Multi-scale Virtual View on the Precessing Jet SS433

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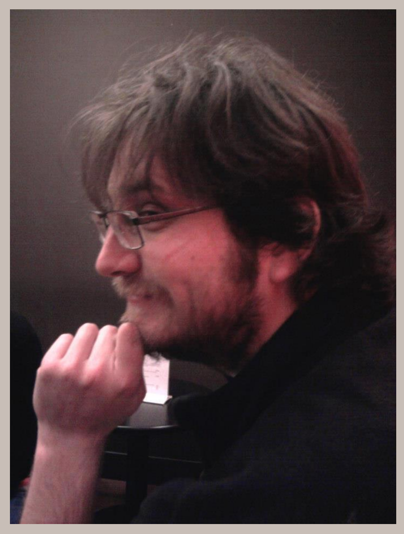

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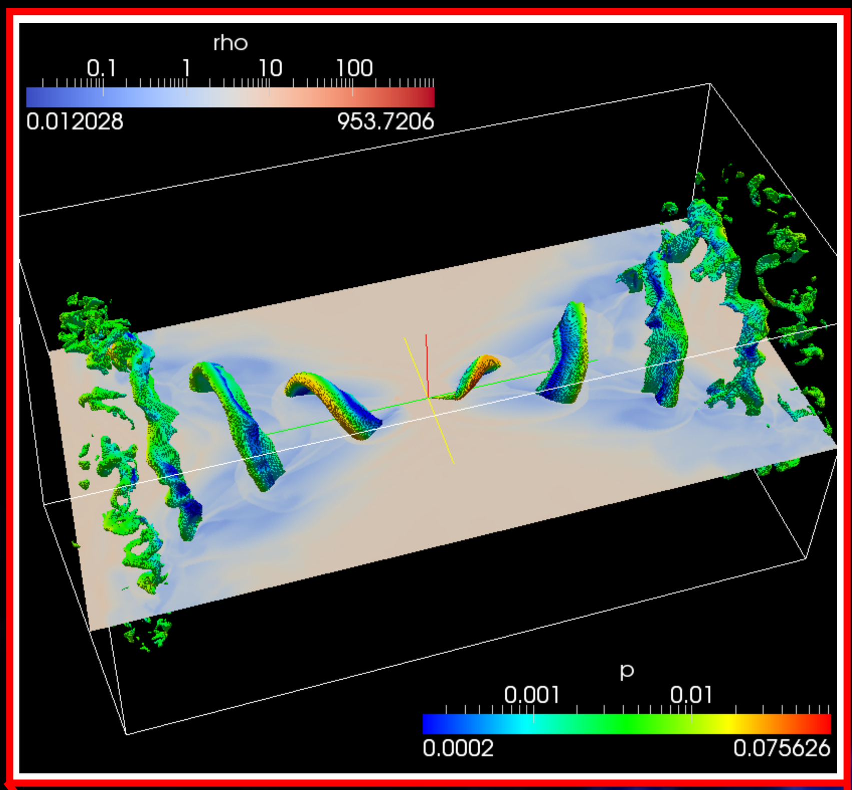
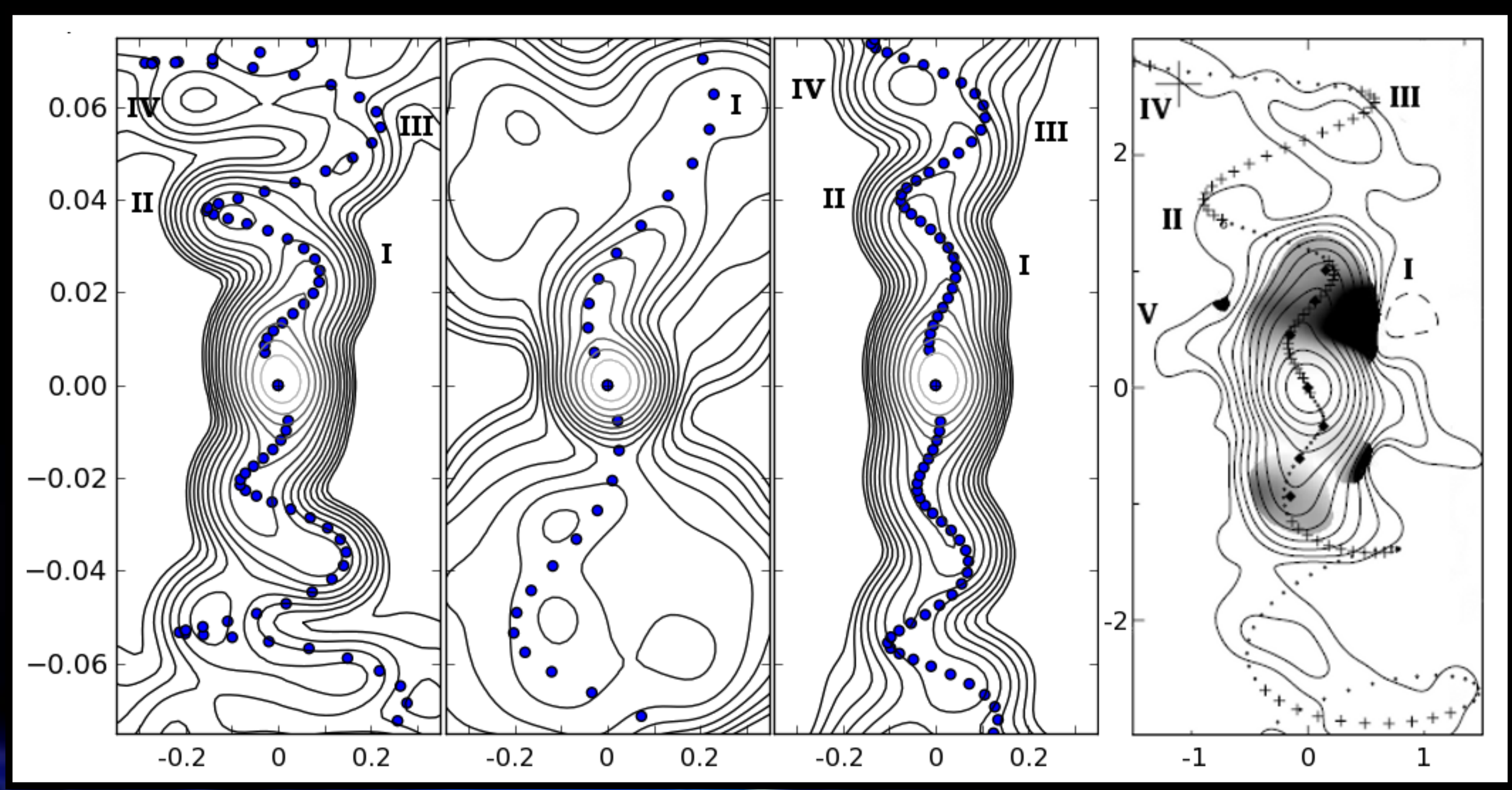
