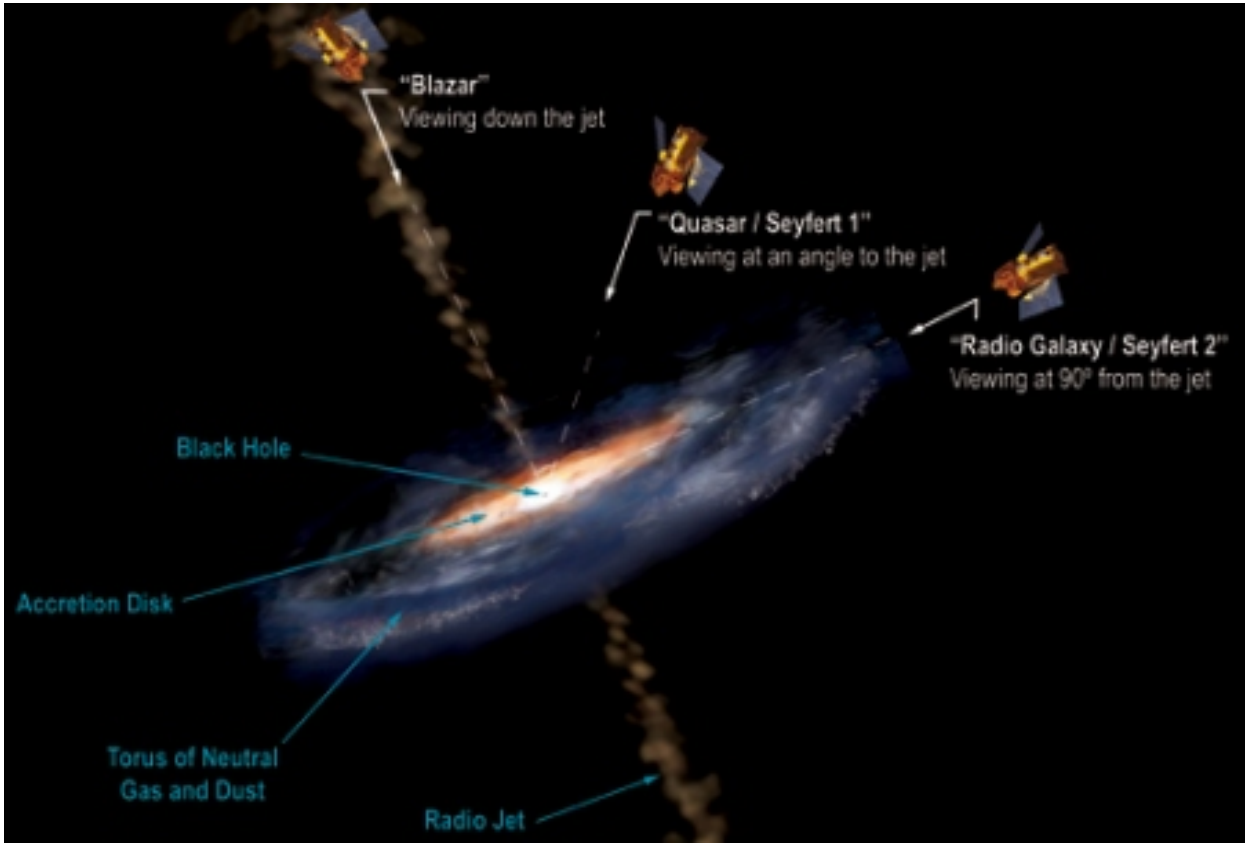
Are core-dominated triple sources concealed double-doubles or X-shaped sources?

