EWASS – June 22, 2015

Flat rotation curves at z ~ 1

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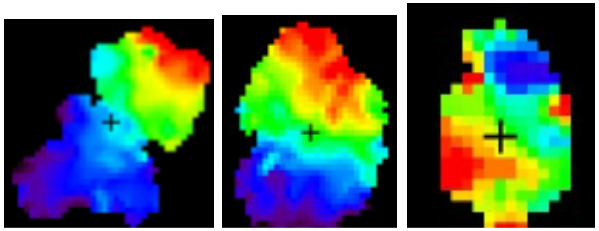
Sarah H. Miller

IFS surveys → Resolved 2D kinematics at high-z through emission-line mapping (Hα, Hβ, [OIII], [NII], etc...)



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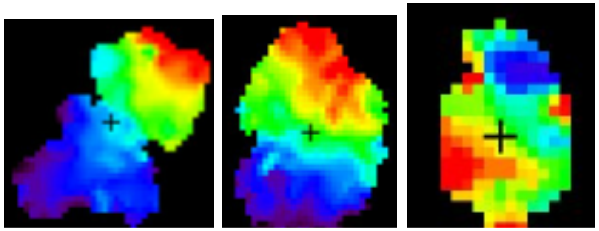

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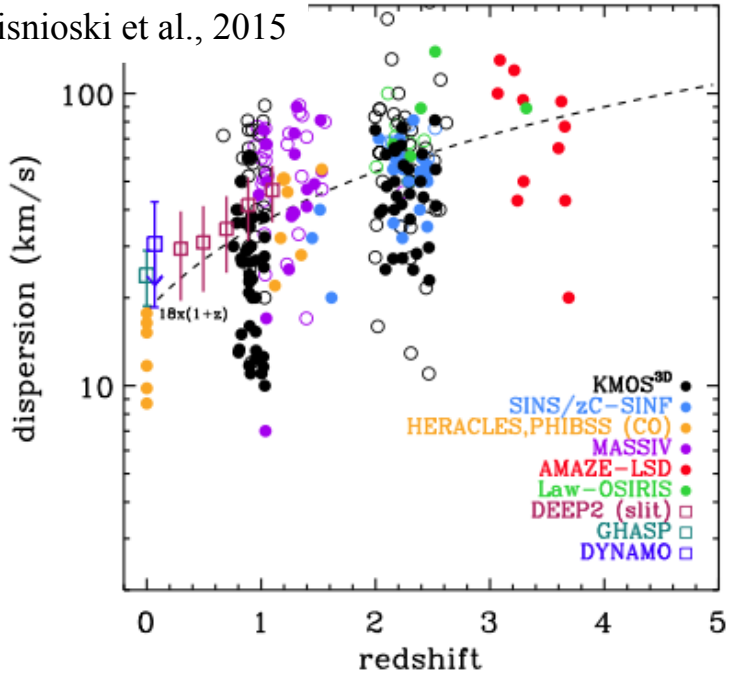
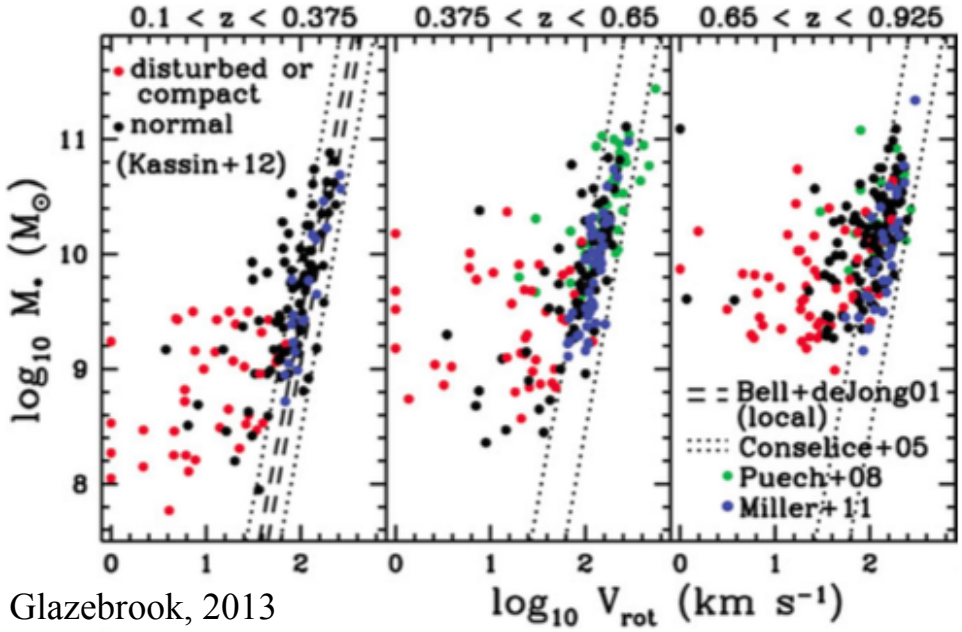
σ ↑ and v/σ ↓ with z

Wisnioski et al., 2015



Tully-Fisher Relation evolution



Glazebrook, 2013

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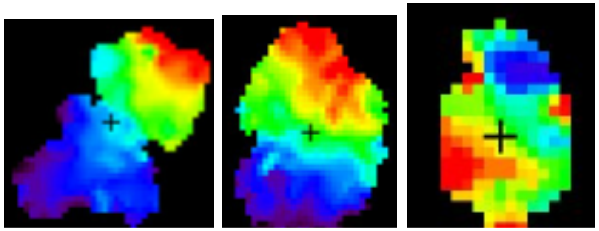

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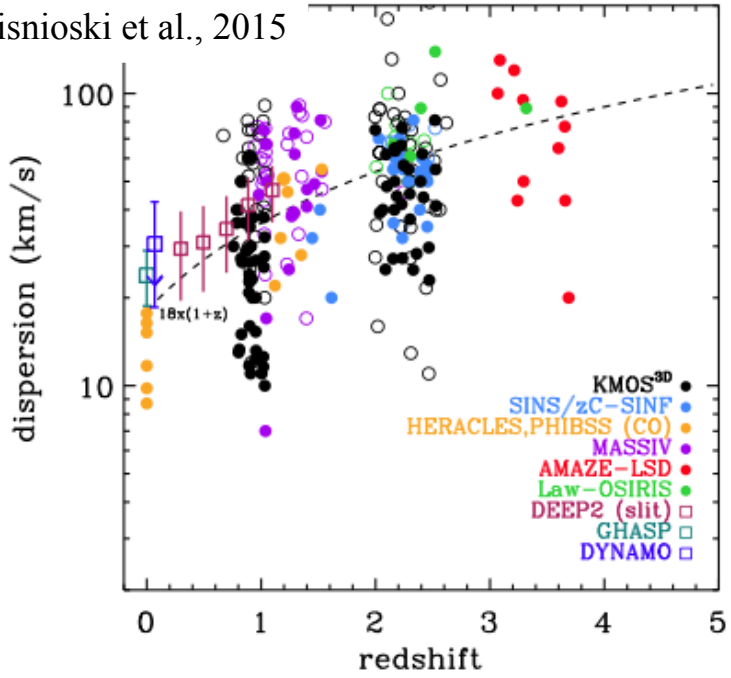