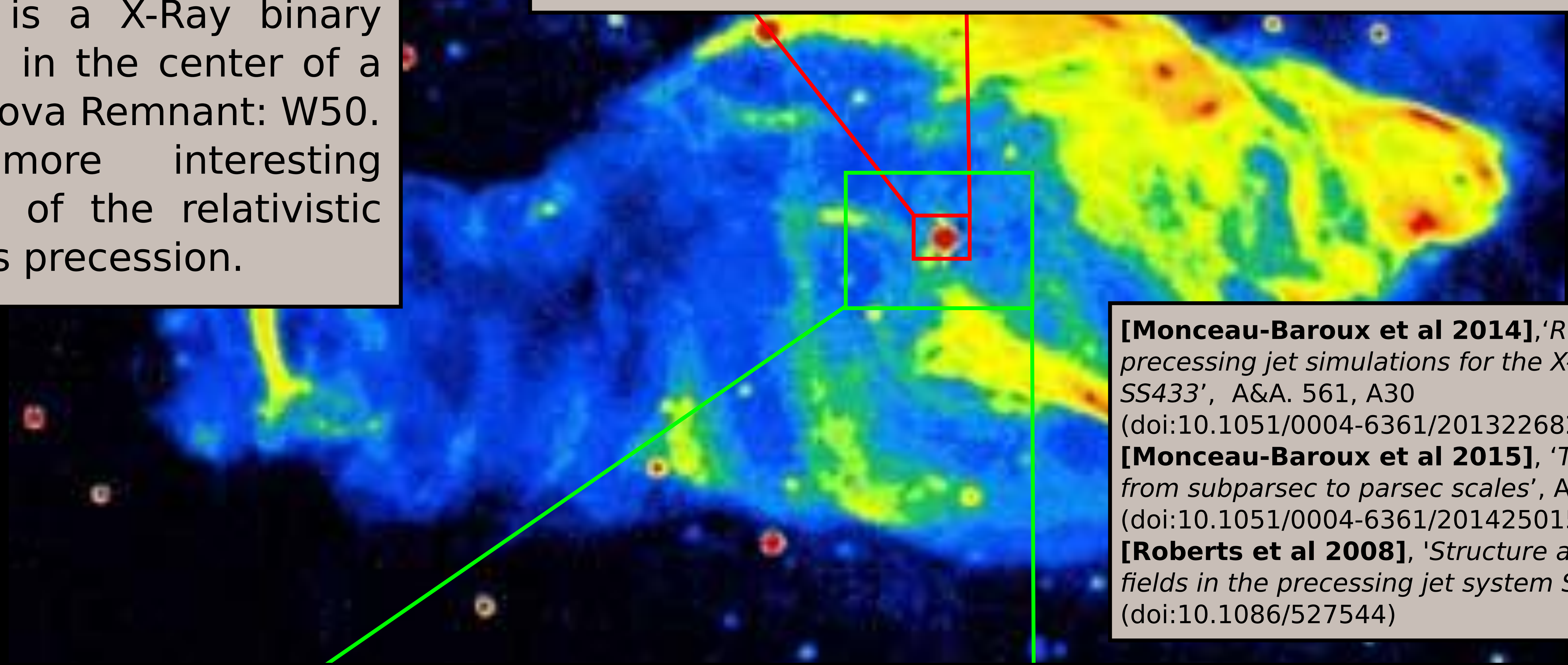
Since 1977, SS433 has been extensively studied. Throughout observations, a canonical model emerged. We tested this model with simulations as shown on the left panel picture. We also made synthetic radiomaps out of our simulations and compared it to observations.





