MIRAGE SIMULATIONS OF THE MASSIV SAMPLE

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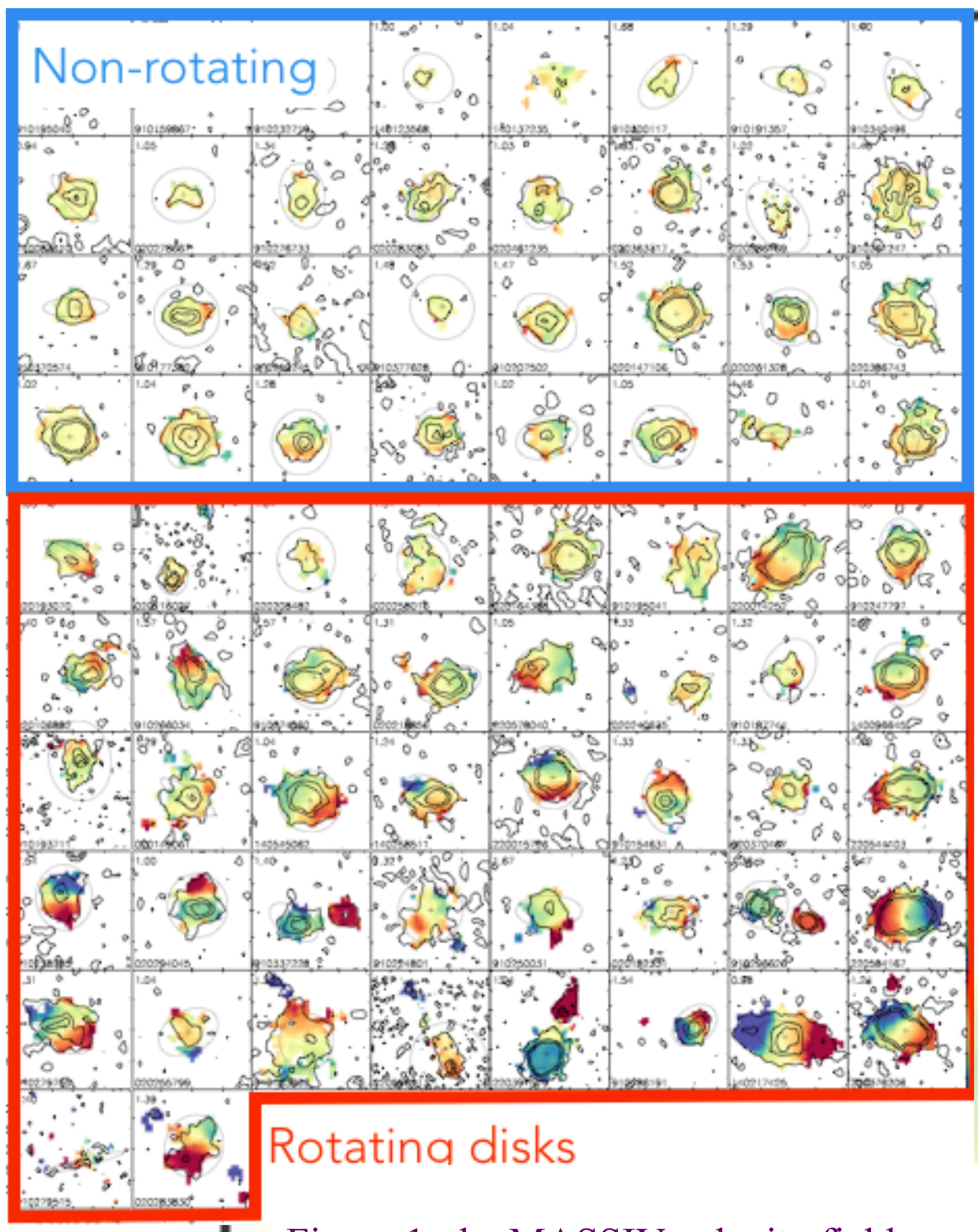

Figure 1: the MASSIV velocity fields

The MASSIV sample.

ESO Large program (200 hours)
Sample: 83 star-forming galaxies @ $0.9<z<1.8$
Observed with SINFONI IFU @ VLT
Seeing-limited (<0.8")
13 galaxies observed with AO/LGS
J/H Bands / Hα emission line

Knowledge of the nature of the dynamical support of galaxies is a way to constrain different evolutionary scenarios.

The MIRAGE sample, based on the RAMSES code,

- has been built in order to understand the contribution of the merger processes to the mass assembly in the MASSIV sample.
- required about 3.5 million hours CPU time, is composed of 20 simulations of mergers exploring the initial parameters of mass and orientation of the disks with a spatial resolution reaching 7 parsecs.
- consists of a sample of idealized simulations. Initial conditions are designed to reproduce the physical properties of the most gas-rich young galaxies.

MASSIV : Mass Assembly Survey with SINFONI in VVDS
MIRAGE : Merging & isolated high-redshift AMR galaxies

- How clumps impact the measured kinematical properties?
- Nature of non-rotating objects (mergers, spheroids, face-on disks) ?
- Can we unambiguously identify kinematical signatures of a recent merger ?

The MIRAGE simulations show

- an absence of star formation bursts in mergers of fragmented and turbulent disks, suggesting a saturation mechanism.
- the gas rich clump merging mechanism is able to control the bulge mass growth, to erode the central profile of the dark matter halo and to drive massive gas outflows into the disk plane
- Whatever the orbital configuration (prograde or retrograde) and whatever the mass ratio between the disks (1/3/6 - log M=10.6/10.2/9.8), a new disk of gas is reconstructed quickly after the merger. This is due to the high gas fraction at the merging event (60%).