Marek Szablewski

Centre for Astronomy of the Nicolaus Copernicus University

Manchester, 20.07.2011

Internal structure of an Active Galactic Nucleus



Standard external structure of a radio galaxy

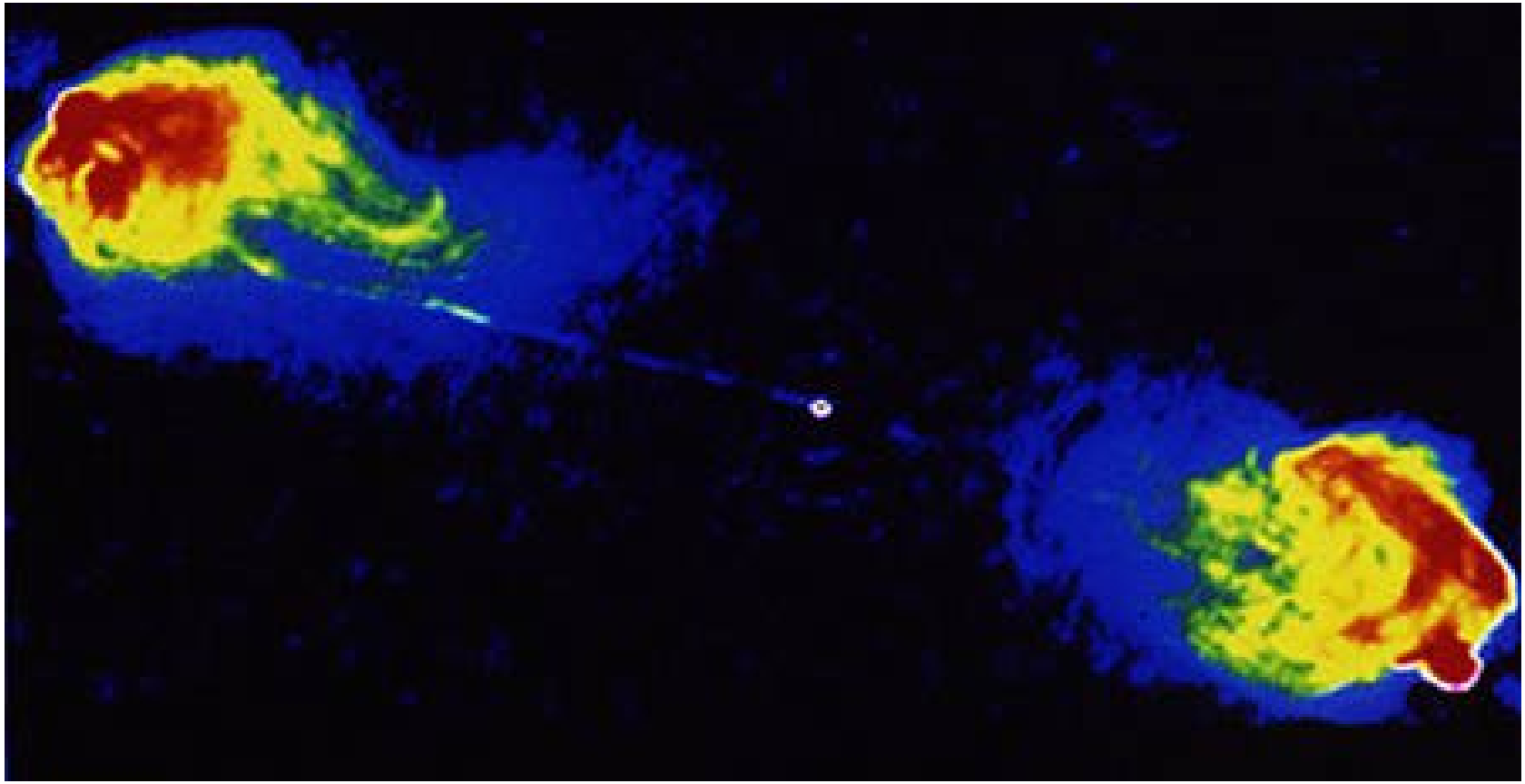


Figure: Cygnus A

Non-standard external structure of a radio galaxy

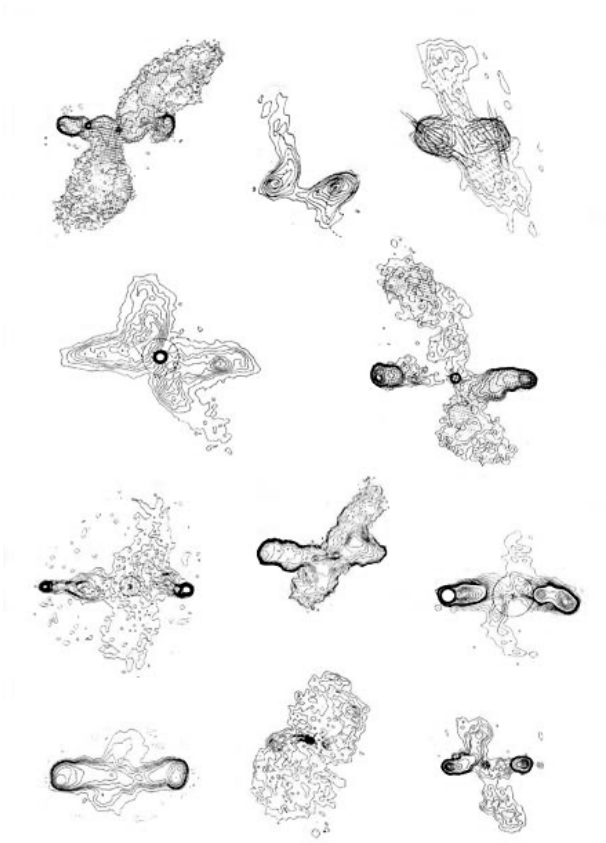


Figure: X-shaped objects

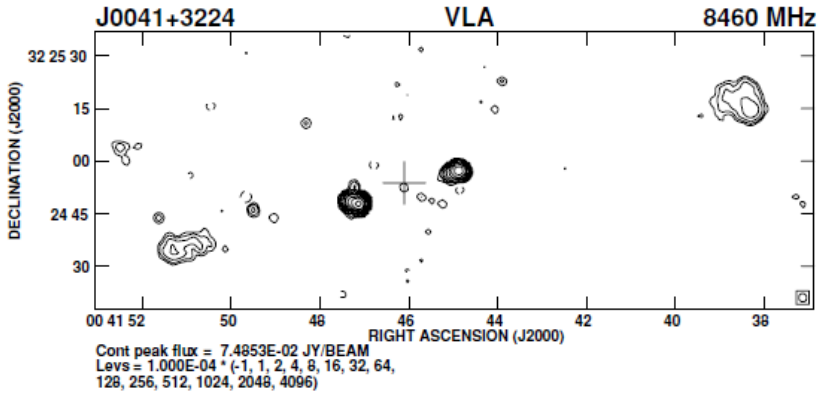
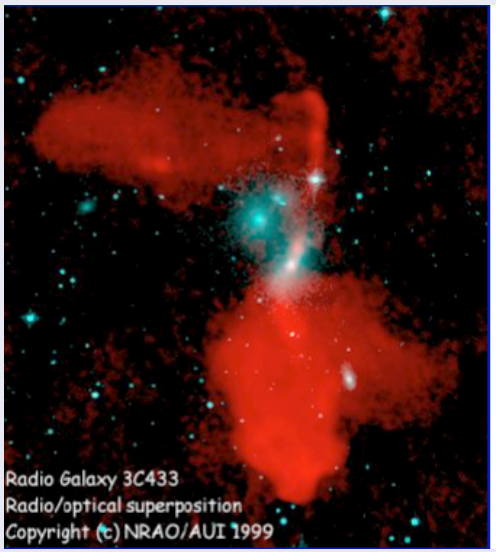


Figure: Double-double object

The two models of formation of X-shaped radio sources

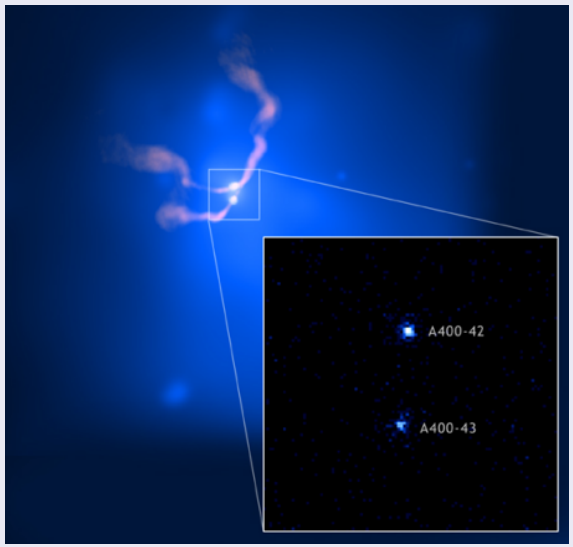
The backflow model

Lobe material flowing back from the hotspot towards the core is deflected by the thermal gas halo associated with the host galaxy to form wings.