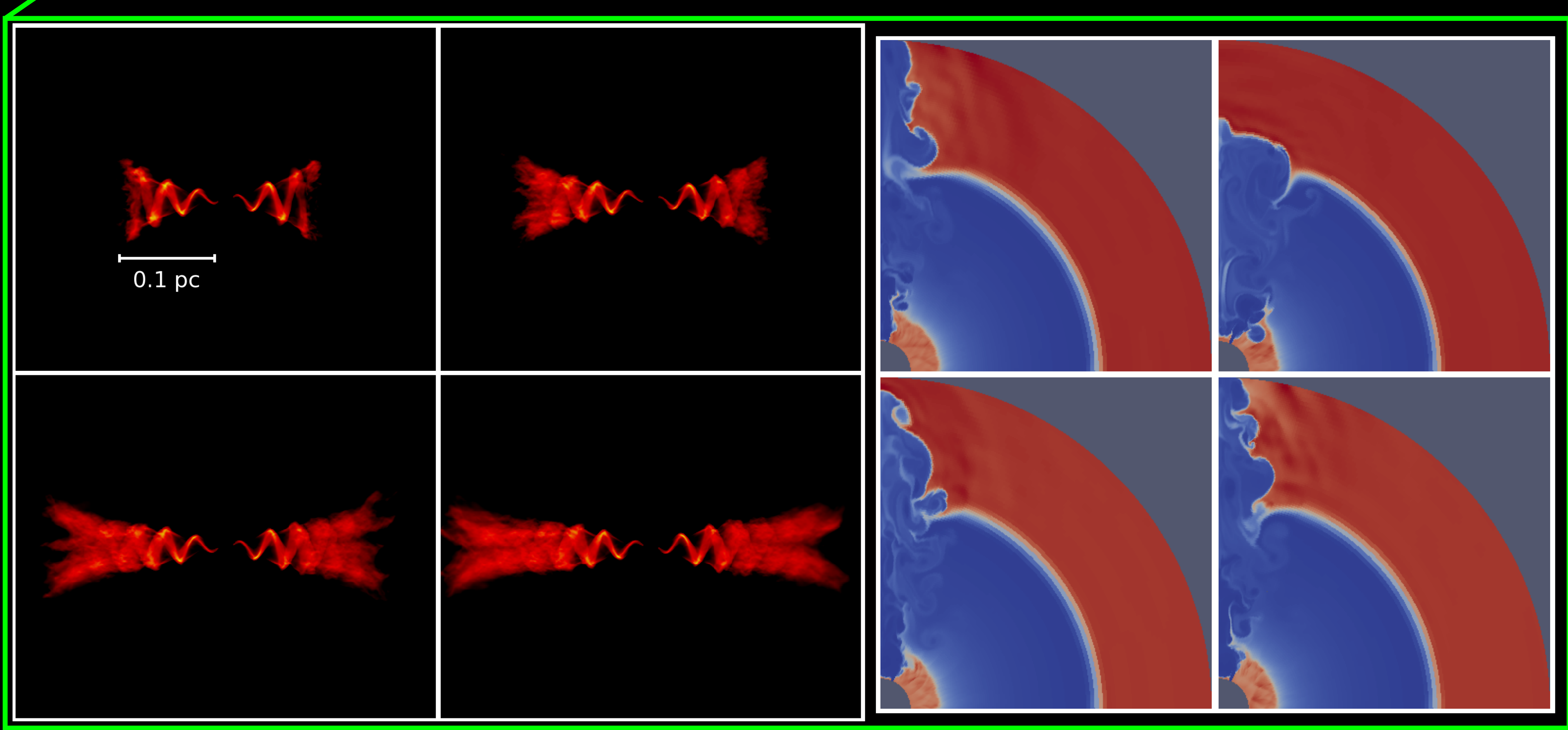
On the right panel you can see three radiomaps from our simulations. From left to right: purely canonic model; jet speed is 0.81c instead of 0.27c; precession angle is 10° instead of 20°. The right image is observation data from Roberts 2008. We see that the canonic model does fit better the observations.

