

# AGN jet simulations for double-double radio galaxies

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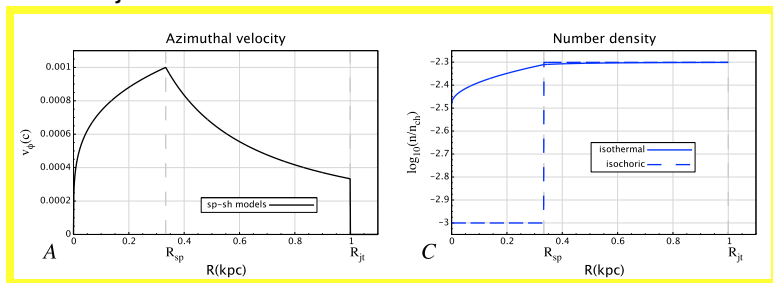
*with S. Walg, O. Porth, S. Markoff, A. Achterberg, Z. Meliani*

# Walg et al. MNRAS 433, 1453 (2013)

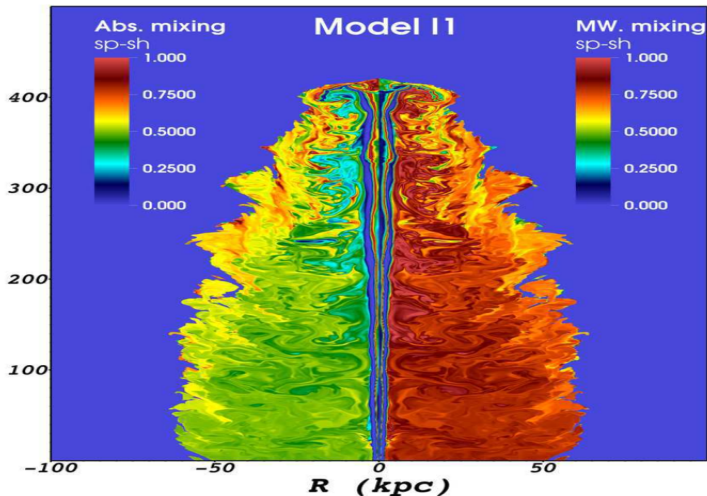
- two-component model and mixing during propagation
  - ⇒ axisymmetric, rotating jets
  - ⇒ investigating spine-sheath integrity at 400 kpc scales!

Models	$L_{\text{jt}} (10^{46} \text{ erg s}^{-1})$		$n (10^{-6} \text{ cm}^{-3})$		$\gamma$	
	sp	sh	sp	sh	sp	sh
$H$ (homogeneous)	3.82		4.55		3.11	
$I$ (isothermal)	1.82	3.35	$P/\rho = \text{constant}$		6.0	3.0
$A$ (isochoric)	0.44	3.39	1.0	5.0	6.0	3.0
External medium	-		$1.0 \times 10^3$		-	

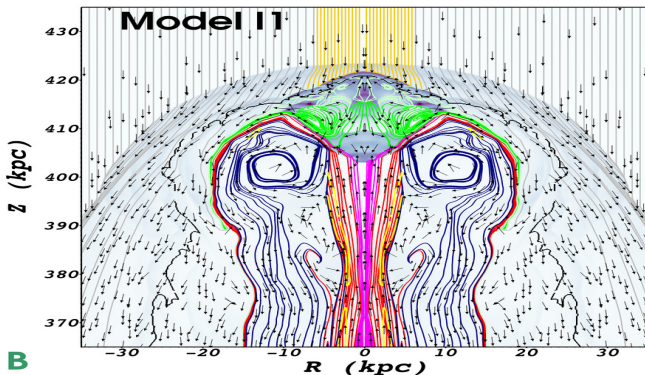
- radial jet stratification: rotation & isothermal/isochoric



- **isothermal** spine-sheath model: layered structure persists!
  - ⇒ even after about 9 internal jet beam shocks ...
  - ⇒ **view on density and mixing**