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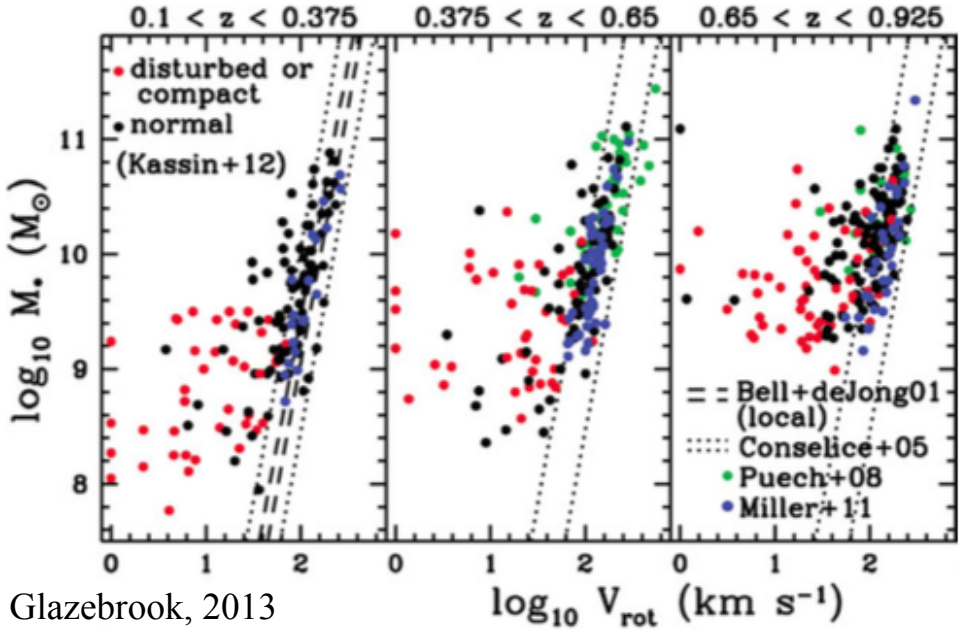
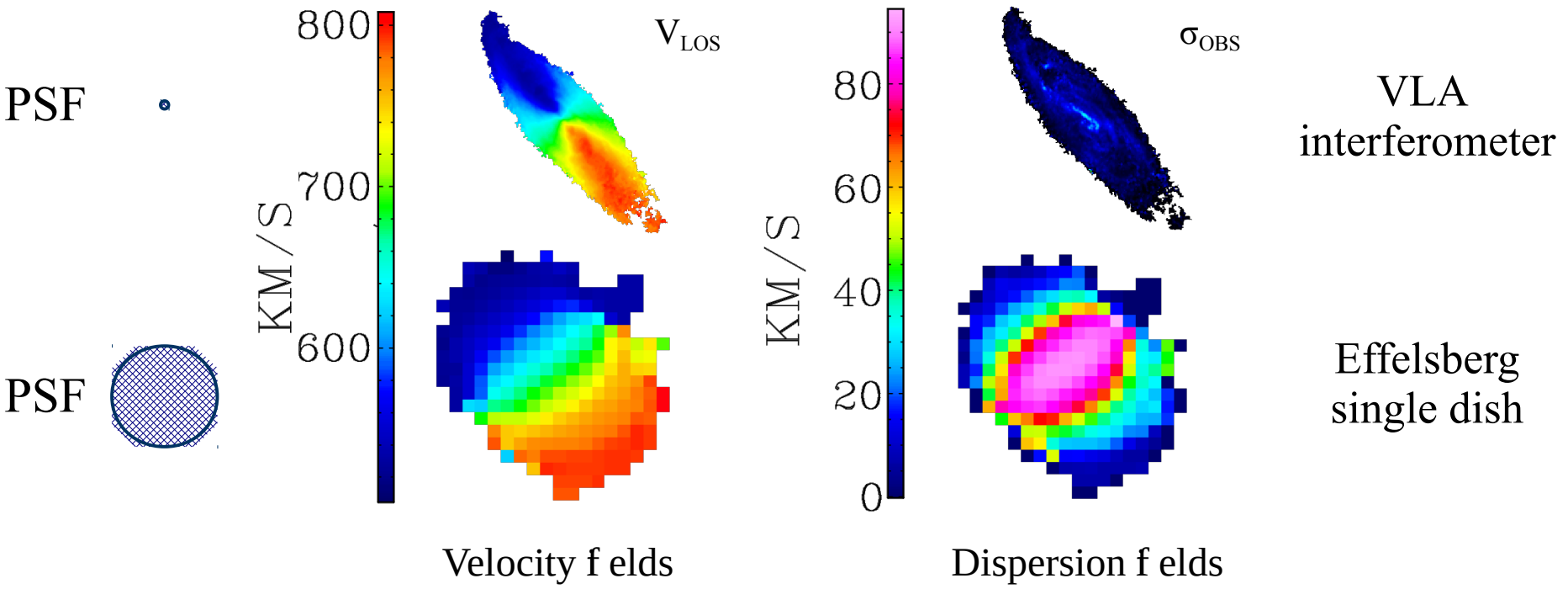


Glazebrook, 2013

→ Deriving reliable V_{rot} and σ_{gas} is essential **BUT** **Degeneracy** due to low spatial resolution

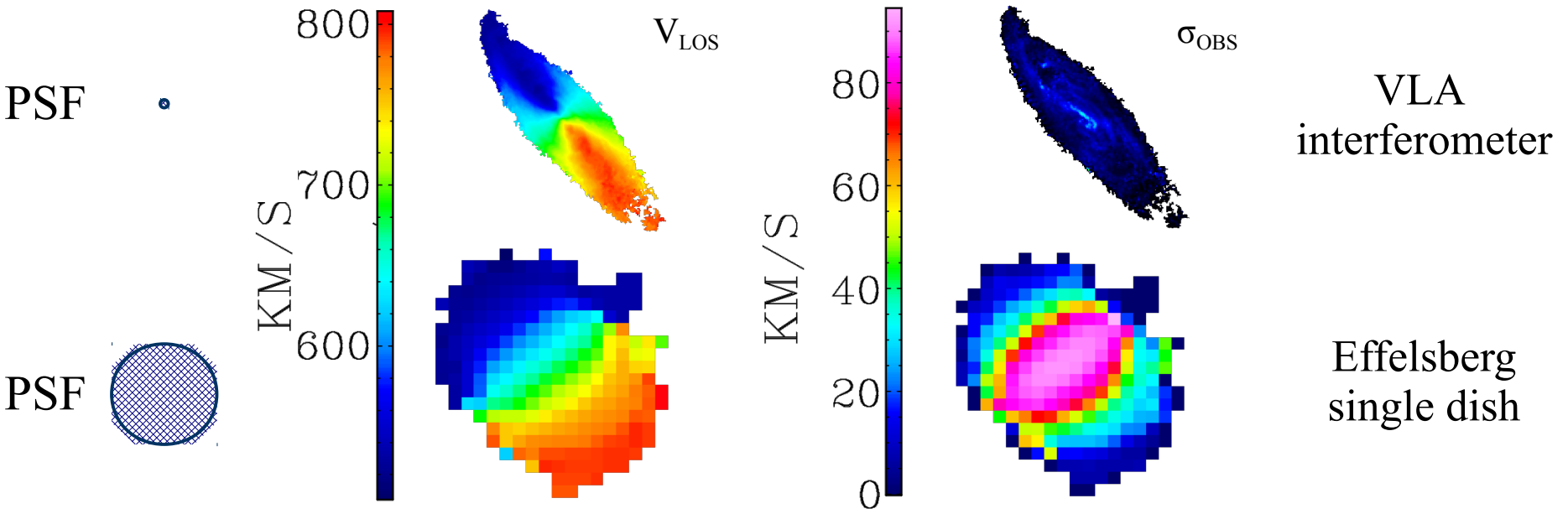
Beam smearing: NGC3198 example



Winkel et al., 12 Gentile et al., 13

SAME galaxy at different resolutions!