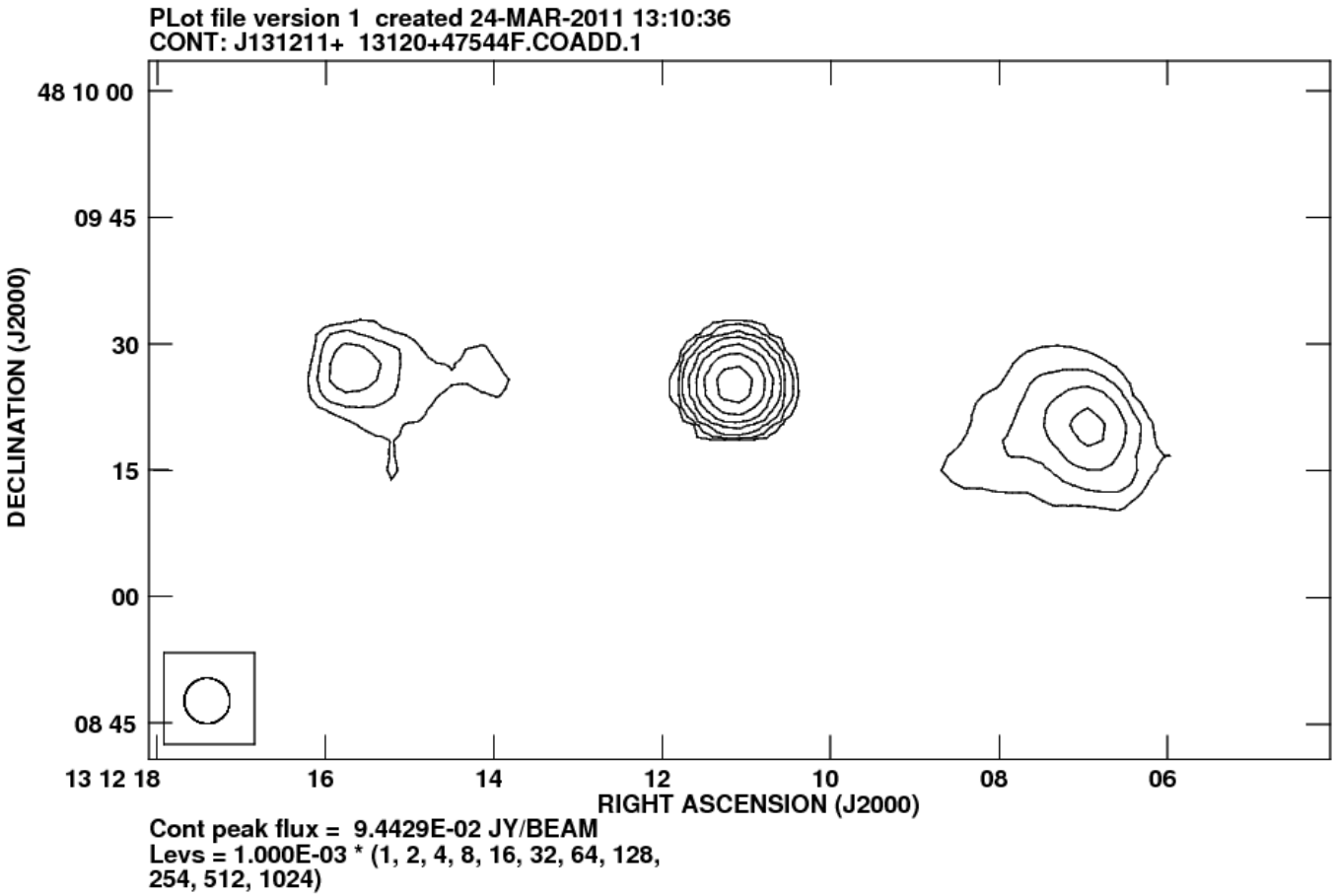


Jet re-orientation model

Jet axis undergoes a flip over a large angle resulting in new lobes at large angle to relic lobes. In what follows, we will prefer this model.



A Core Dominated Triple (CDT)



FIRST-based CDTs – selection process

Assumptions:

- flux density greater than a particular limit 75 mJy,
- a pair of "secondary" sources (the "lobes") were sought within a $2'$ radius of the initially selected sources (the 'core'),
- angle $lobe_1 - core - lobe_2$ greater than 165°,
- the peak flux densities of the 'lobes' were less than 30 %

We rejected objects:

- with flux densities below 40 mJy in GB6 survey,
- those whose spectral indices calculated from the FIRST and GB6 flux densities were: $\alpha < 0.5$ ($S \propto \upsilon^{-\alpha}$)

Selected CDTs

TXS 0726+256
TXS 0940+001
TXS 1024+549
TXS 1033+026
TXS 1308+011
TXS 1312+563
FIRST J155726.1+360133
B3 1704+437
TXS 0818+214
TXS 1002+554
TXS 1025+089
TXS 1046+187
TXS 1309+484
FIRST J152523.6+053736
FIRST J162544.9+271929