SS433 is a X-Ray binary located in the center of a Supernova Remnant: W50. The more interesting feature of the relativistic jet is its precession.



[Monceau-Baroux et al 2014],*'Relativistic 3D precessing jet simulations for the X-ray binary SS433'*, A&A. 561, A30 (doi:10.1051/0004-6361/201322682)
[Monceau-Baroux et al 2015], *'The SS433 jet from subparsec to parsec scales'*, A&A 574, A143 (doi:10.1051/0004-6361/201425015)
[Roberts et al 2008], *'Structure and magnetic fields in the precessing jet system SS433'*, ApJ, 676 (doi:10.1086/527544)

Observations and models have shown that there is a discrepancy between the large scales of the jet where it interacts with W50 and seems to have a precession angle of 10°, and the smaller scales where the observations clearly show a precession angle of 20°.
We explore two models to explain this discrepancy: a spatial recolimation as shown on the left panels, and a temporal transition as shown on the panels on the right. The 4 panels on the left are different times of a same run. The 4 panels are 4 different runs with different precession angle. From top to bottom, left to right: 10°, 20°, instant switch from 10° to 20° and linear evolution from 10° to 20°.



The spatial evolution scenario show how the jet dynamically evolves from a precessing jet with 20° degrees into a hollow cone with an opening angle of 10° as required to fit the large scales. This also could explain the required deceleration of the jet to explain the history of the SS433-W50 system as our jet head propagation speed go from 0.27c to 0.02c.