Beam smearing: NGC3198 example



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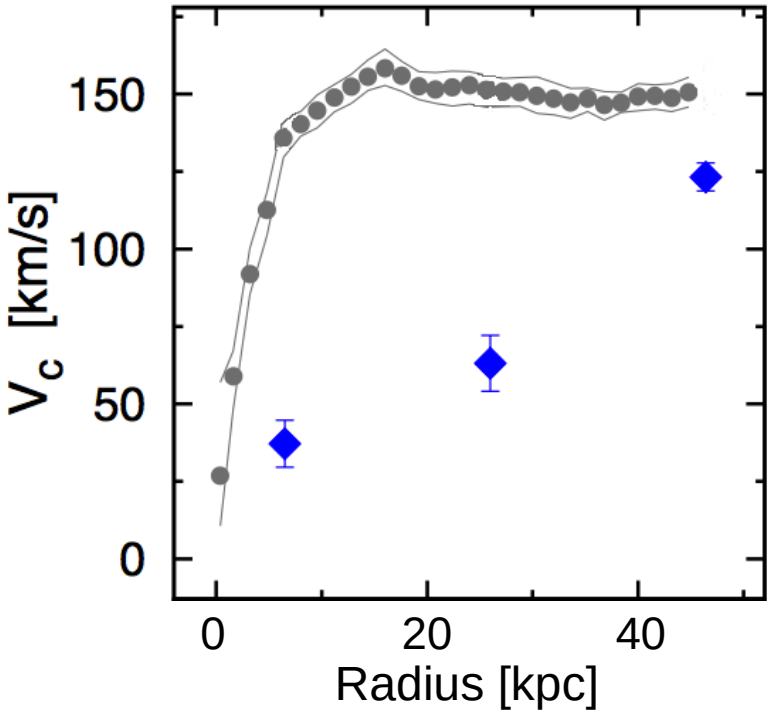
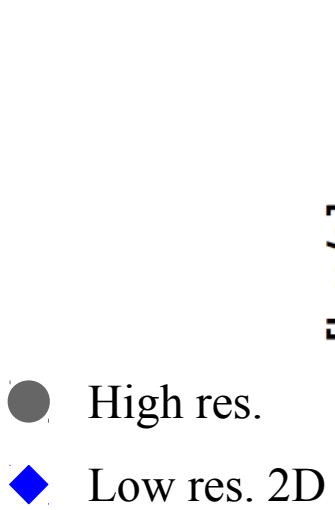
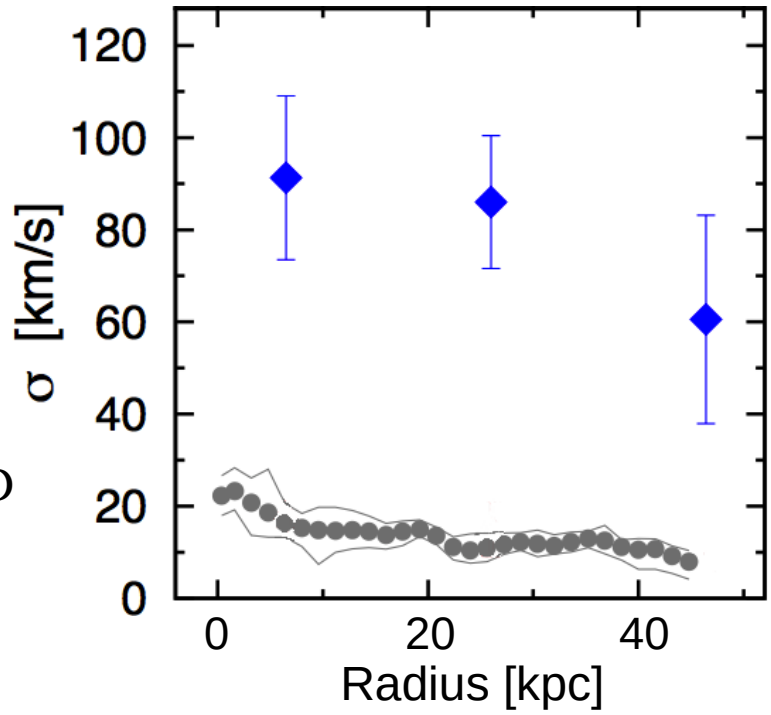
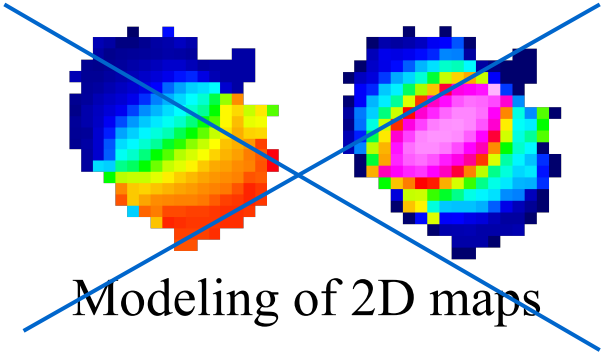


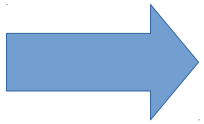


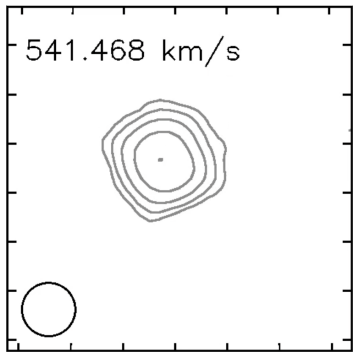


Kinematic modeling of datacubes



Modeling of 2D maps





Full 3D modeling of **cubes**
(NO MAPS, no degeneracy)

Di Teodoro & Fraternali, 2015

BBAROLO

3D Based Analysis of Rotating Objects via Line Observations

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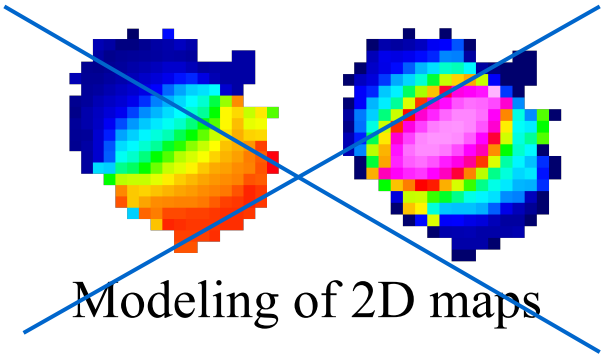

