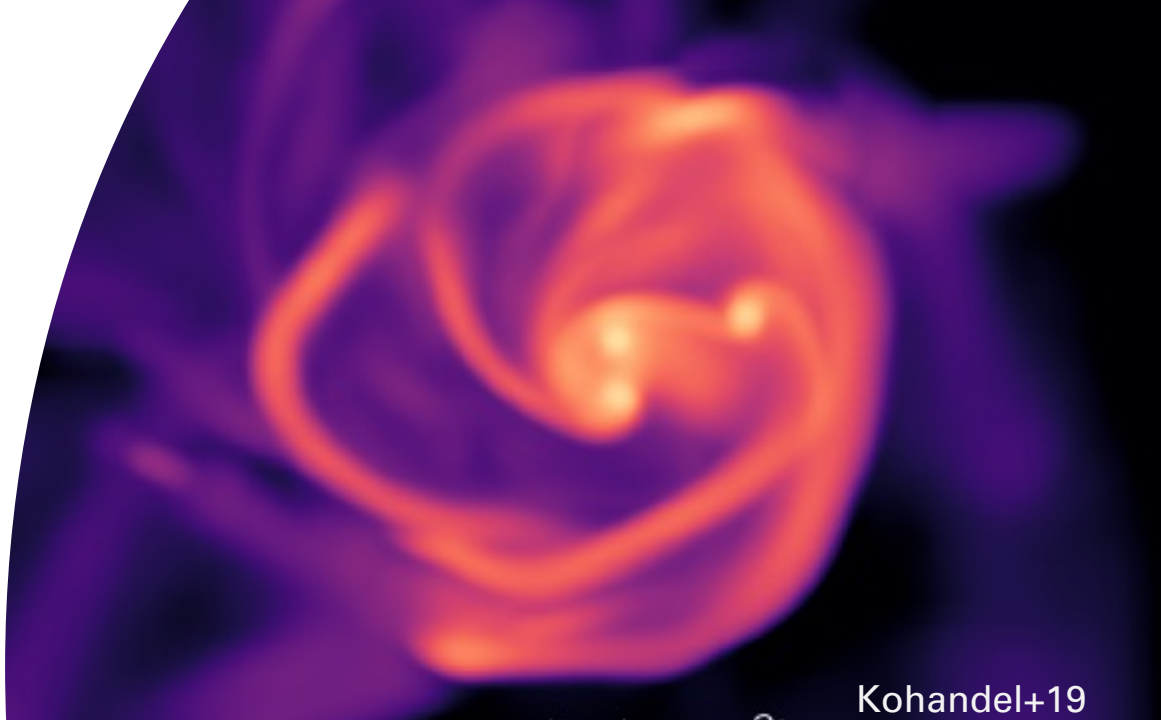
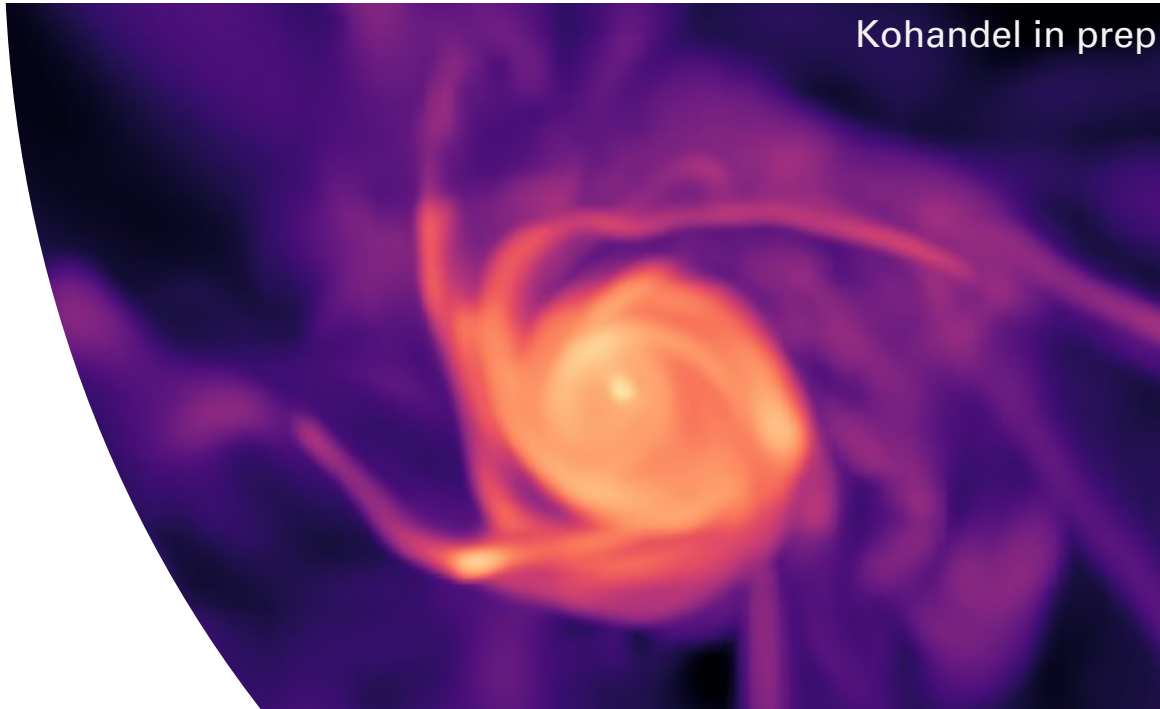
EVIDENCES FOR TURBULENT DISK GALAXIES AT Z>5

