Proper motion and apparent contraction in the CSO J0650+6001

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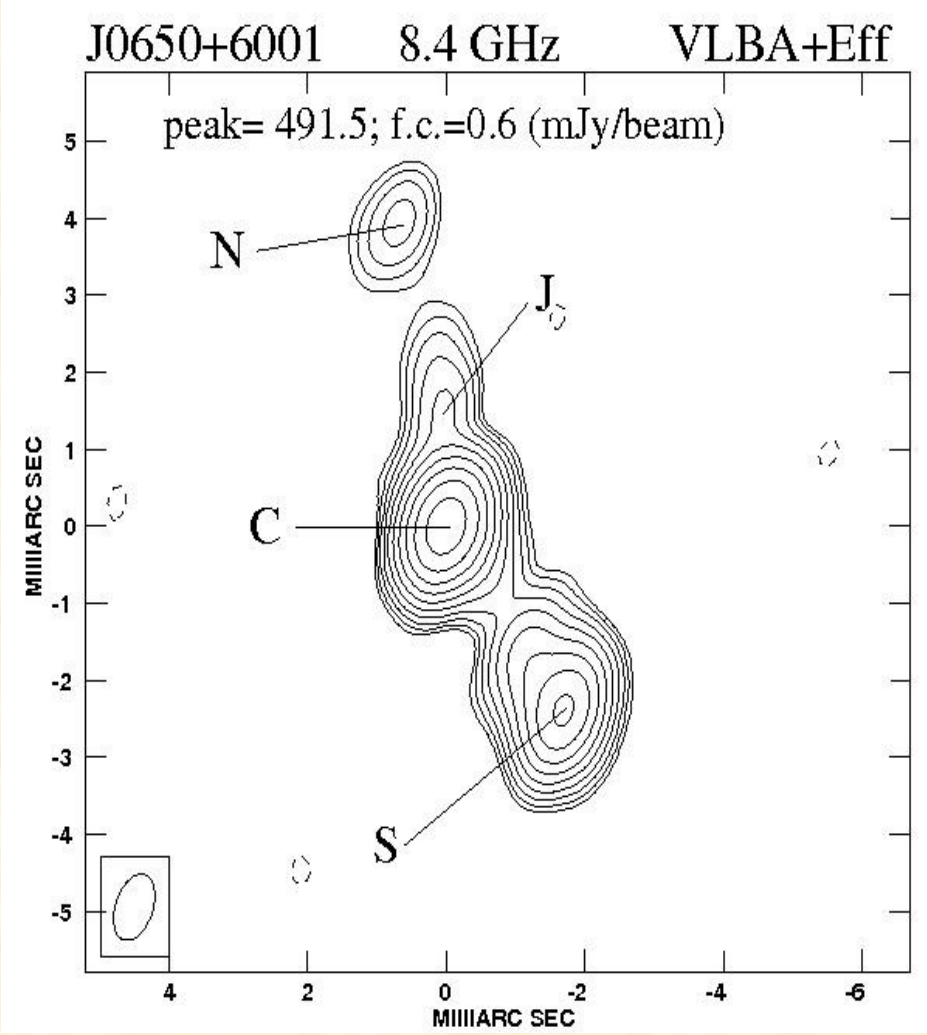
Compact Symmetric Objects

- Compact size (< 1 kpc);
- High radio luminosity ($P_{1.4\ GHz} > 10^{24}$ W/Hz);
- Significant fraction in radio source catalogues selected at 5 GHz (~15-30%);
- Radio synchrotron spectra with a turnover frequency ranging from ~ 100 MHz to a few GHz.

The radio source J0650+6001

- Quasar @ z=0.455;
- Spectral peak at 5.5 GHz;
- Total linear size LLS=40 pc;
- Very asymmetric triple radio moprhology;
- 70% of the total flux arises from the central component;
- $S_S/S_N \sim 30$;
- Misalignment between the outer components.