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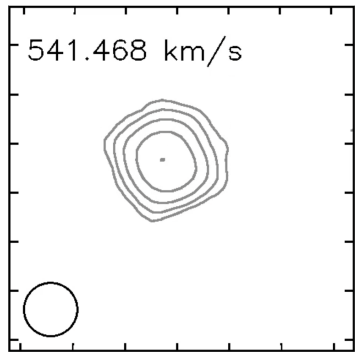

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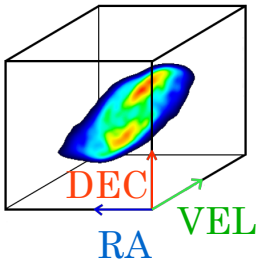
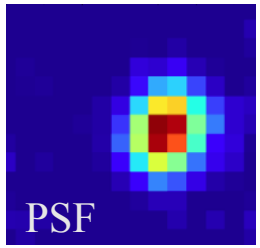
BBAROLO STRATEGY

Disc model in 3D space
(2 spatial, 1 spectral dimensions)

+

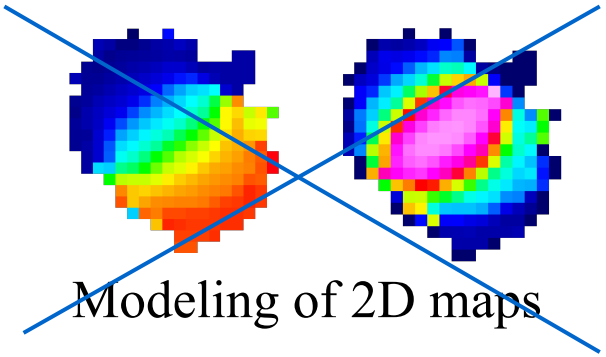
Instrumental effects
(it takes into account **beam smearing**)





Comparison
with observations

Kinematic modeling of datacubes



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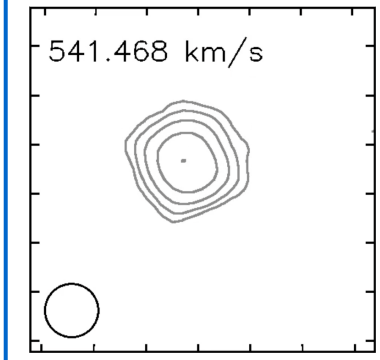

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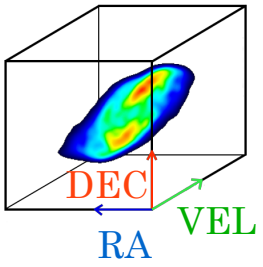

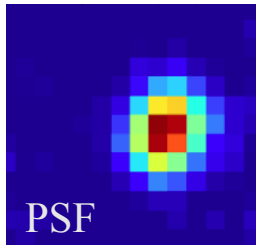

Comparison
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Disc parameters:

- Geometrical: galaxy center, inclination and position angle
- Kinematical: redshift, V_{rot} , σ_{gas}

No assumptions on the shape

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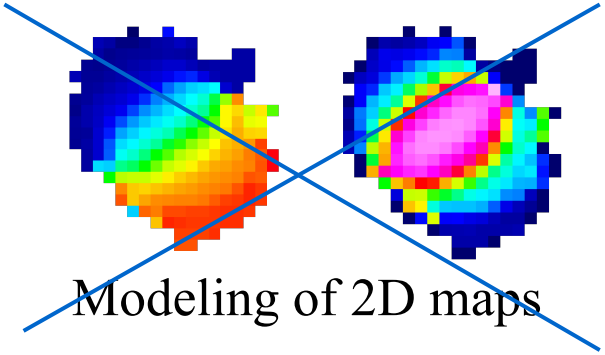

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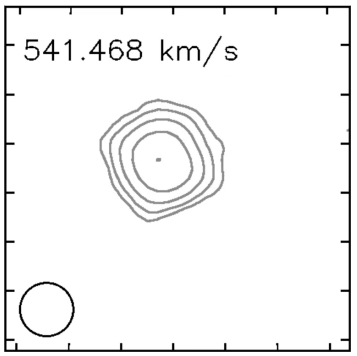

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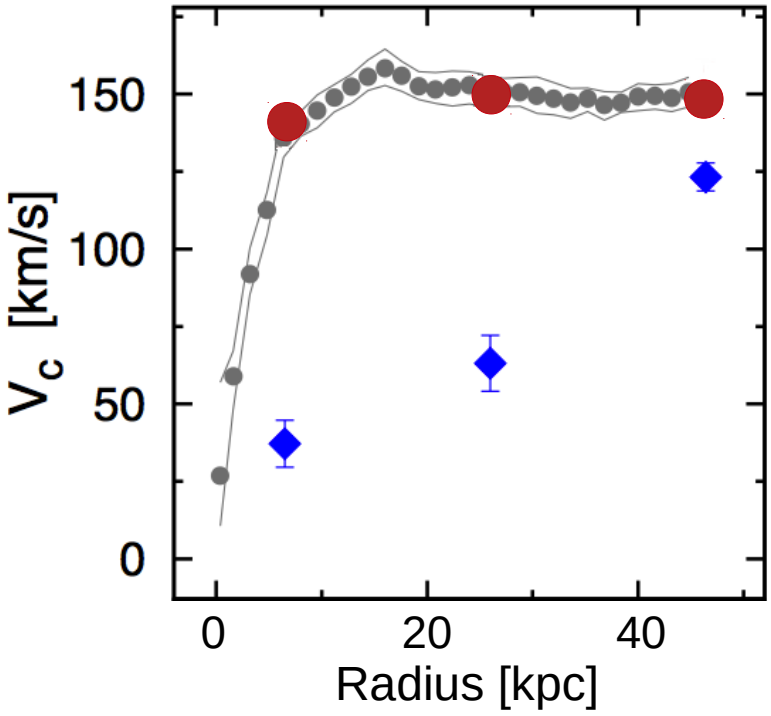
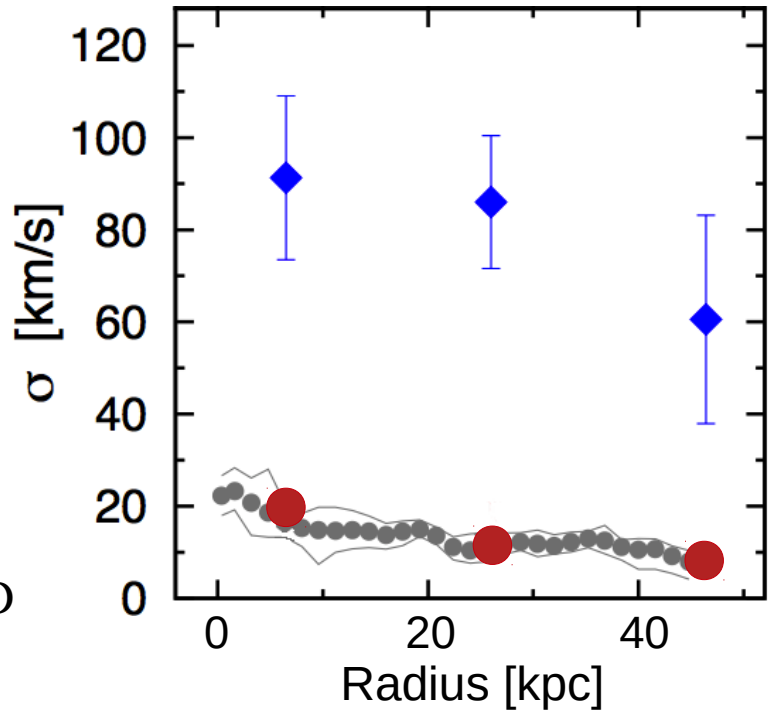


High res.