Eleonora Parlanti

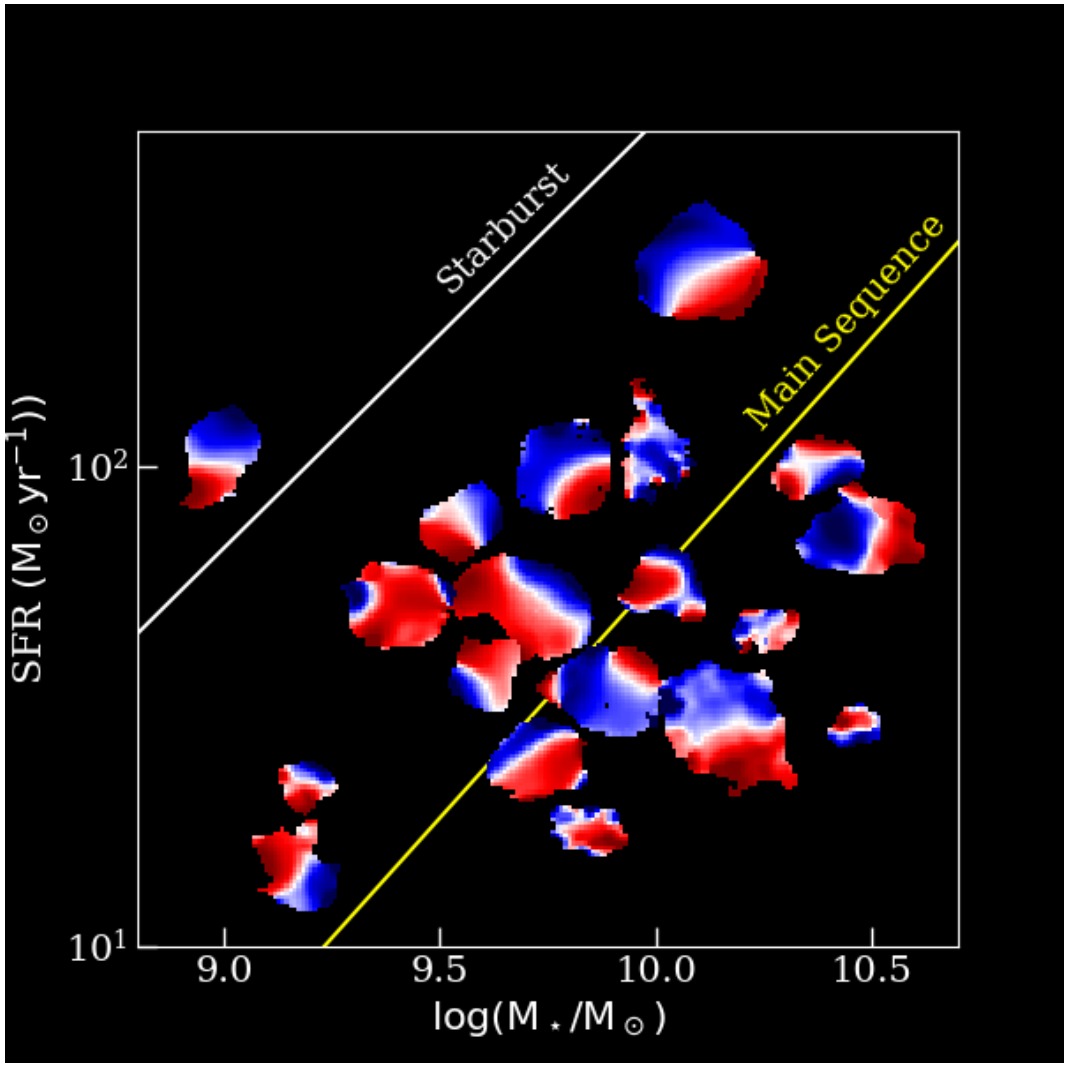
Scuola Normale Superiore, Pisa





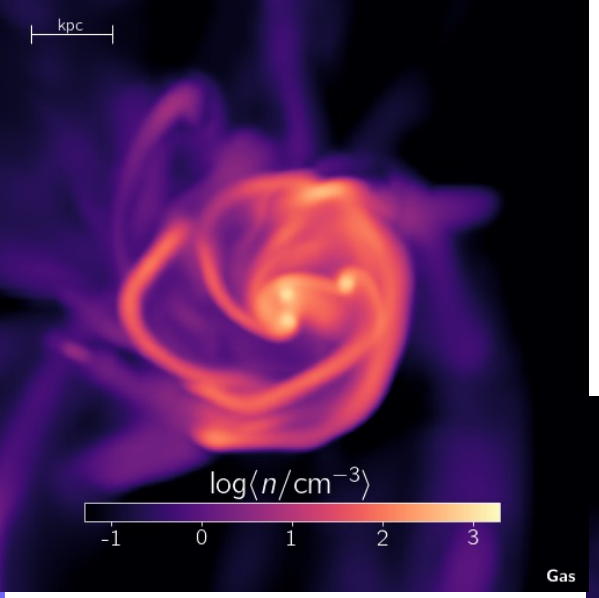
Outline

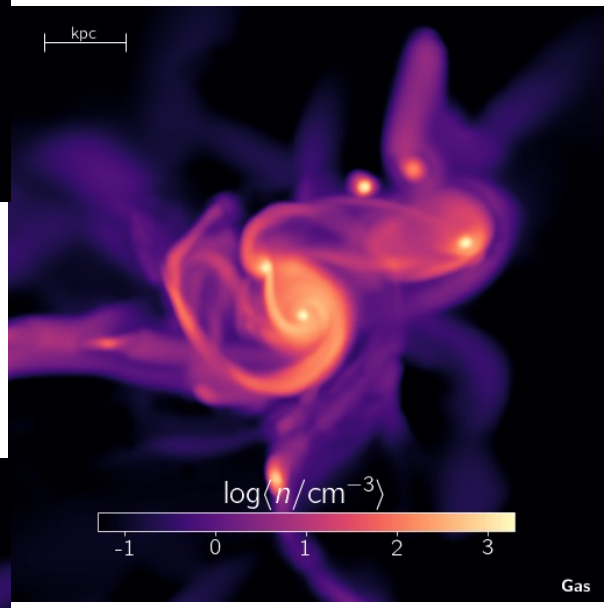
- Introduction
- Turbulence in galaxies across cosmic time
- New sample of z>5 galaxies
- Results
- Conclusion