B0818+214

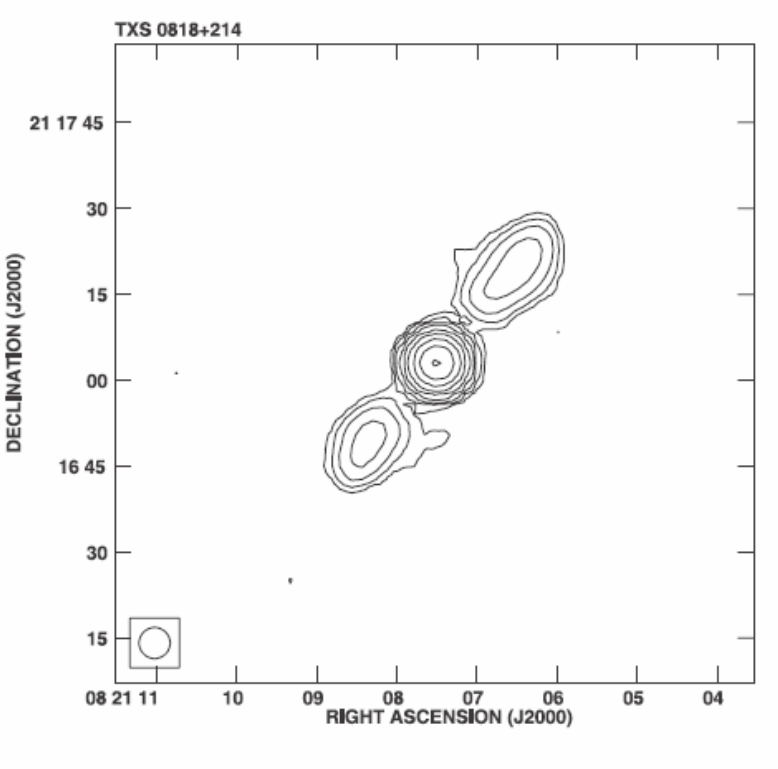


Figure: FIRST

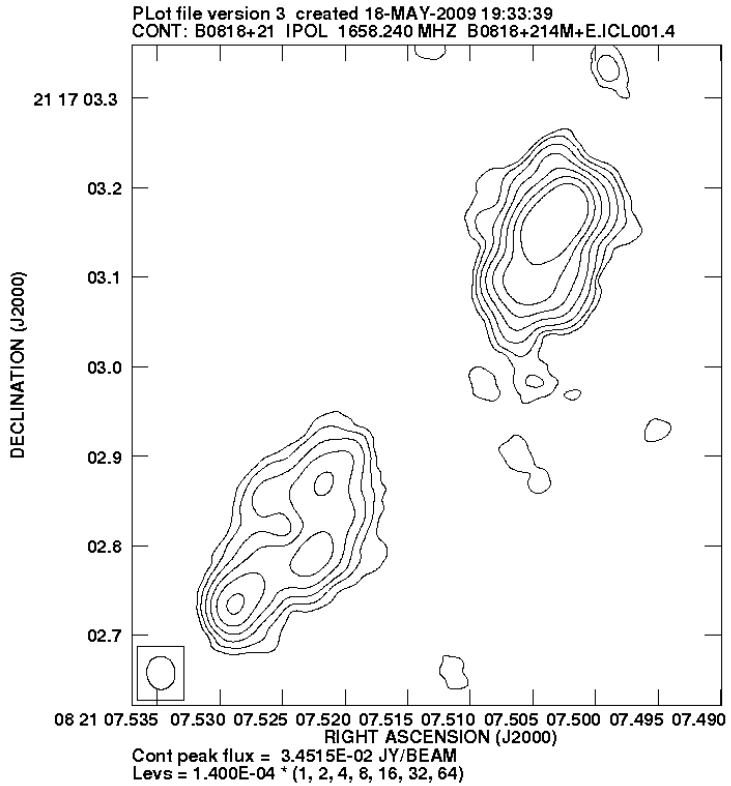
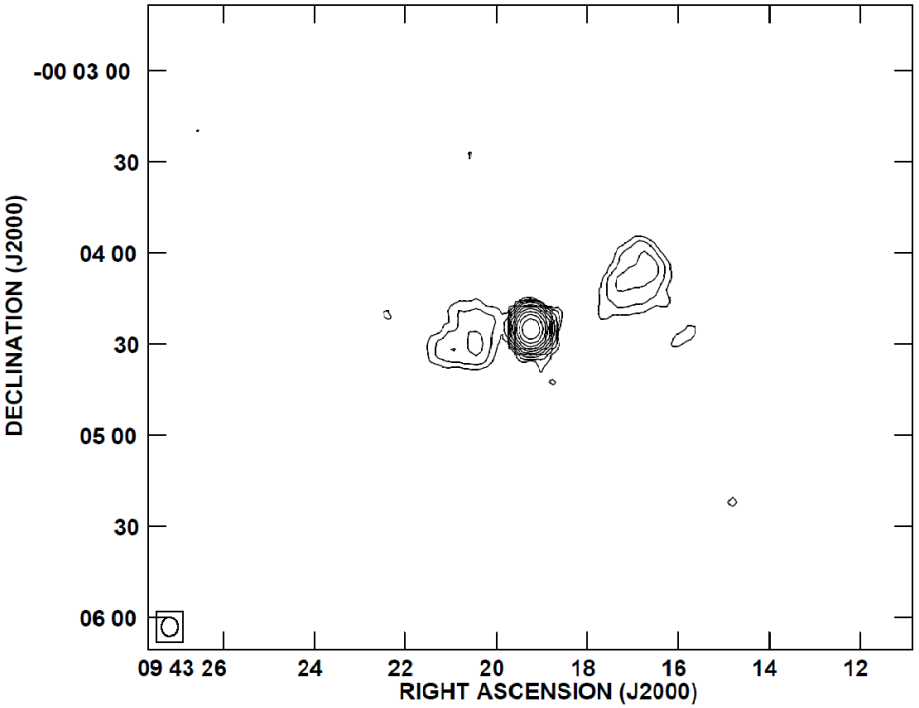