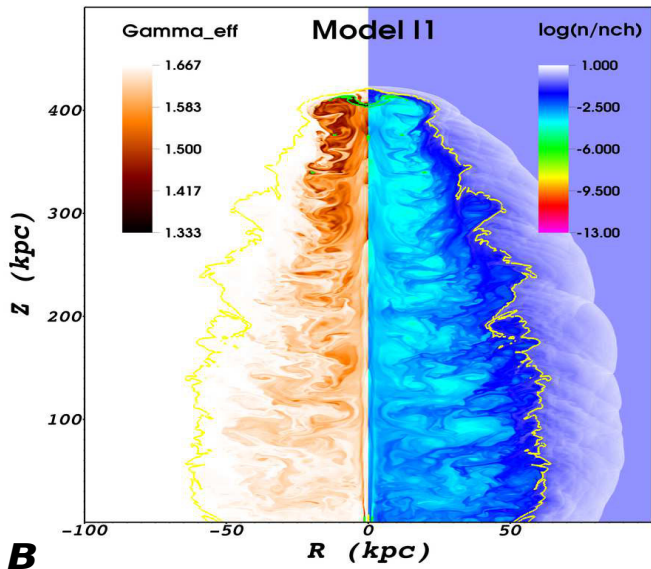


- identified **effective impact area** of radially structured jet  
⇒ yellow streamlines, plot in Mach disk rest frame

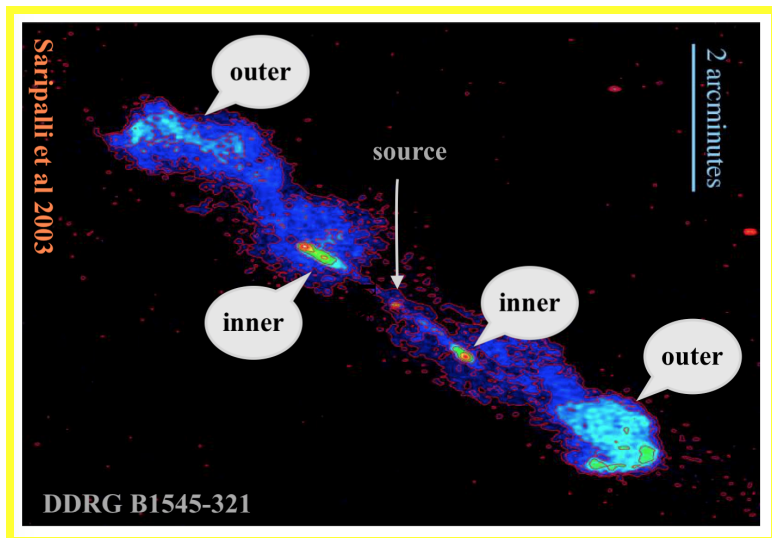


- increased surface area explains ‘reduced’ propagation speed

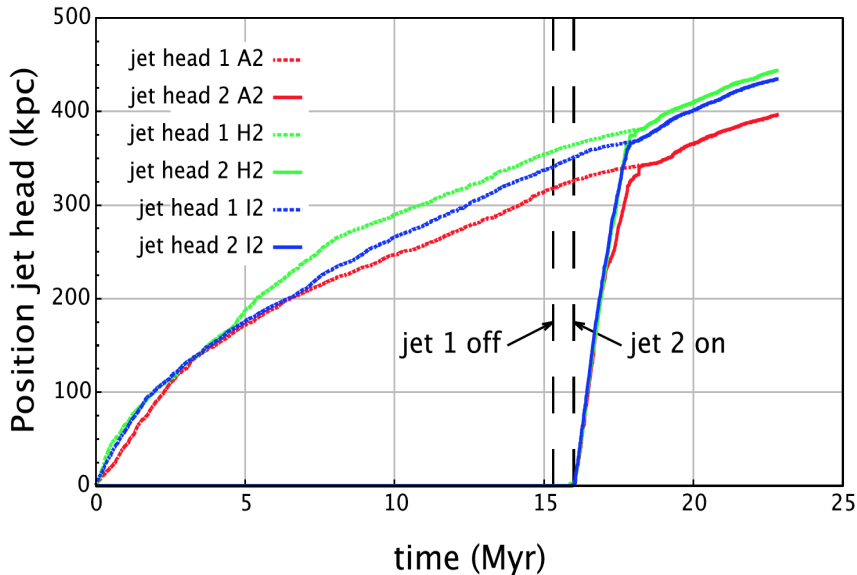
- effective polytropic index: relativistically hot vs cold matter