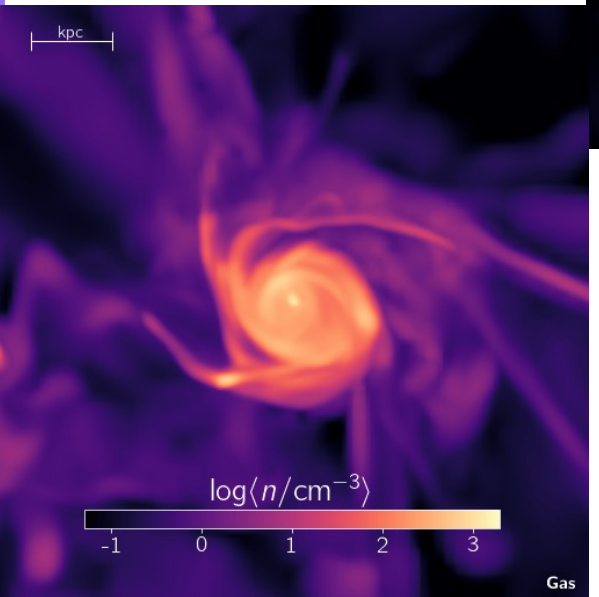


Introduction

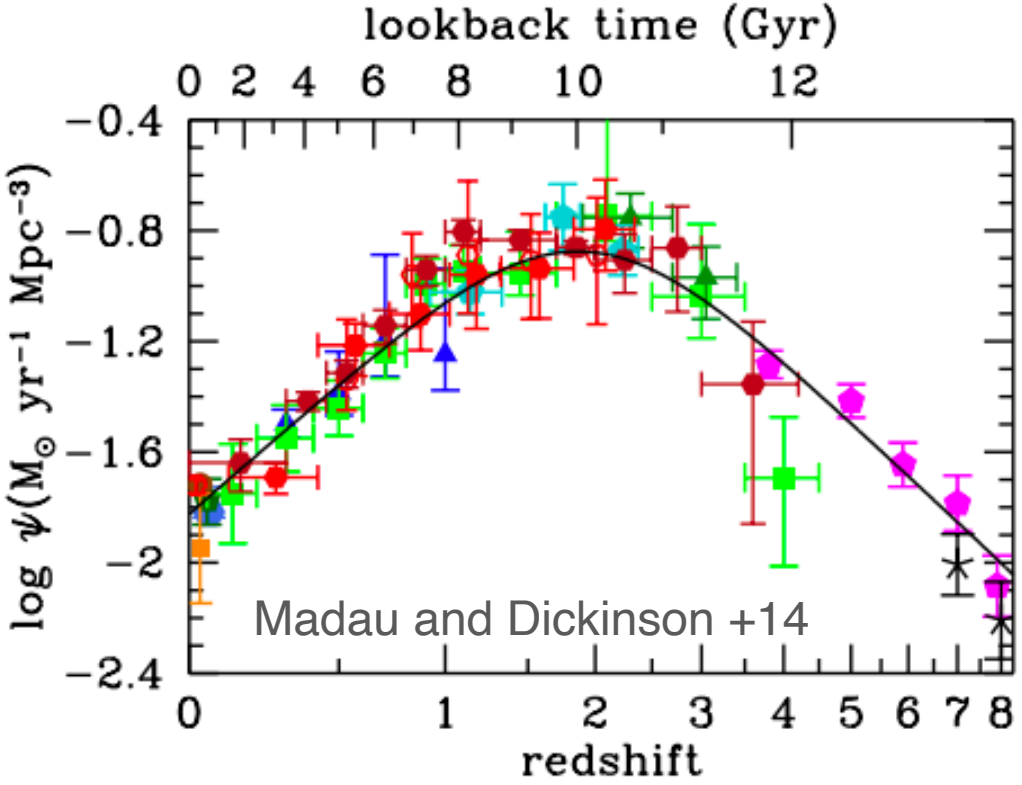
Local galaxies are the result of 13.8 Gyr of cosmic evolution.





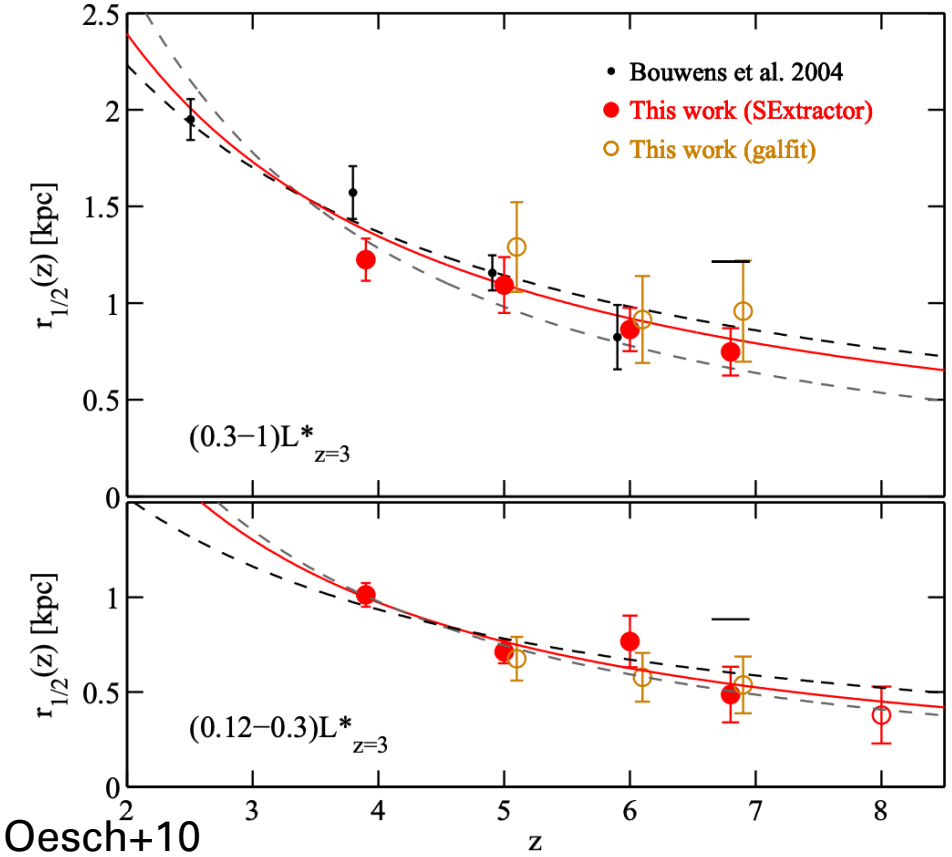


Kohandel+19
Kohandel in prep

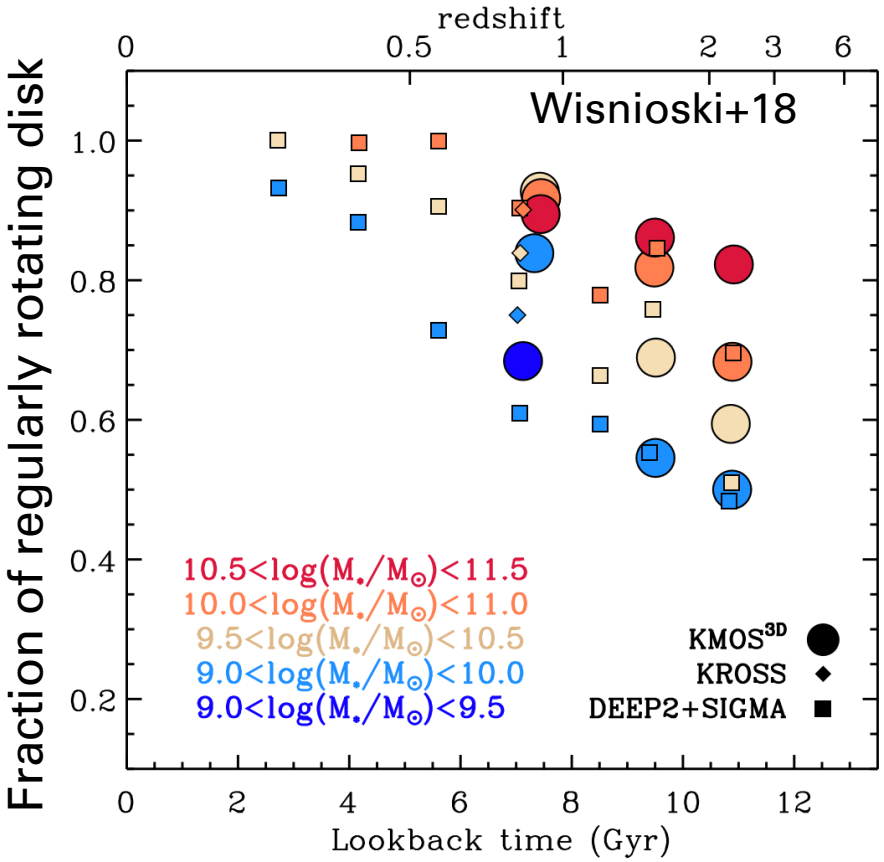


Introduction

High redshift galaxies are more compact and undergo more merger events.