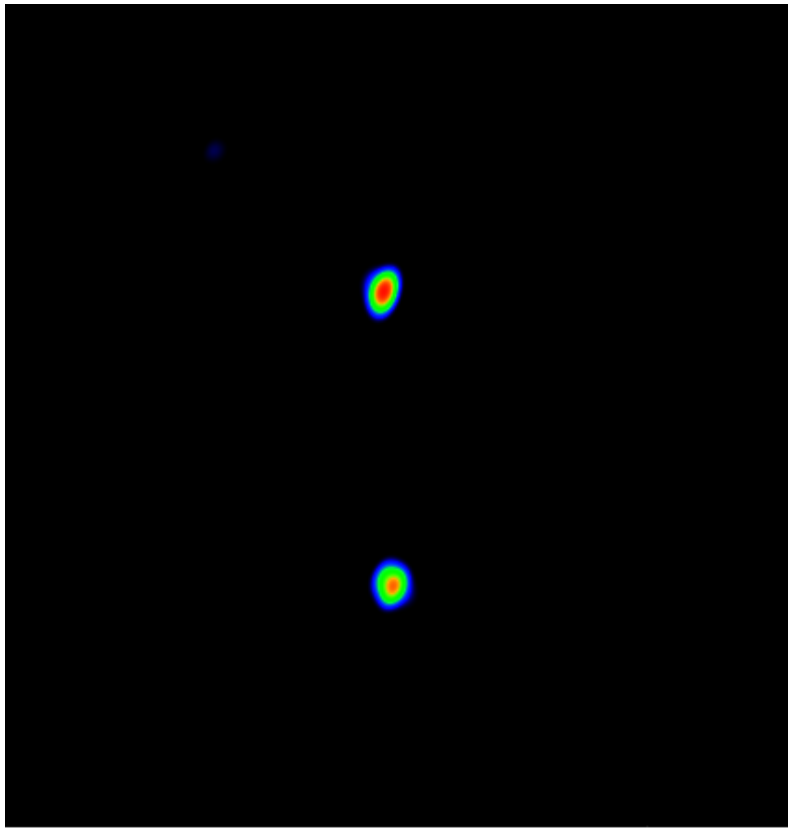
Figure: EVN+MERLIN

Results from EVN observations (6cm)

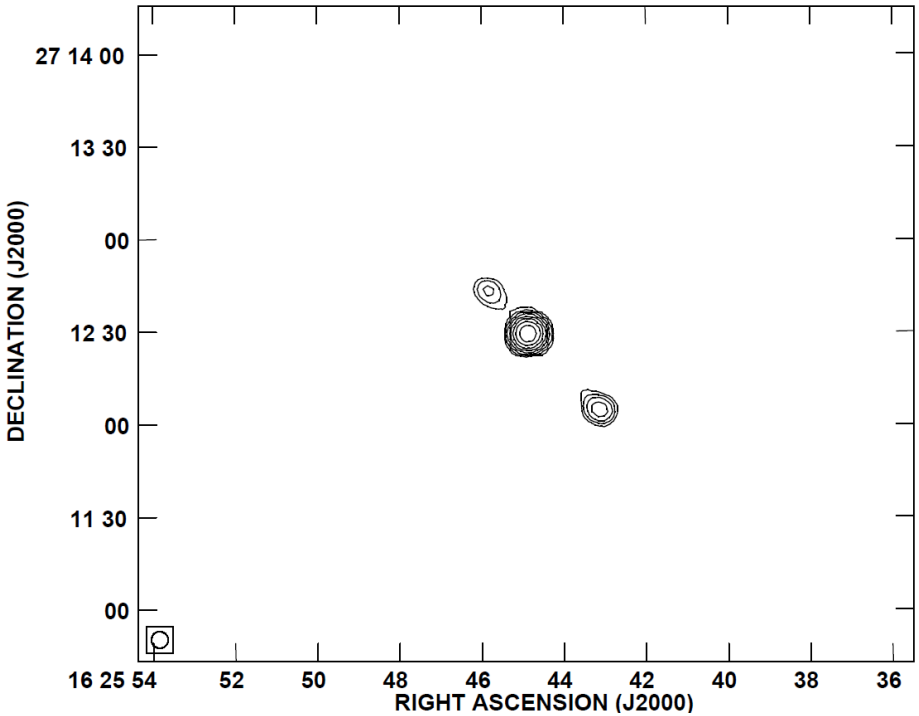
- B0726+256
- B0940+001
- B1002+554
- B1309+484
- J1525+0537
- J1625+2719

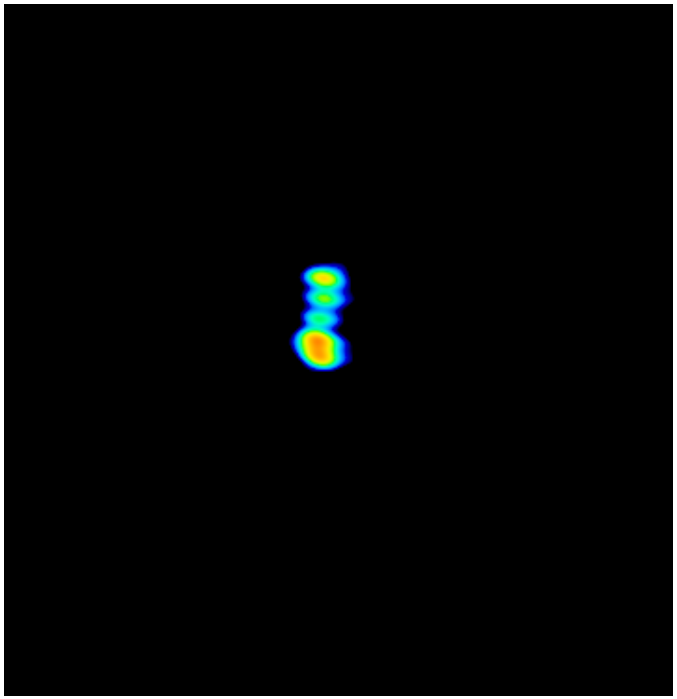
B0940+001 - FIRST and EVN





J1625+2719 - FIRST and EVN





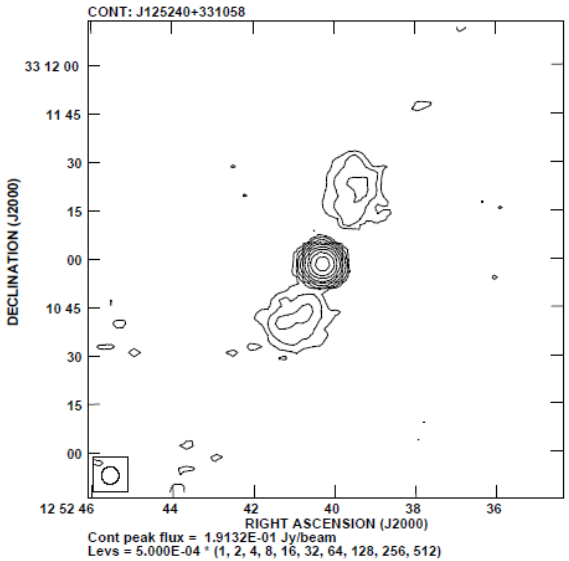
The sample was limited to objects with steep spectra to maximise the probability that the cores themselves, which mainly contribute to the total flux density, were likely to have steep spectra.