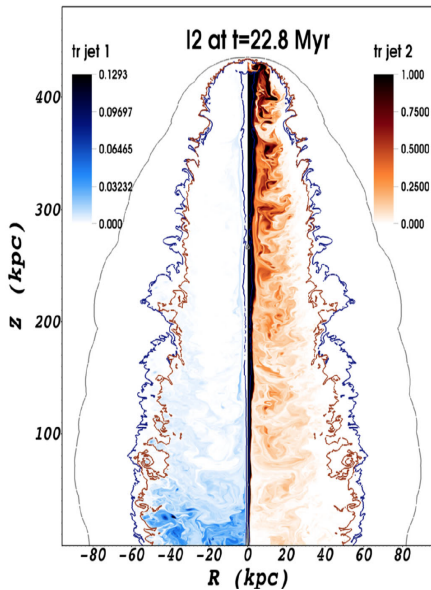
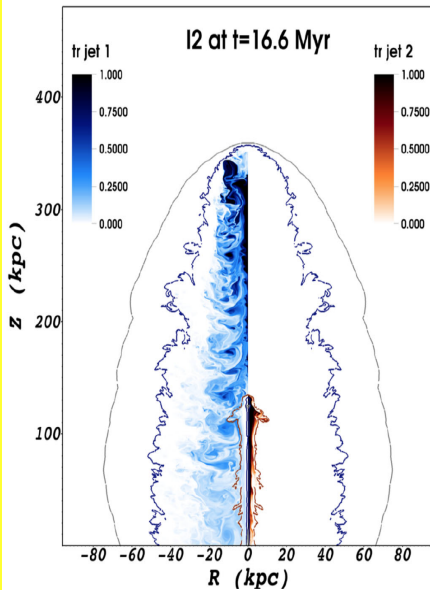
- Motivation: Double-Double Radio Galaxies



restarted jets: rapidly traversing the hot and inflated cocoon



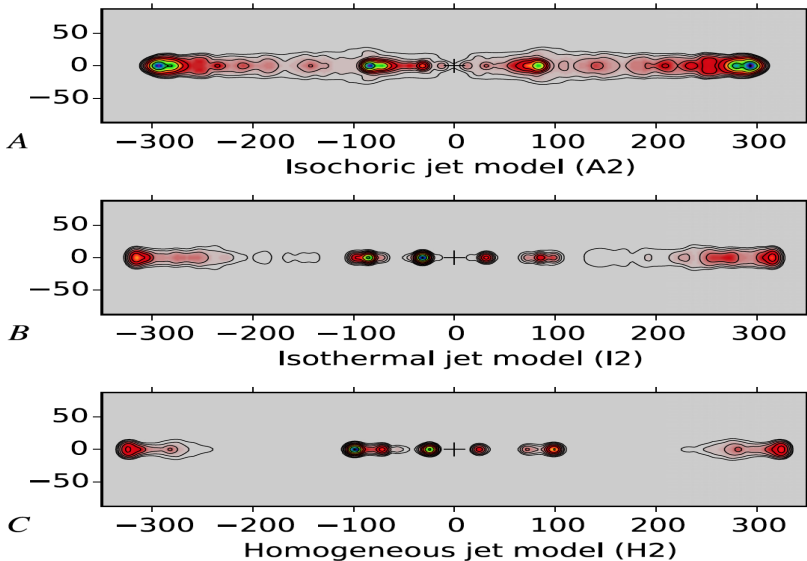
# restarted isothermally structured jet: tracers view



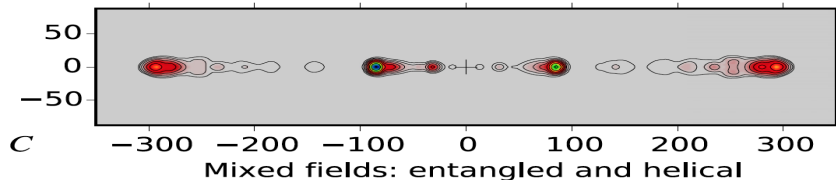
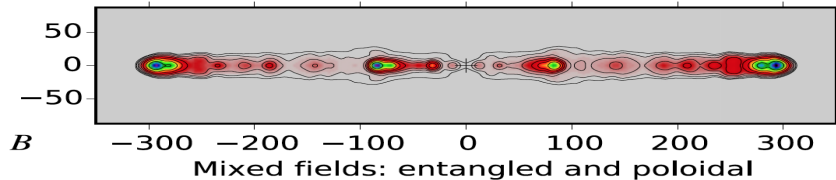
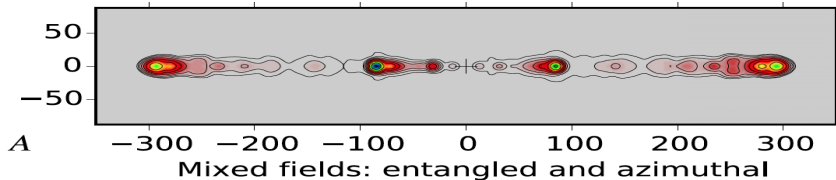