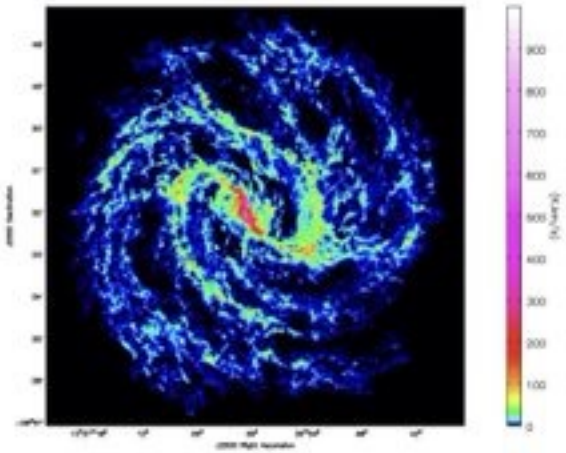
Oesch+10



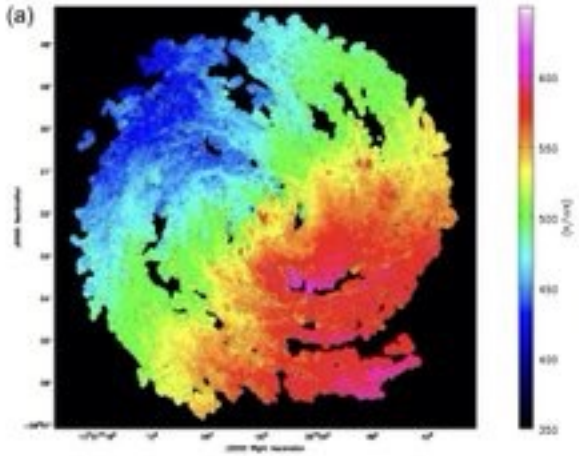
Galaxy kinematics

Koda+23

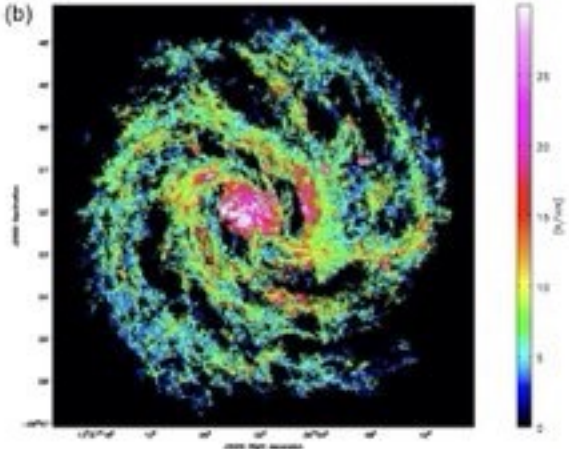
Flux map



Velocity map

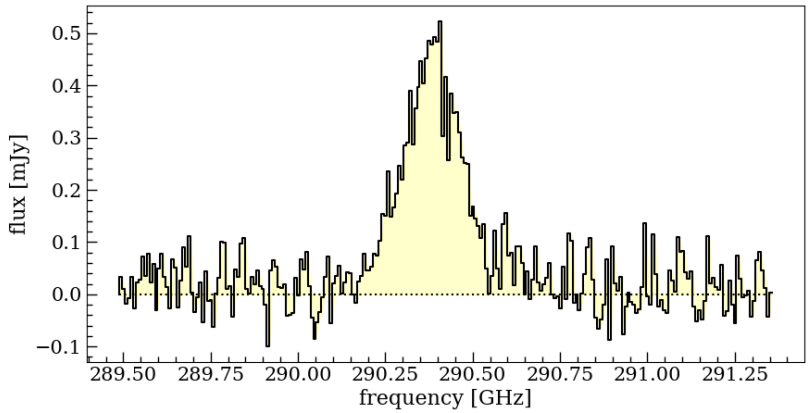


Velocity dispersion map

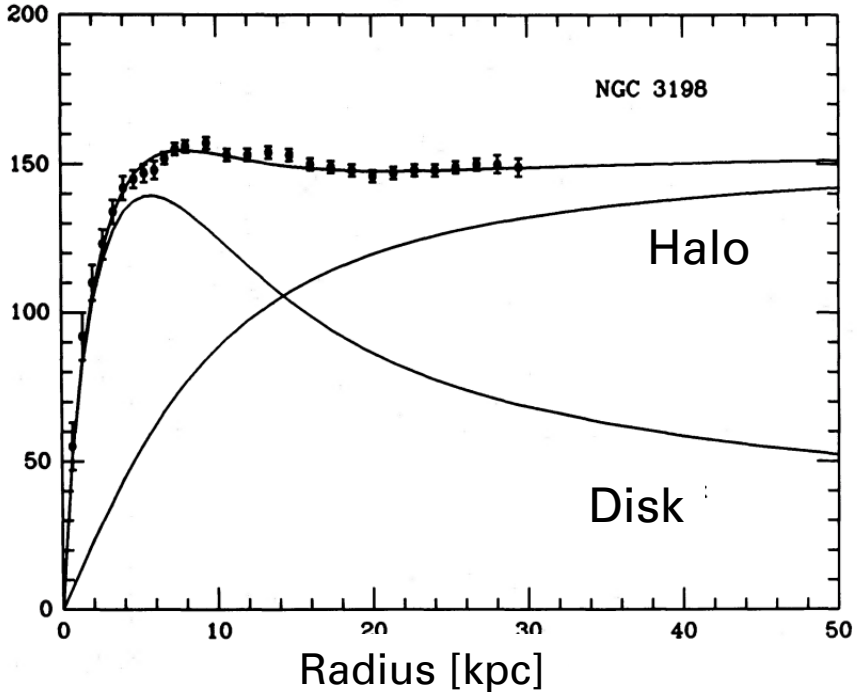


van Albada+84

$$V_c = \sqrt{r\frac{\delta\phi}{\delta r}}$$



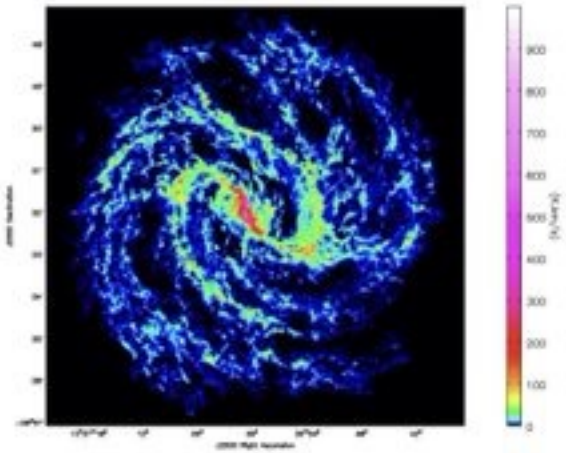
V [km/s]