Low res. 2D

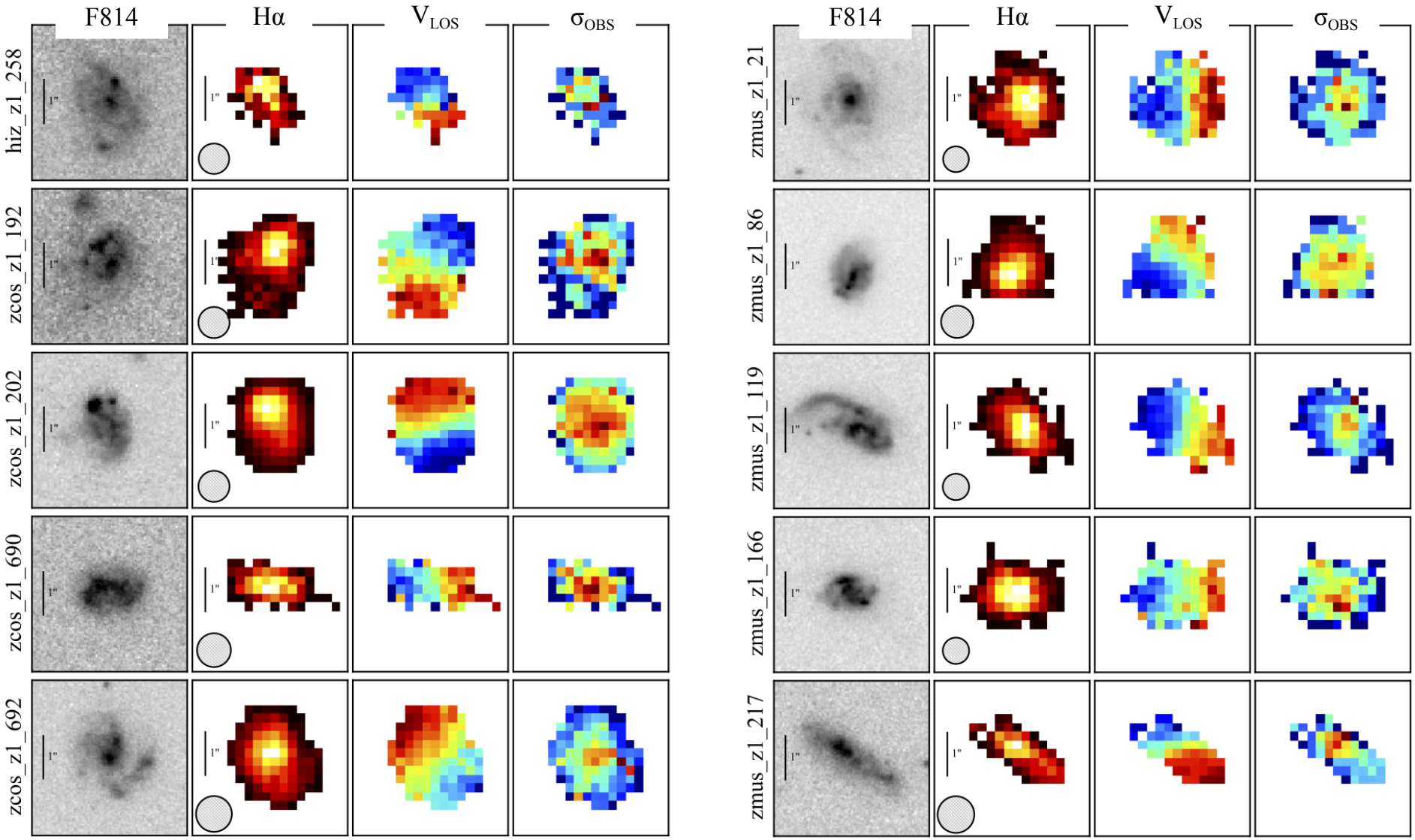
Low res.
3D BAROLO



Galaxy sample

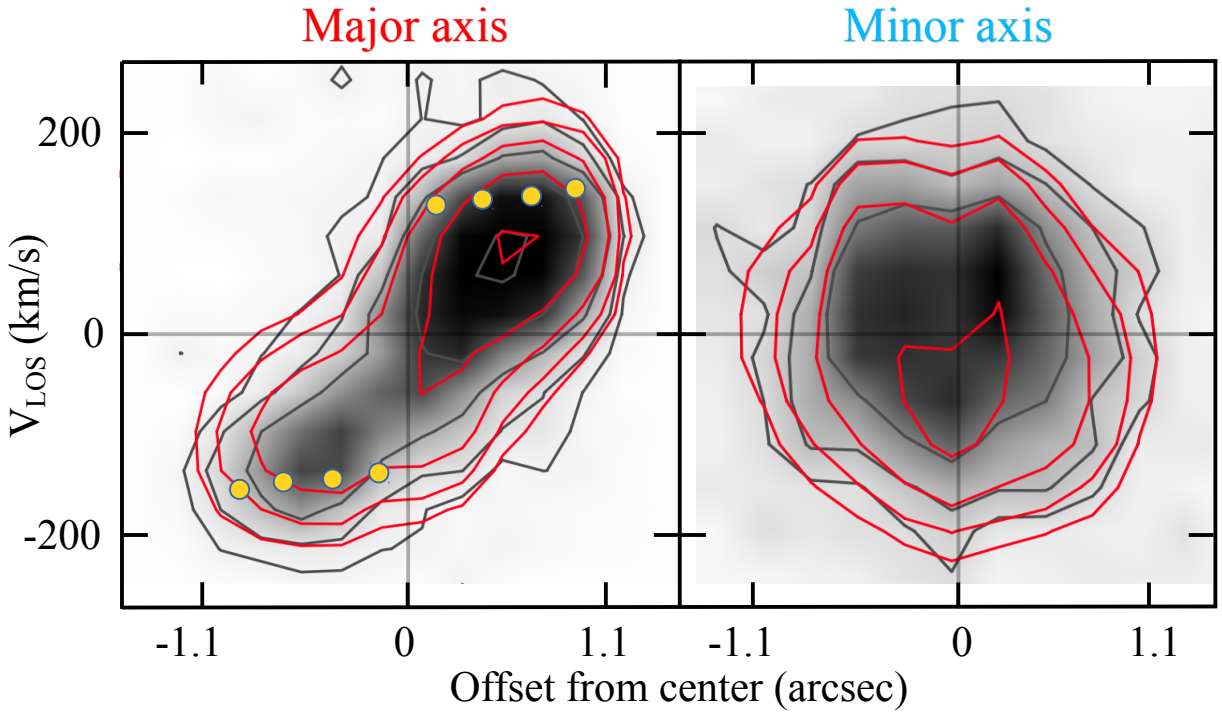
10 galaxies in Hα with KMOS
(KROSS survey, Stott et al., submitted)