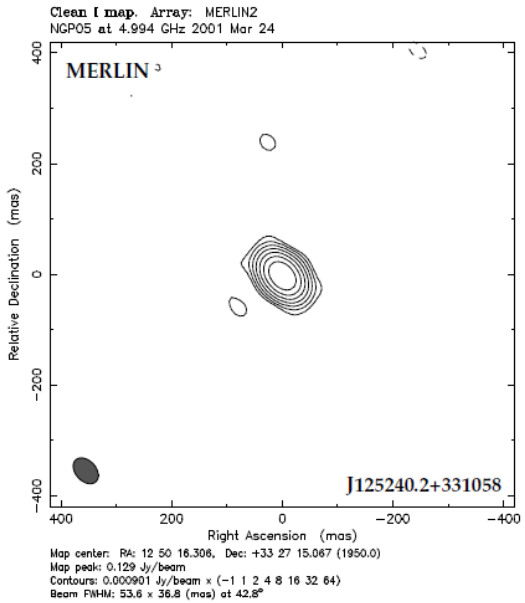
The sample was limited to objects with steep spectra to maximise the probability that the cores themselves, which mainly contribute to the total flux density, were likely to have steep spectra.

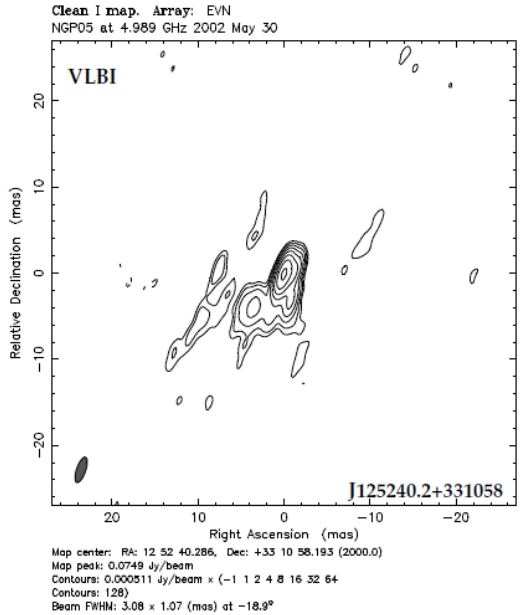
Alternatively, we required that spectra were flat.

J125240+331058 $z = 0,488464$ FSRS

Figure: VLA (left), MERLIN (center), VLBI (right).







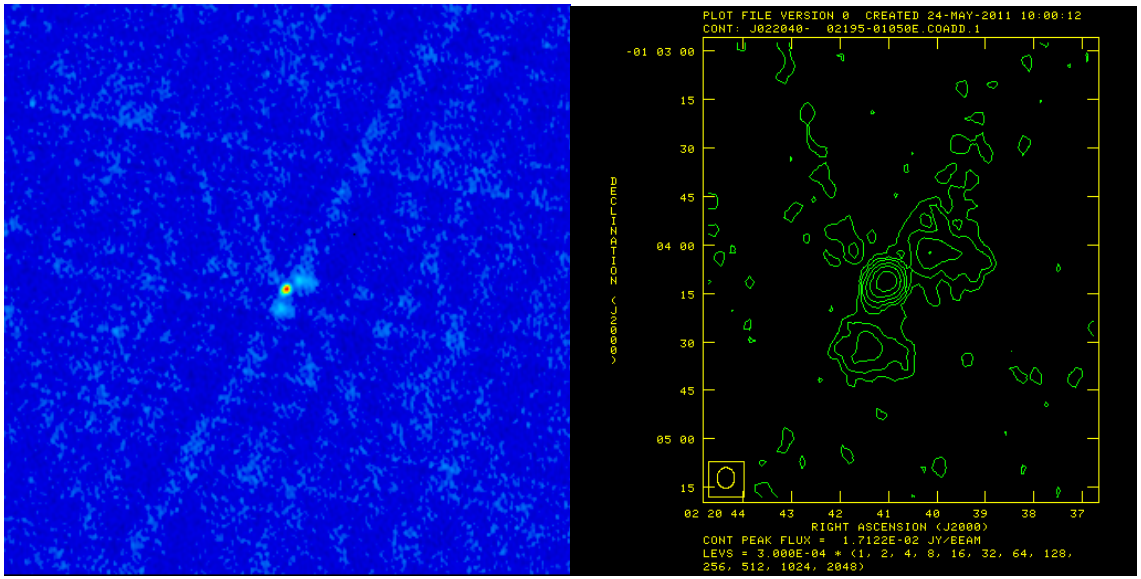
Mosoni et al. (2006)

Objects from Plotkin catalogue

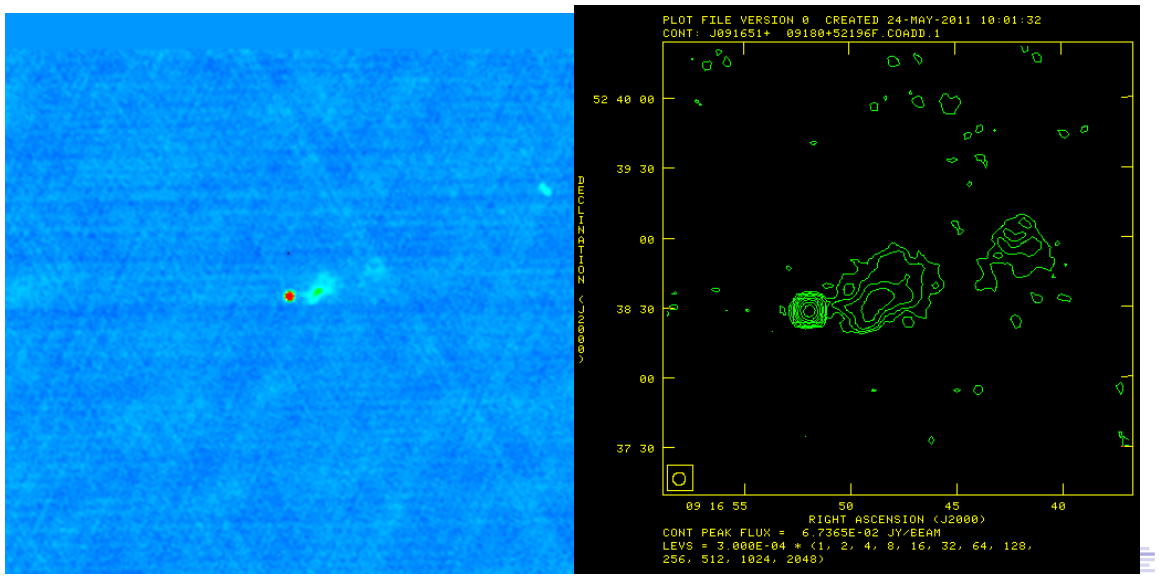
R. Plotkin et al. selected a large sample of BL Lac from SDSS and FIRST. This is a large sample of 501 radio selected BL Lac candidates (426 higher-confidence candidates and 75 lower-confidence candidates).