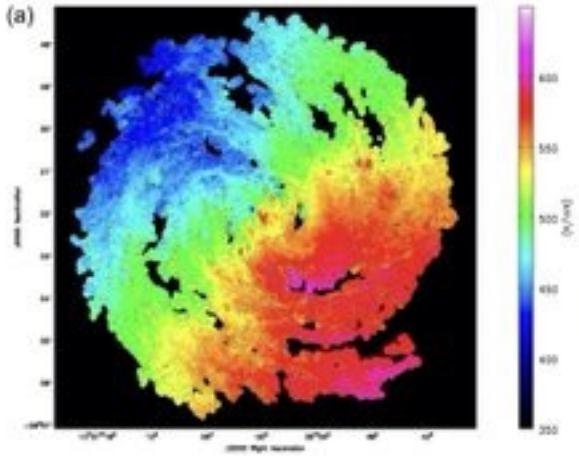
Galaxy kinematics

Koda+23

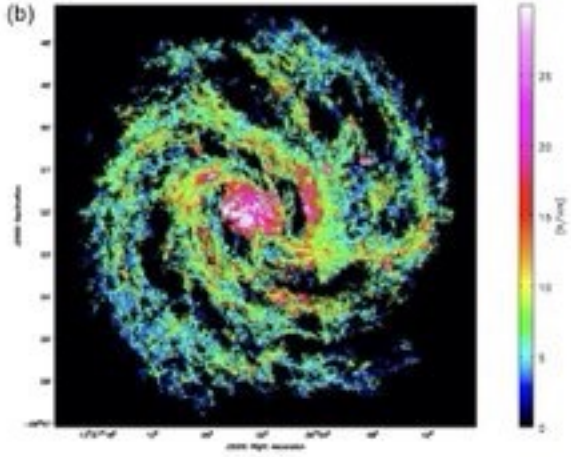
Flux map



Velocity map



Velocity dispersion map



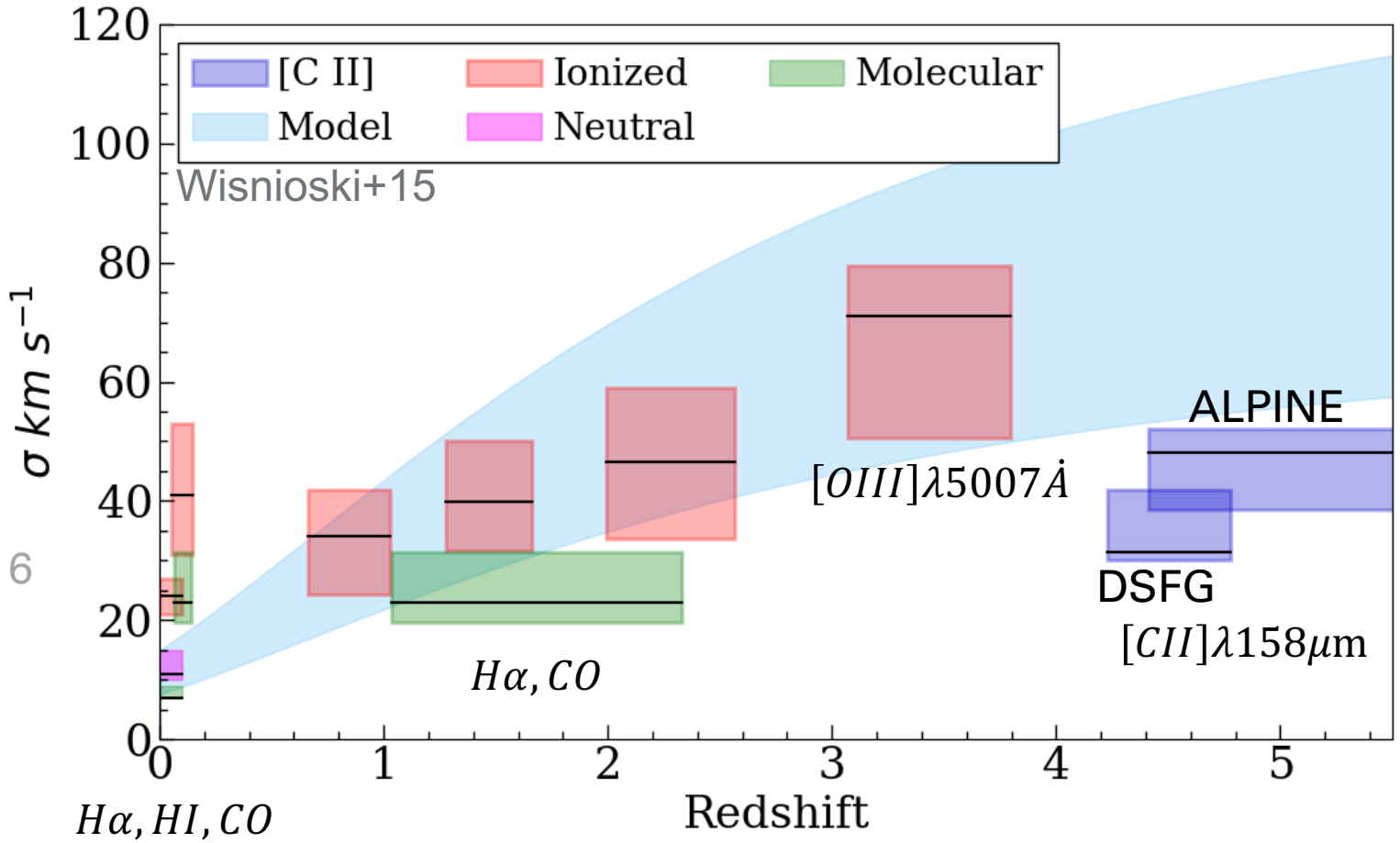
What drives velocity dispersion?

- Feedback
  a) AGN
  b) Supernovae
- Gravitational instabilities
  a) Gas accretion
  b) Mergers
  c) Gas transport within the disk