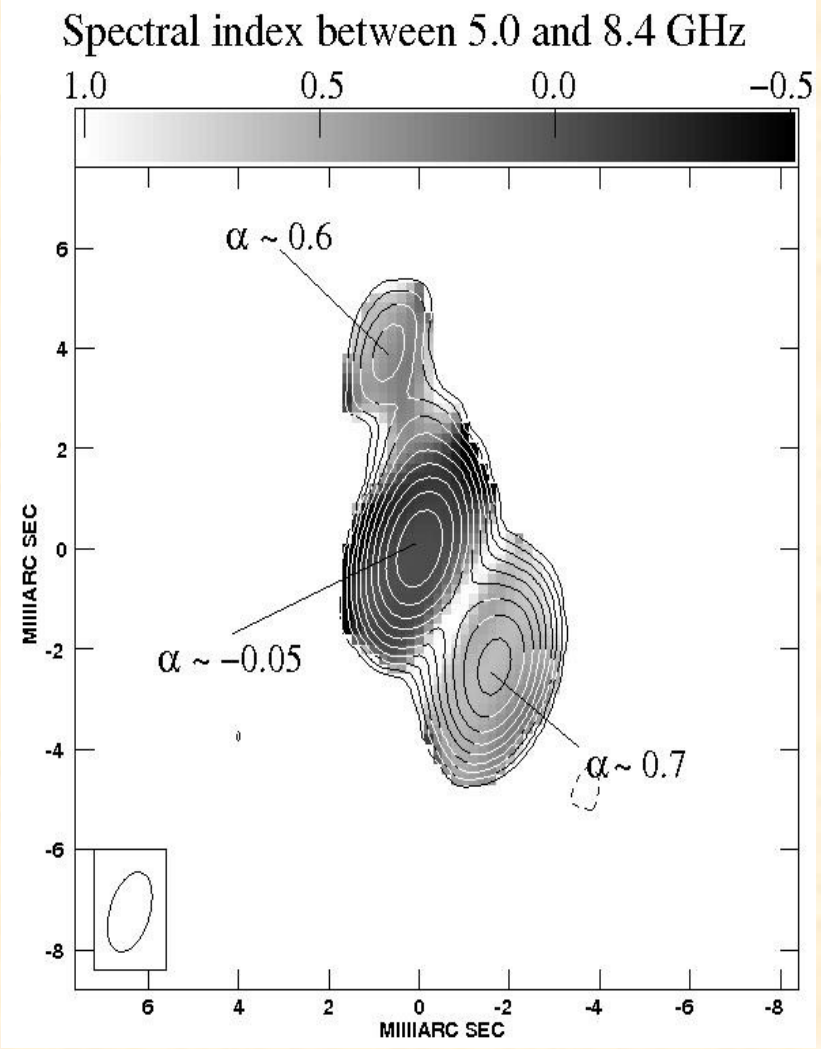
The radio source J0650+6001

- Central component with flat spectrum $\alpha = -0.05$

presence of the **source core**;