- $0.85 < z < 1$
- $9.5 < \mathrm{Log}(M_*/M_\odot) < 10.5$
- Normal SF (SFR < 40 $M_\odot$/yr)

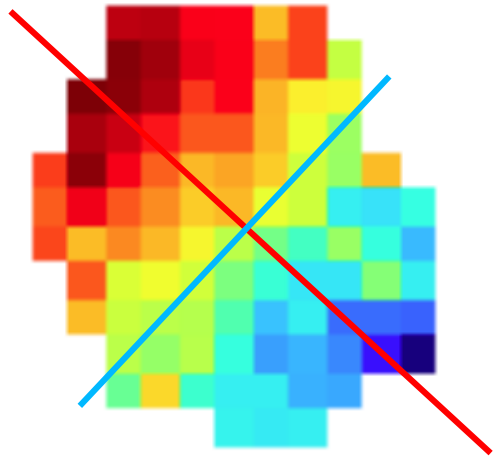


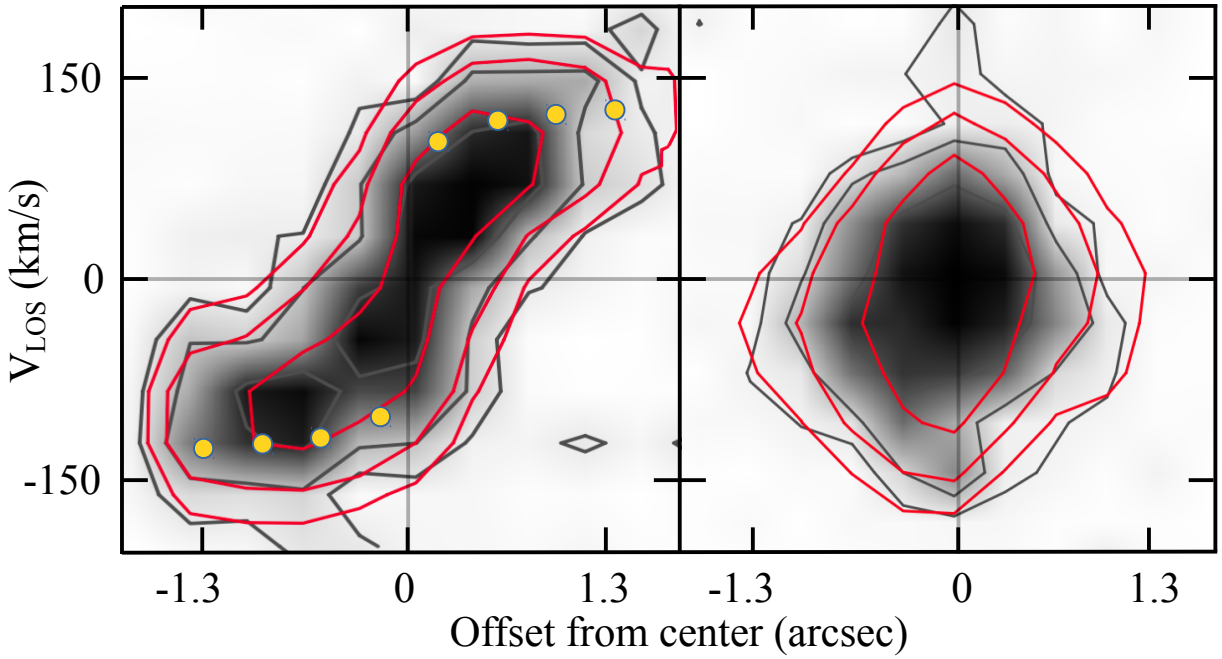
3D models vs data

zcos_z1_202

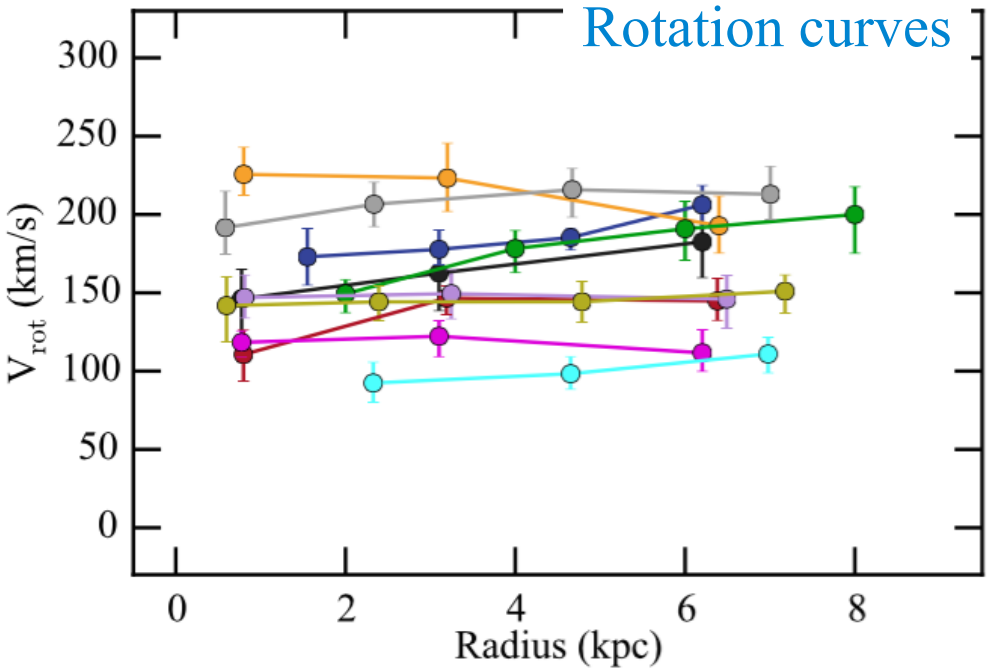


zcos_z1_692





Rotation curves and velocity dispersion



Steeply rising +
Flat until last point

Shape similar to local
SF galaxies with ~ M_*

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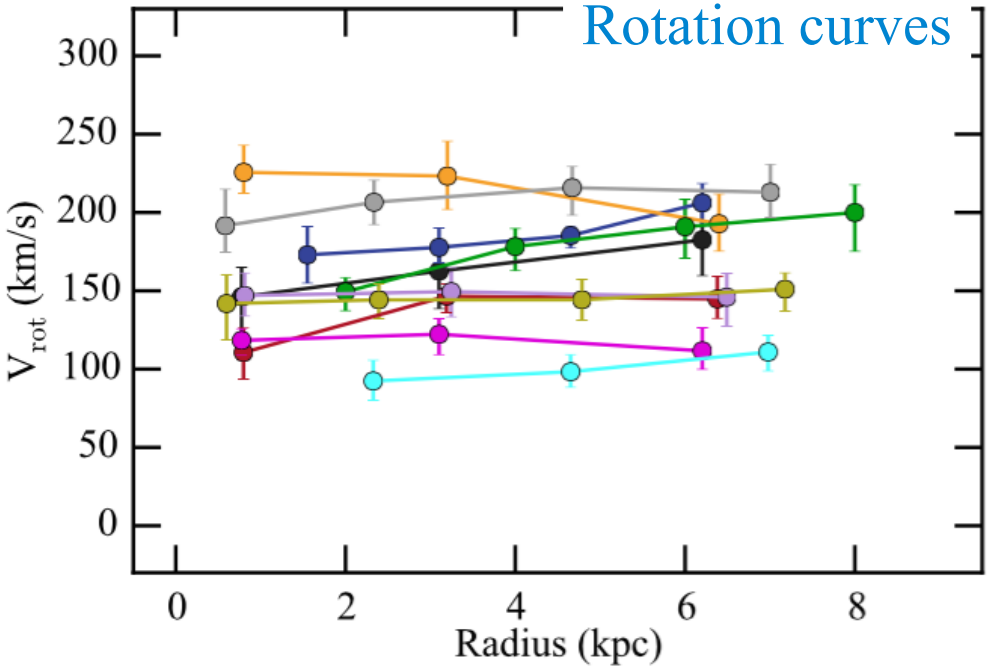