Velocity dispersion across cosmic time

Epinat+10
Green+14
Turner+17
Ubler+19

Mogotsi+16
Girard+21

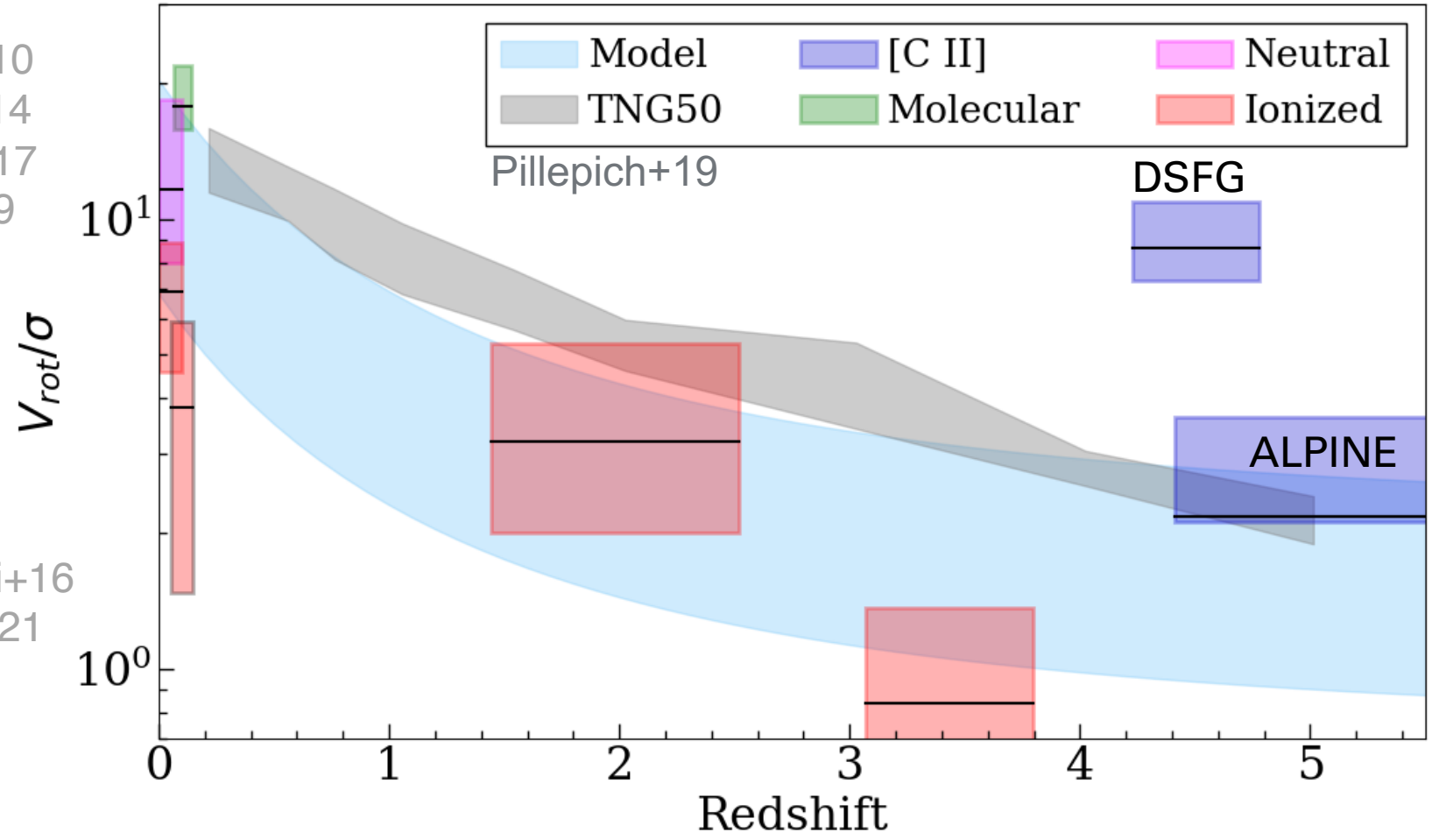


Sharda +19, Neeleman+20 Rizzo +20, 21 Lelli+21, Fraternali+21, Jones+21

V_{rot}/σ across cosmic time

Wisnioski+15

Epinat+10
Green+14
Turner+17
Ubler+19



Sharda +19, Neeleman+20 Rizzo +20, 21 Lelli+21, Fraternali+21, Jones+21

Mogotsi+16
Girard+21

Why do we have such a difference?

1. Different tracer?

   [C II] against [OIII] and $H\alpha$ for z<4

2. Different galaxy properties?

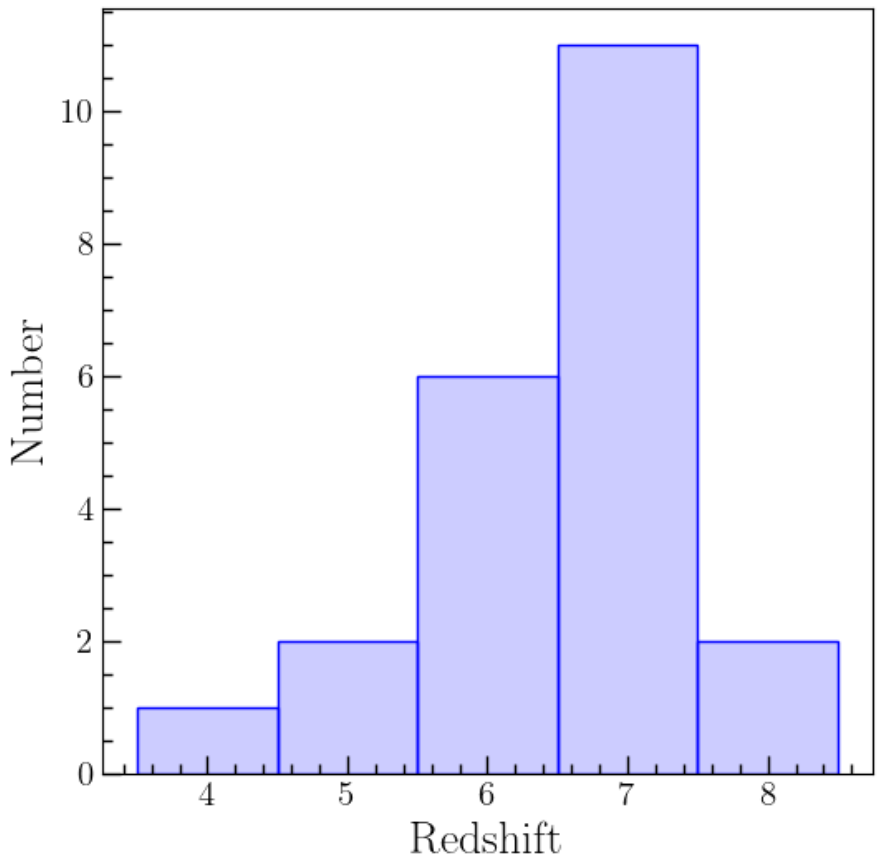
   Massive, starburst, dusty galaxies

3. A different mechanism that drives the velocity dispersion?

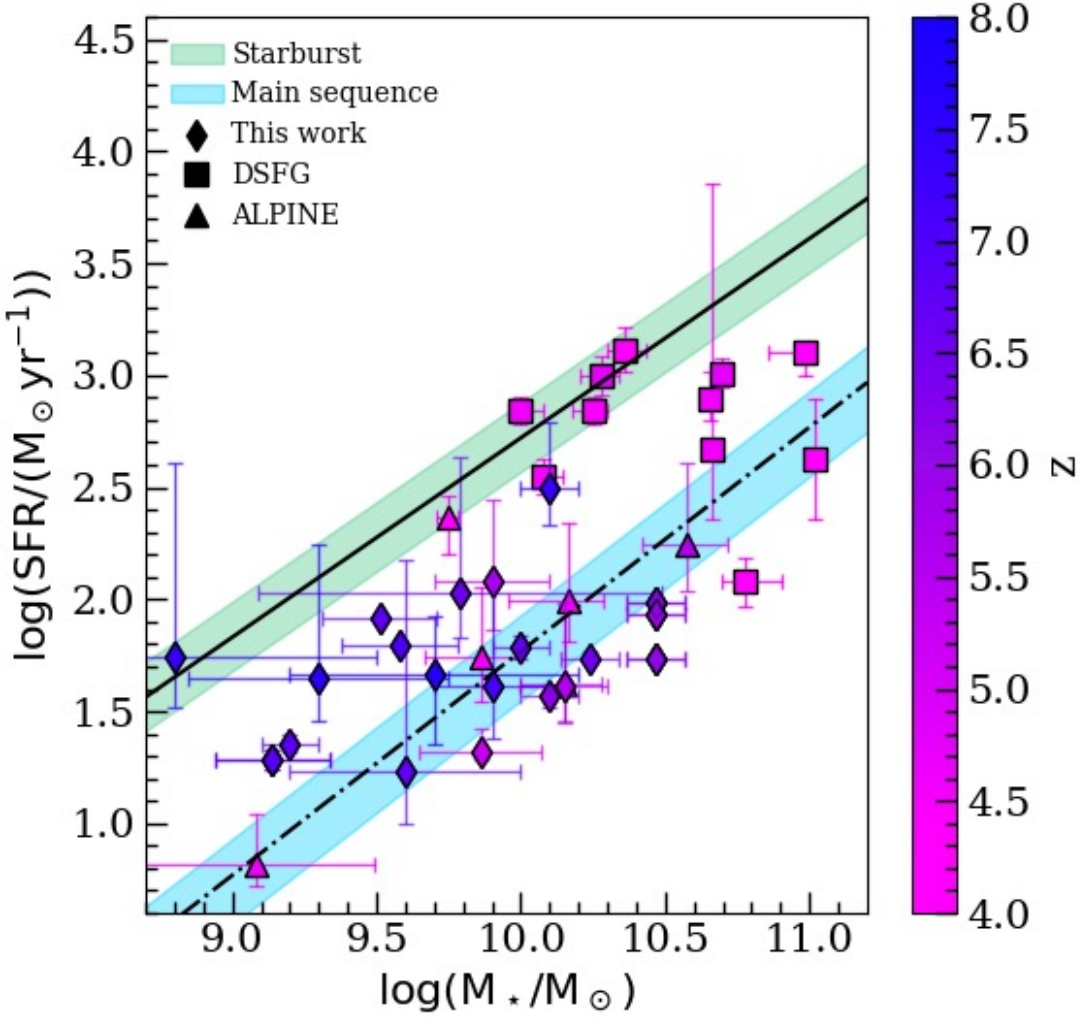
   Feedback? Gas accretion? Merger?