- synthesize synchrotron images for DDRG from relativistic HD
  - ⇒ ordered vs mixed magnetic field
  - ⇒ spectral ageing from synchrotron cooling
  - ⇒ viewing angle and Doppler (de)boosting
  - ⇒ contribution from different jet components
- adopt J1835+6204 as reference

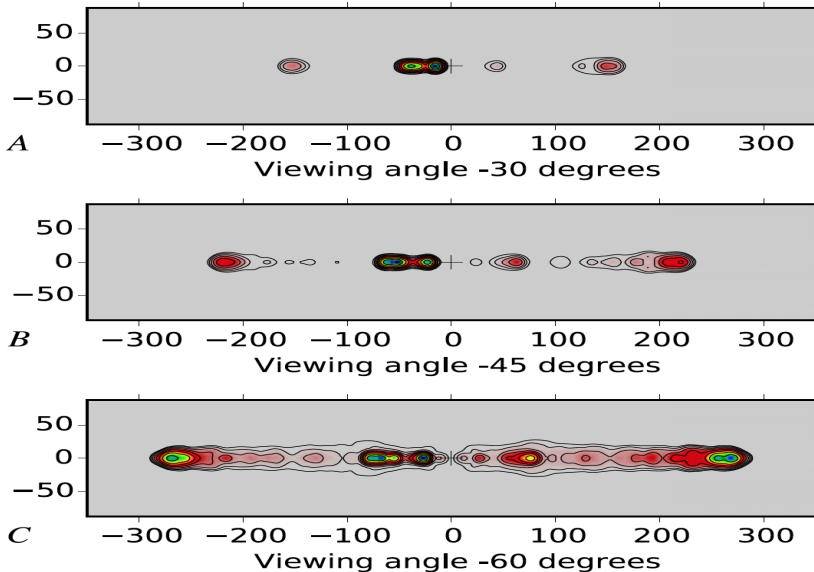
## Clearly different views due to internal structure



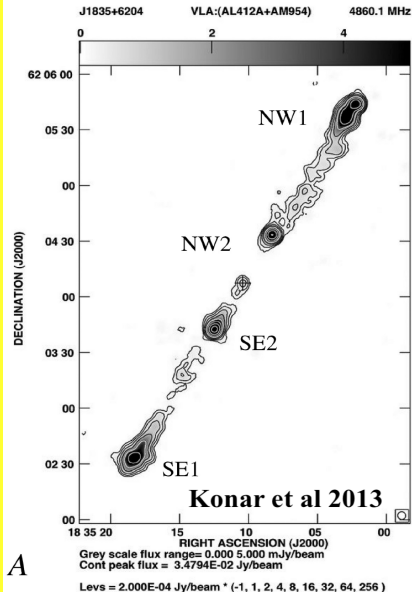
# clear impact of assumed **B** morphology



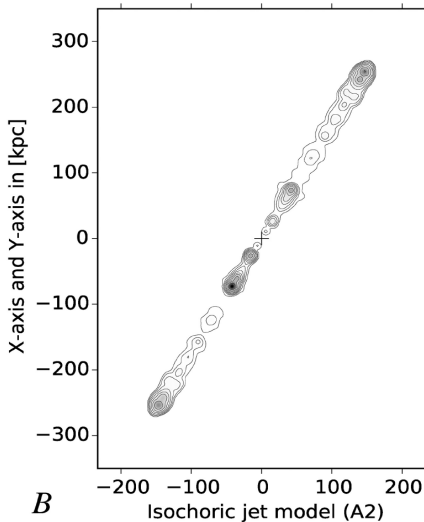
## Obvious viewing angle effects and Doppler (de)boosting



# Best fit: with restarted isochorically structured jet, viewing angle $-71^\circ$



A



B

# Outlook

- isochoric jet lost radial jet integrity: important for matching at the 4.8 GHz with 8kpc resolution
- DDRGs are rare: first jets may easily fade when turned off!
- restarted jets with internal structure in 3D relativistic MHD  
⇒ which aspects of the synthesized views prevail?

THANKS FOR LISTENING!