Clump Merger

- Gas-rich clump merger → massive gas outflows
- Clump merger ejections take place in the plane of the disk
- Outflows are sporadic

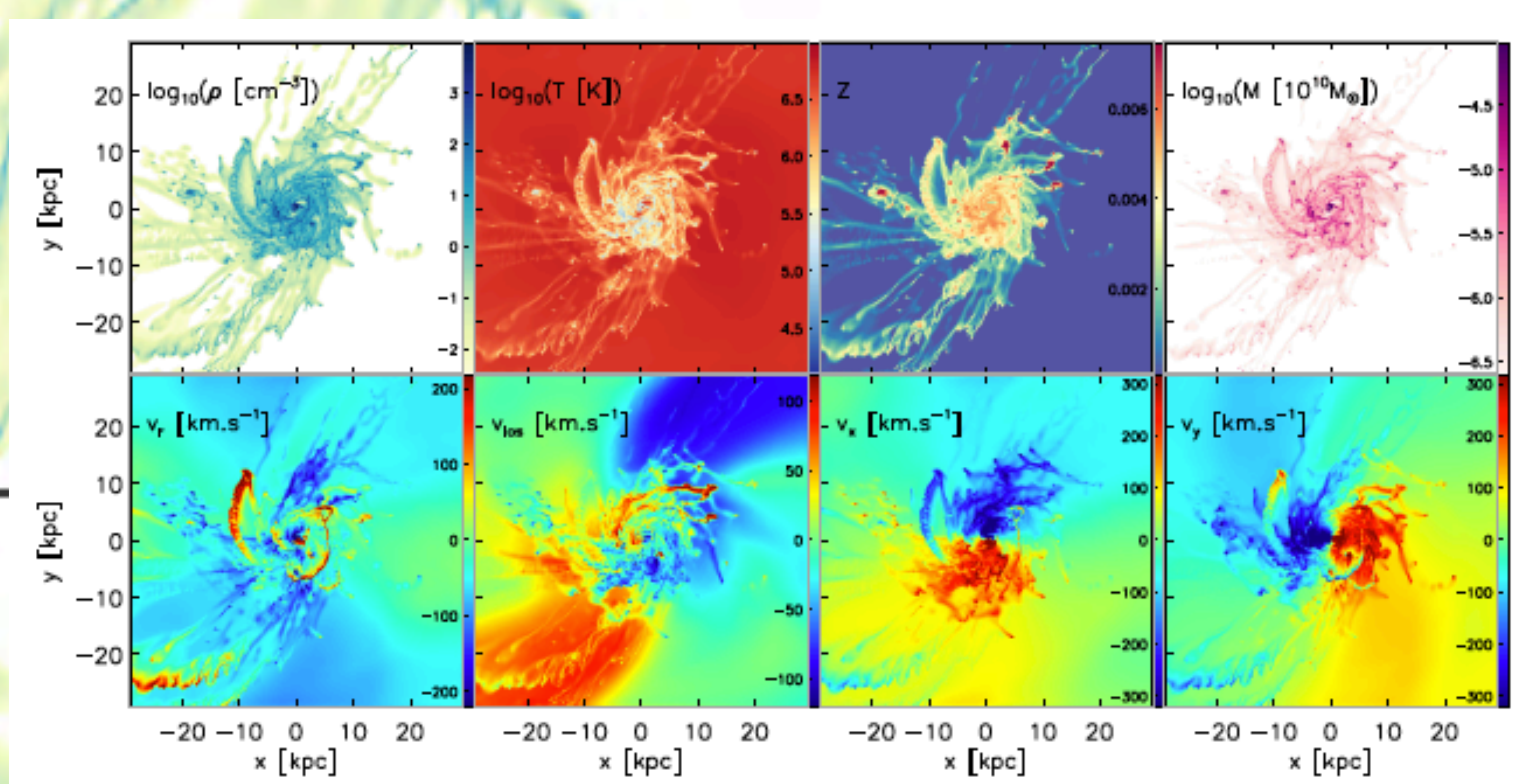

Figure 2: Example of MOCKS built from MIRAGE outputs. For this face-on example the coalescence occurred 280 Myr ago and a new disk has already been reconstructed.

Upper panels from left to right: density (the same one as the background image), temperature, metallicity and mass maps.

Bottom panels from left to right: radial cylindric velocity in the plane of the disk, line-of-sight velocity and the two last ones are projections on the two planes perpendicular to the sky plane.

We carry out a comparative study of the MASSIV kinematical data to a set of more than 4000 pseudo-observations at z=1.7 built from simulations of the MIRAGE sample to determine the ability to detect galaxy merger signatures under the observational conditions of the SINFONI instrument.

References:

- Perret 2014, PhD dissertation
- Divoy et al 2014 (Astro-ph1406.5704)
- Perret et al 2014 (AA 562, 1)
- Amram et al 2013, IAU 295, 86
- Lopez-Sanjuan et al 2013 (AA 553, 78)
- Perret et al 2012 (Astro-ph 1212.1356)
- Vergani et al 2012 (AA 546, 118)
- Contini et al 2012 (Msngr 147, 32)
- Queyrel et al 2012 (AA 539 93)
- Epinat et al 2012 (AA 539, 92)
- Contini et al 2012 (AA 539, 91)
- Queyrel et al 2009 (AA 506, 681)
- Epinat et al 2009 (AA 504, 789)

Background image: Face-on (top) and edge-on (bottom) mass-weighted average density maps of the gas for one of the MIRAGE Simulation 280 Myr after the coalescence (Perret, 2014)