Sample selection

22 galaxies with [CII]
4 of them with [CII] and [OIII]$\lambda 88\mu$m observation

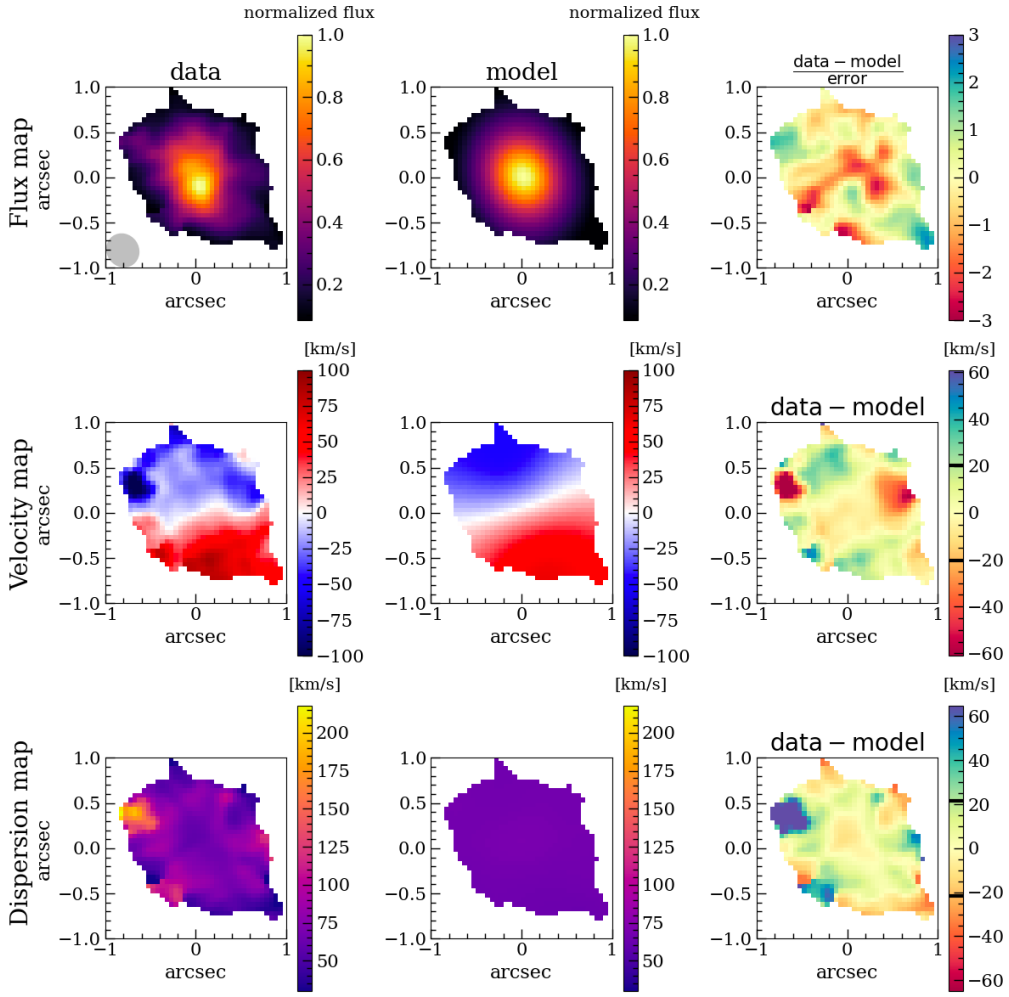


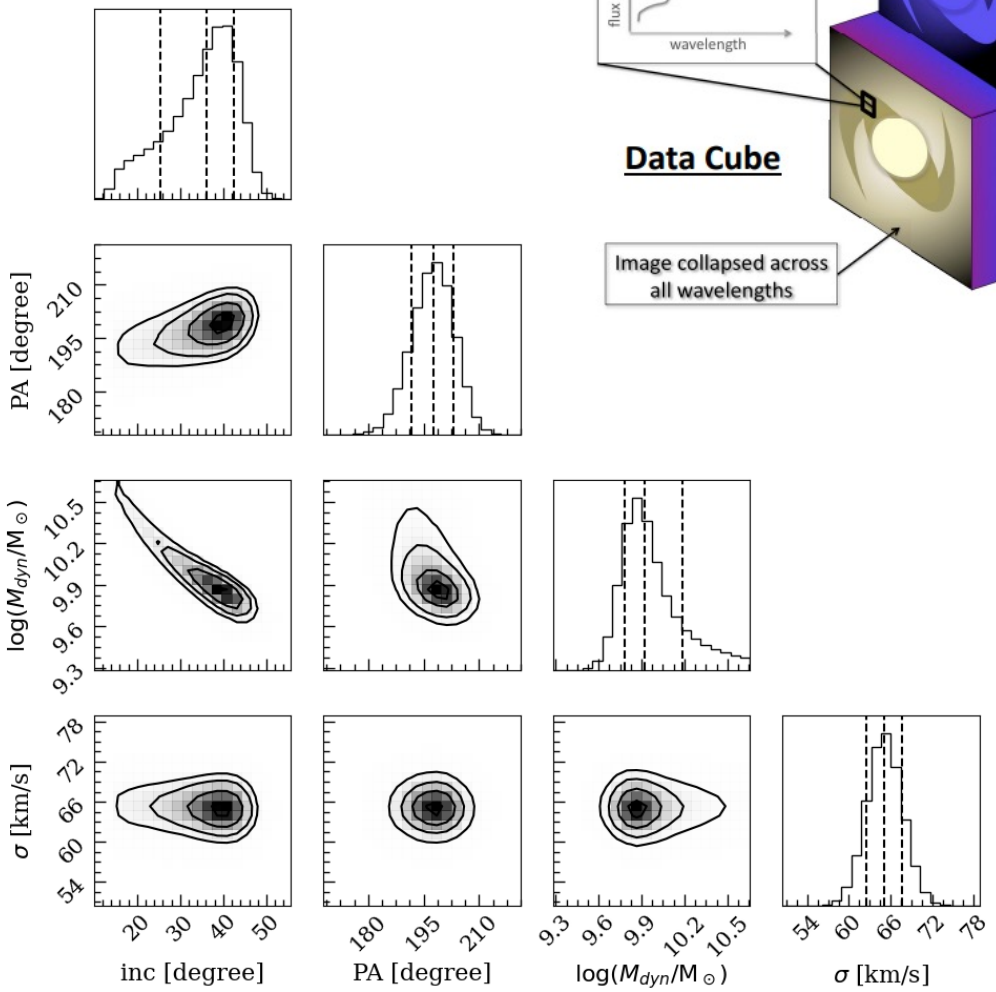
Sharda +19, Rizzo +20, 21 Lelli+21, Fraternali+21, Jones+21