- Outer components with steep spectra $\alpha = 0.6 - 0.7$

hotspots and mini-lobes



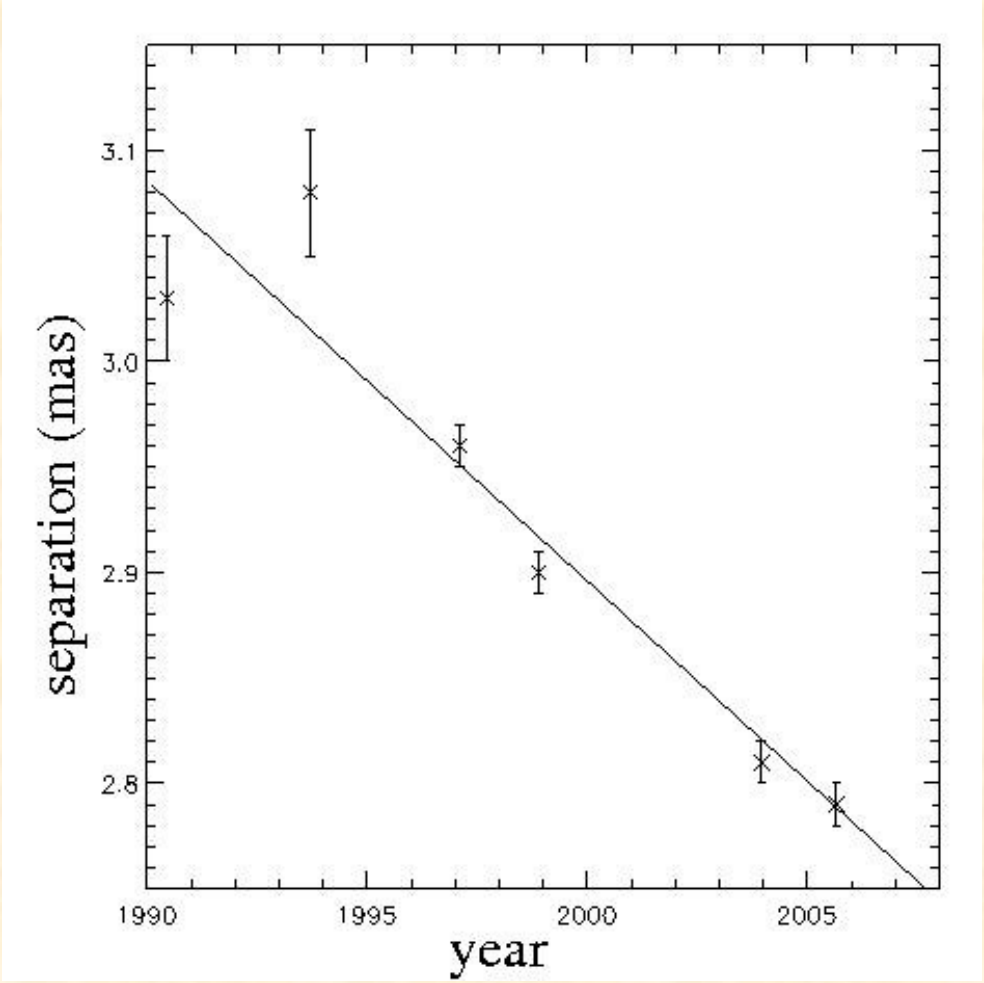
Proper motion & apparent contraction

- Components N and S are separating with $\mathbf{v_{i,s} \sim 0.39c \pm 0.18c}$

$\mathbf{t_{kin} \sim 360 \pm 170\ yr}$;

- Component C and S are decreasing their distance with an apparent contraction velocity $\mathbf{v_{a,c} \sim 0.37c \pm 0.02c}$

Presence of a knot in the jet that is moving from component C towards component S.



Beaming effects

- From the source expansion:

$$\beta_{a,a} = \frac{2\beta_{a,i}\sin\theta}{1-\beta_{a,i}^2\cos^2\theta}$$

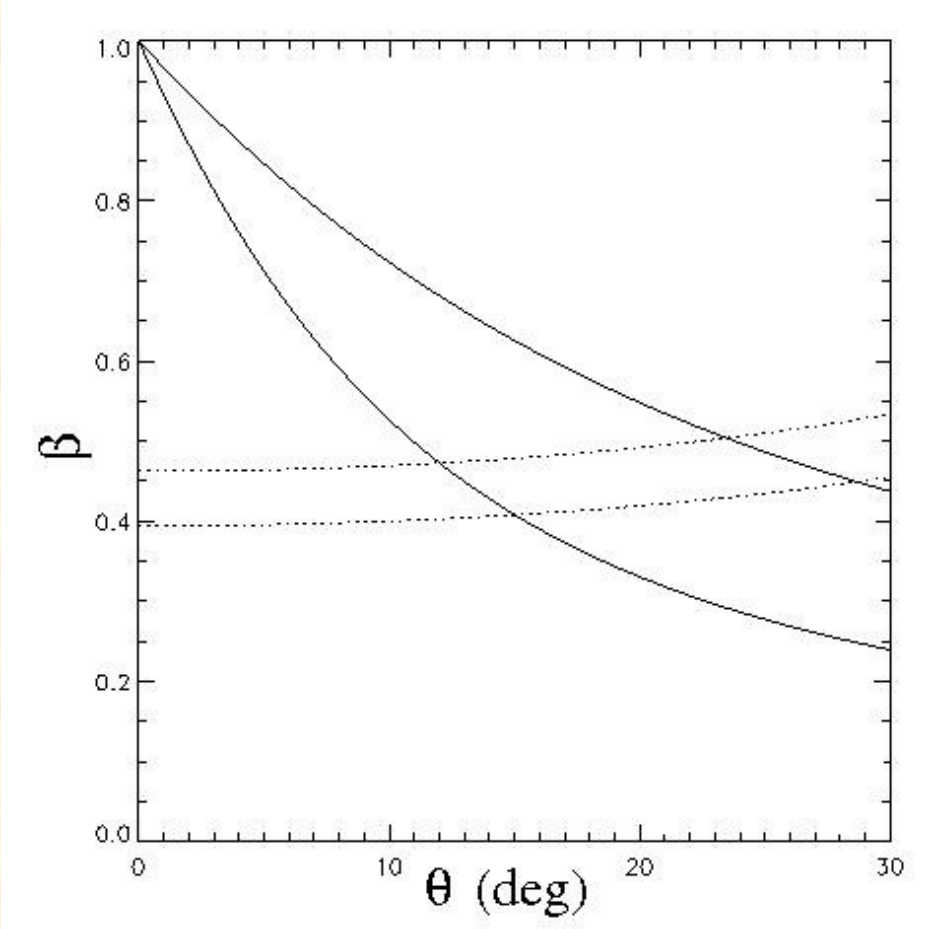
- From the flux density ratio:

$$\frac{S_S}{S_N} = R = \left(\frac{1+\beta\cos\theta}{1-\beta\cos\theta}\right)^{3+\alpha}$$