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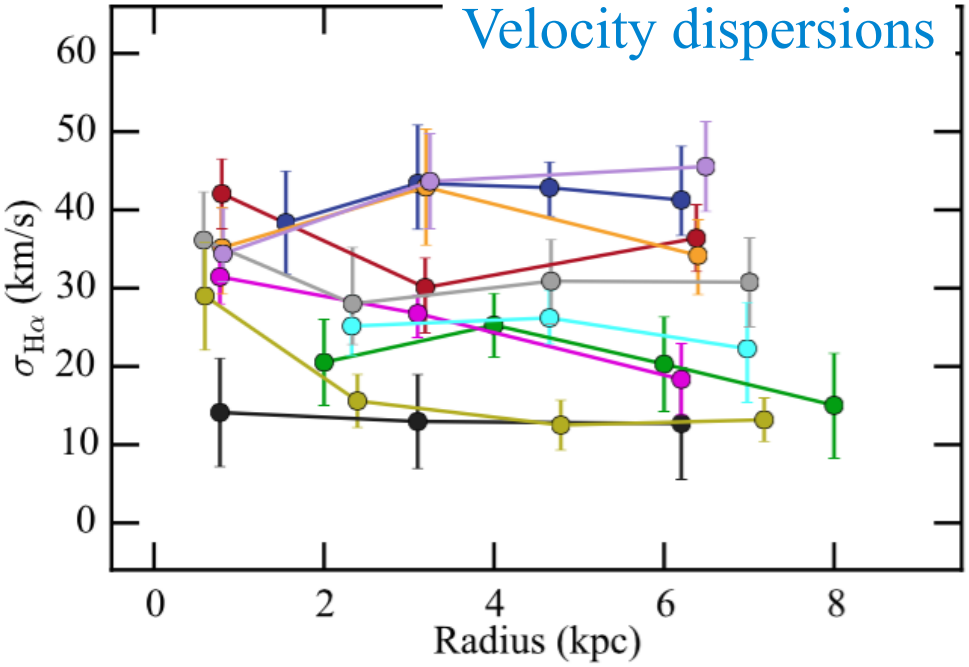
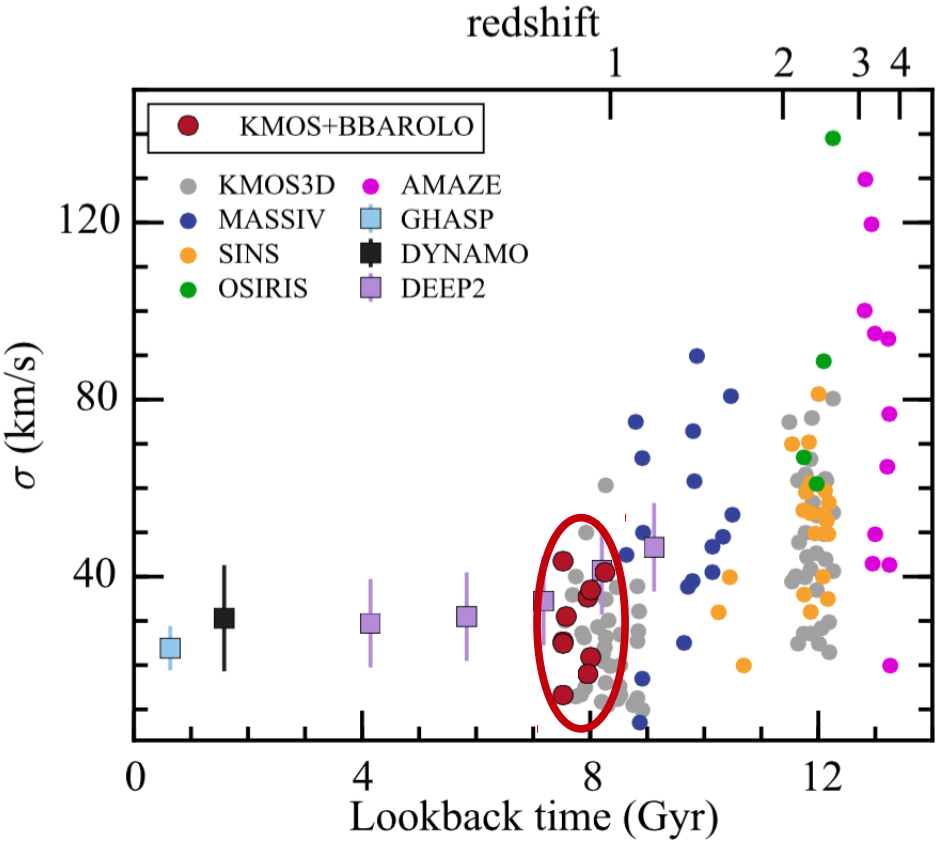


10 km/s < $\sigma_{H\alpha}$ < 40 km/s

Comparable to local galaxies

Velocity dispersion and TF relation



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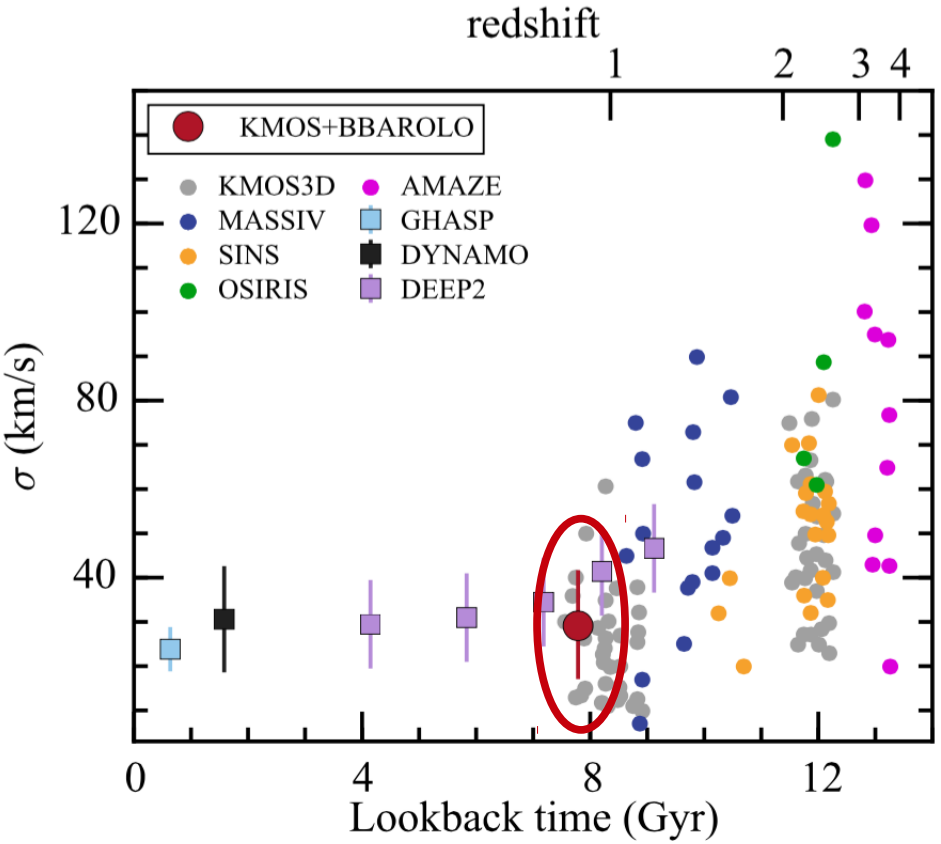