¿From this catalogue were selected 89 CDT objects.

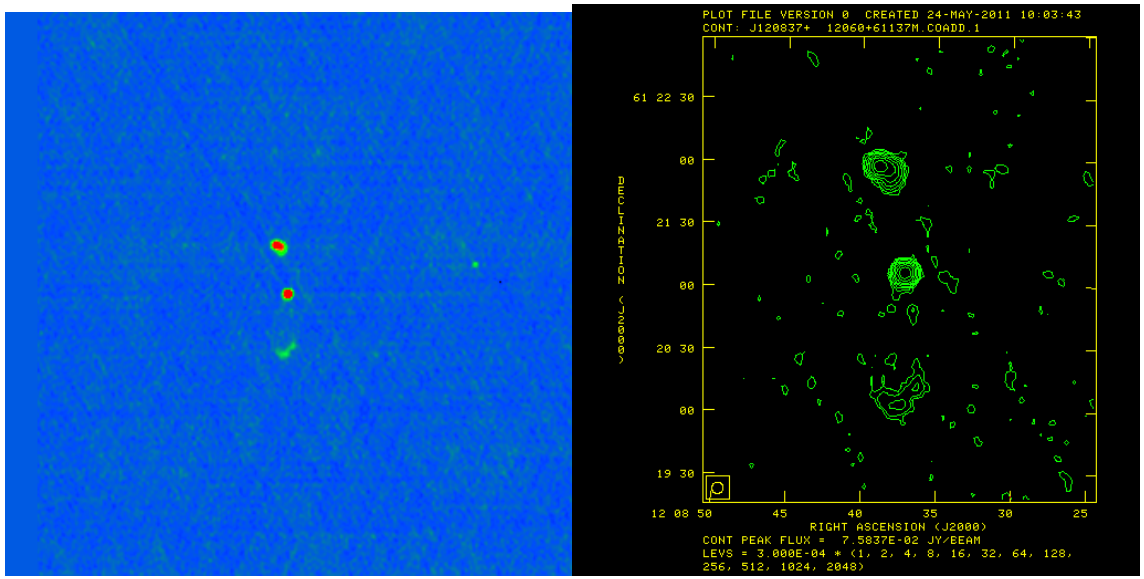
J022040.94-010410.8 $z = 0,349651$ BL Lac