The possible (θ-β) combinations are:

$v_{i,s} = 0.43c \pm 0.04c$

$12° < \theta < 28°$



Flux density variability

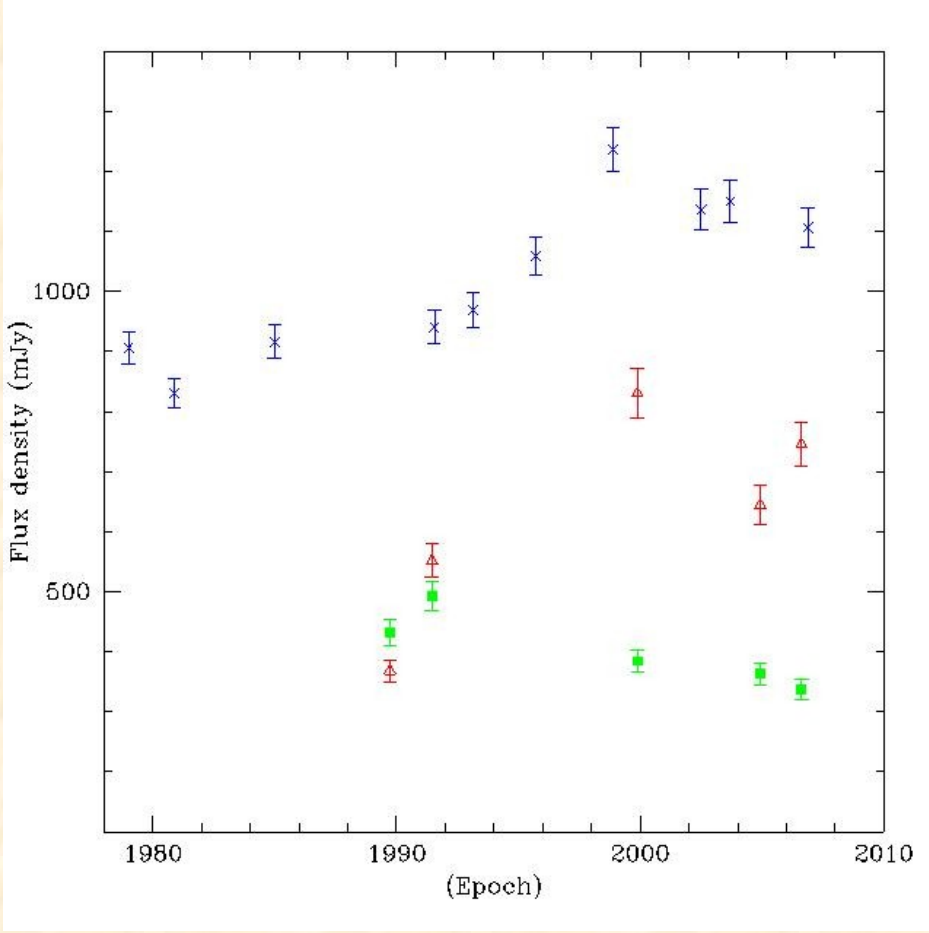
- The 5 GHz lightcurve shows a steady increment of the flux densities S_{tot} and S_C

  Source expansion;

- From the beaming model, the distance between C and S decreases with:

  $\mathbf{v_{i,c} \sim 0.66c \pm 0.03c}$

- No variability in S_S



Conclusions

- J0650+6001 has a peculiar non-aligned asymmetric radio structure dominated by the central component;
- The outer components are increasing their distance with $v_{a,s}$=0.39c±0.18c, that corresponds to a source age t_{kin}=360±170yr;
- Apparent contraction between components C and S, suggesting the presence of a knot in the jet that is moving from C towards S
- The total flux density and the flux density of component C are steadily increasing, in agreement with what expected in source expansion;
- The peculiar properties of this source may be explained in terms of Doppler beaming effects where the jets are separating at a mildly relativistic velocity, and oriented close to the line of sight.