No significant evolution to z~1

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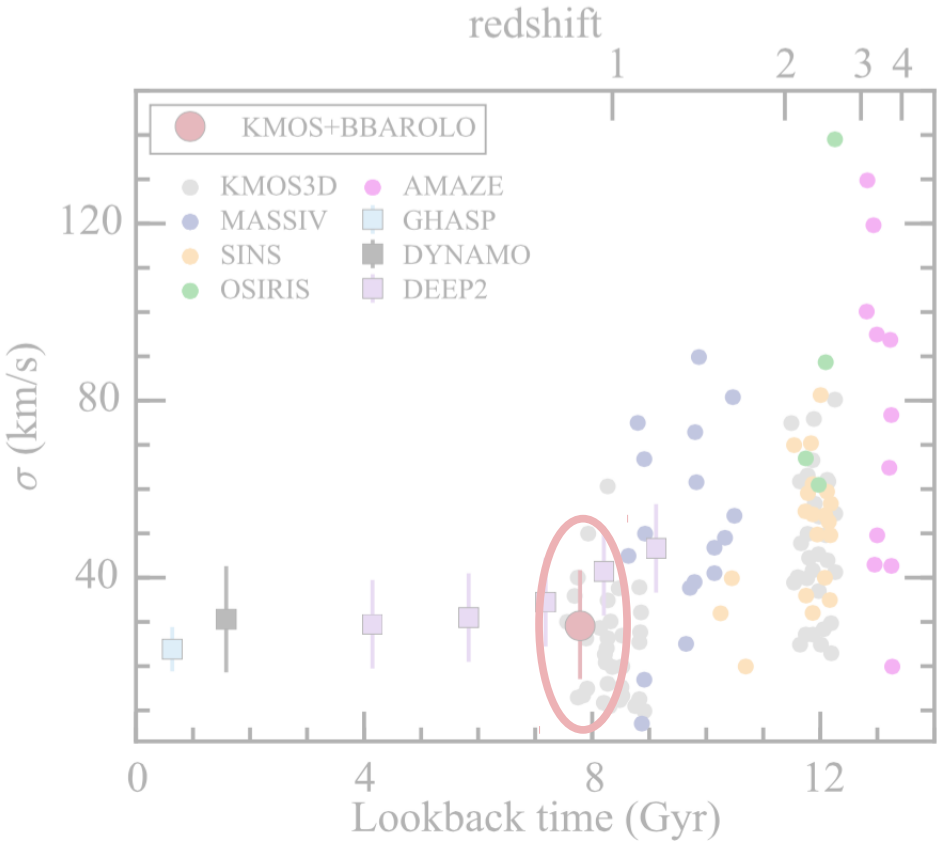

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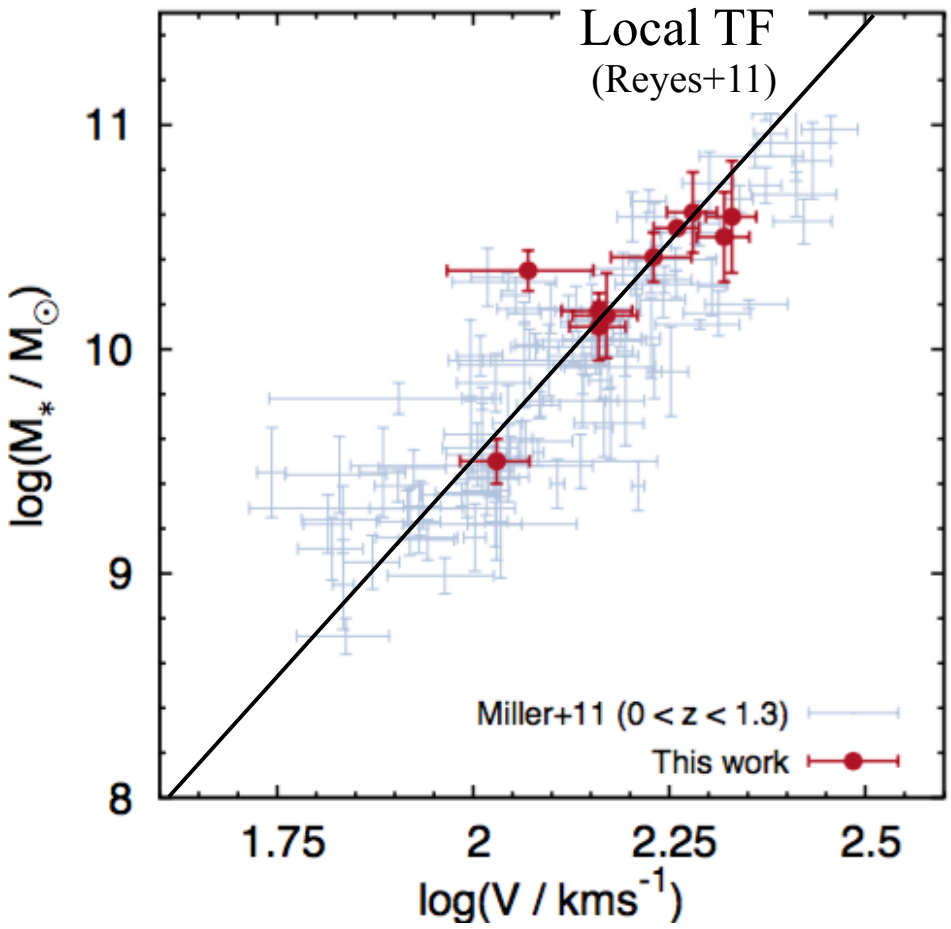

Good agreement with local TF

Final remarks

- 3D modeling can be successfully applied to high-z datacubes

  → Powerful in disentangling V_{rot} from σ_{gas}

- Our z ~ 1 galaxies have kinematics akin to that of local discs

  → Flat rotation curves and low velocity dispersions

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Next steps

- Extending the 3D analysis to larger samples and higher redshifts

- Using ALMA capabilities to break the z ~ 4 wall

Thank you for your kind attention