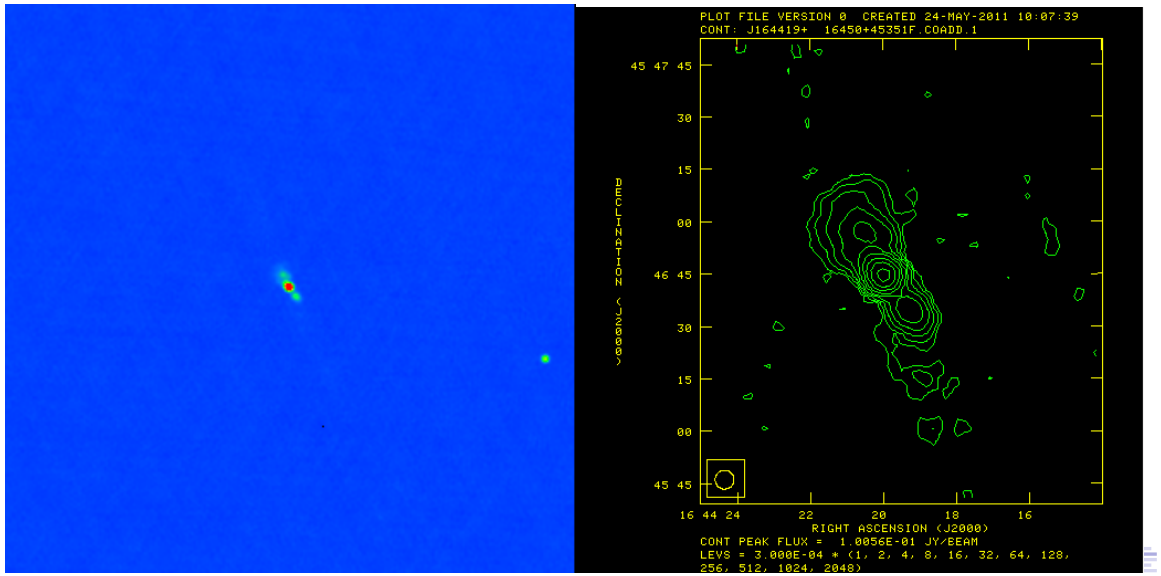
J091651.93+523828.1 $z = 0,190481$ FSRS



J12083705+6121069 $z = 0,274783$ BL Lac

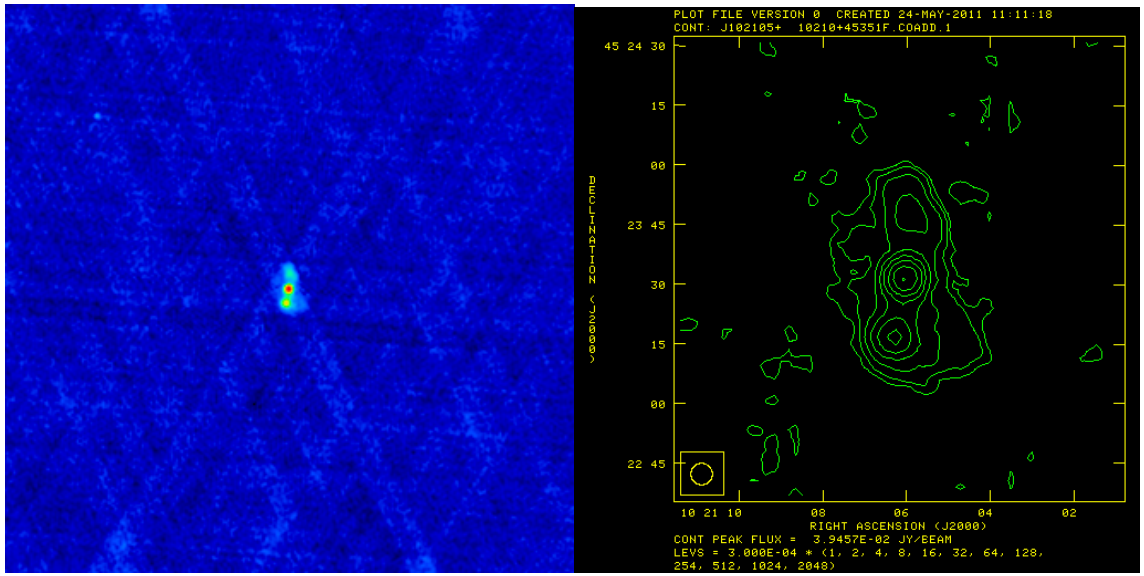


J164419.97+454644.3 $z = 0,224775$ BL Lac

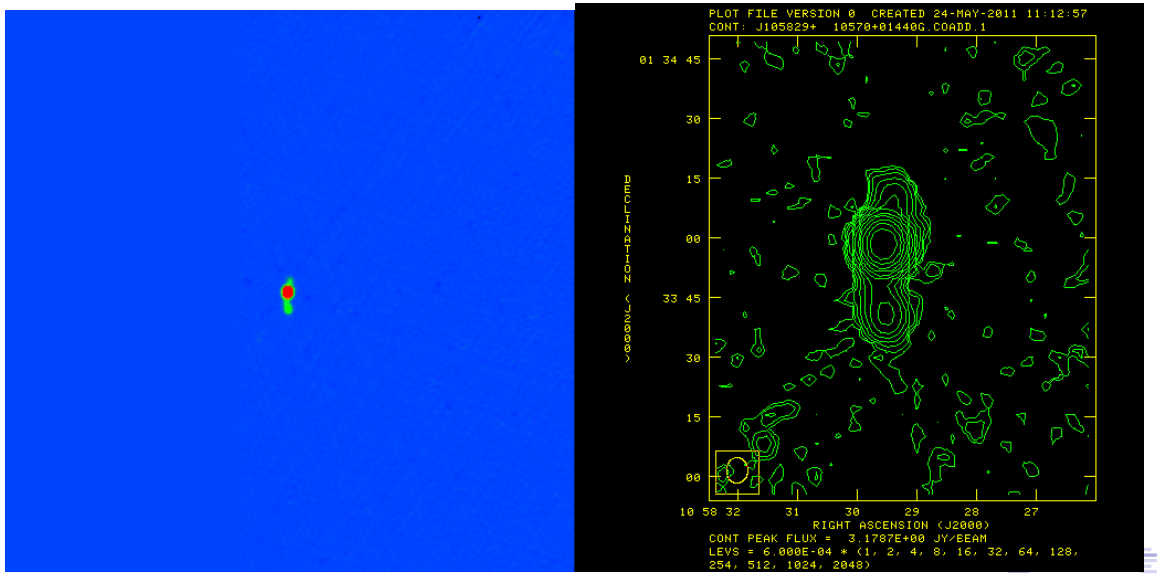


Objects from Roma-BZCAT catalogue

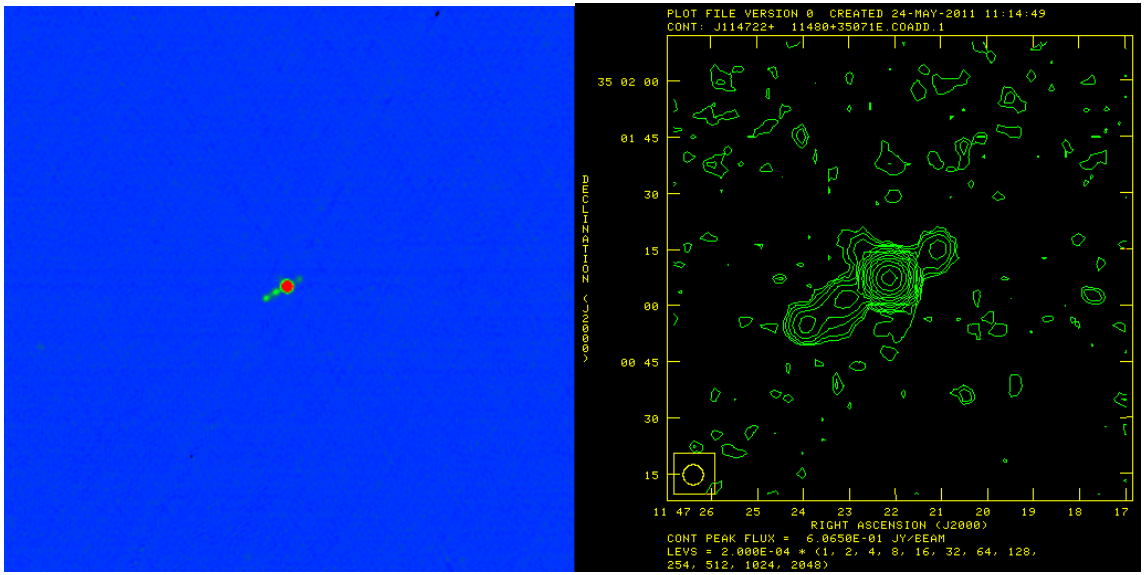
J102106.04+452331.8 $z = 0,364$ FSRS



J105829.60+013358.7 $z = 0,89$ BL Lac



J114722.14+350107.6 $z = 0.063130$ BL Lac



J151641.59+291809.2 $z = 0,13$ BL Lac