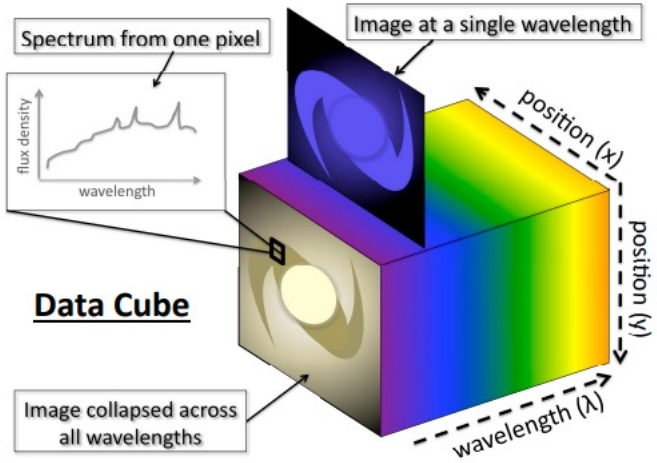


Parlanti+23

Results

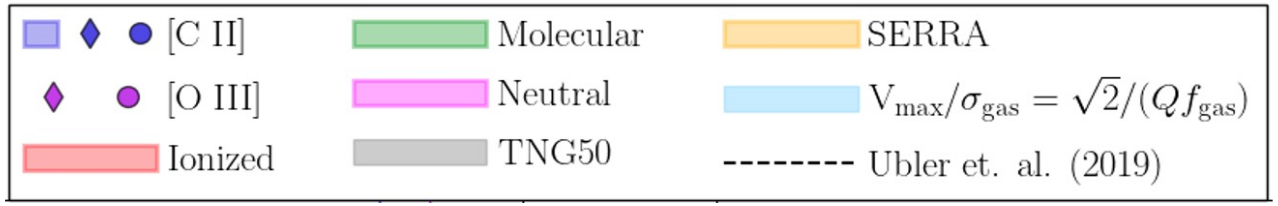




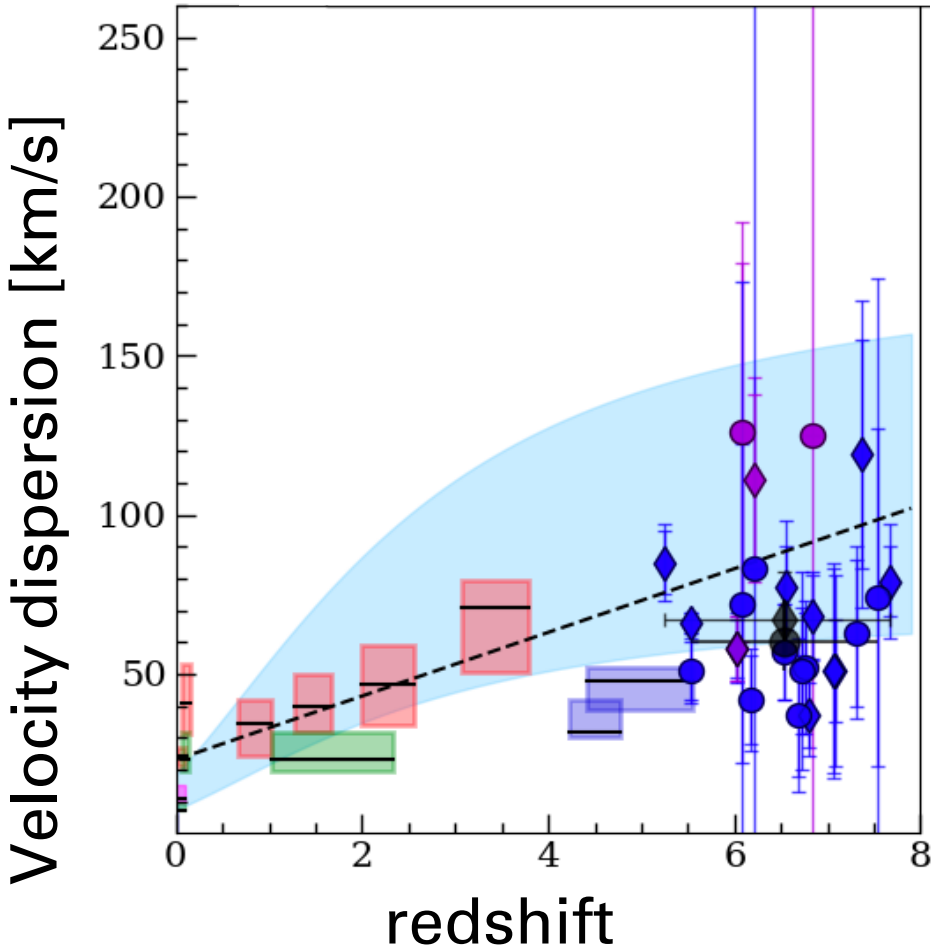


Parlanti+23

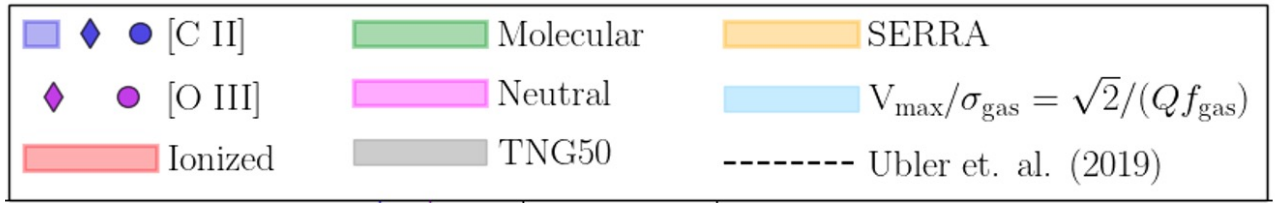
Results



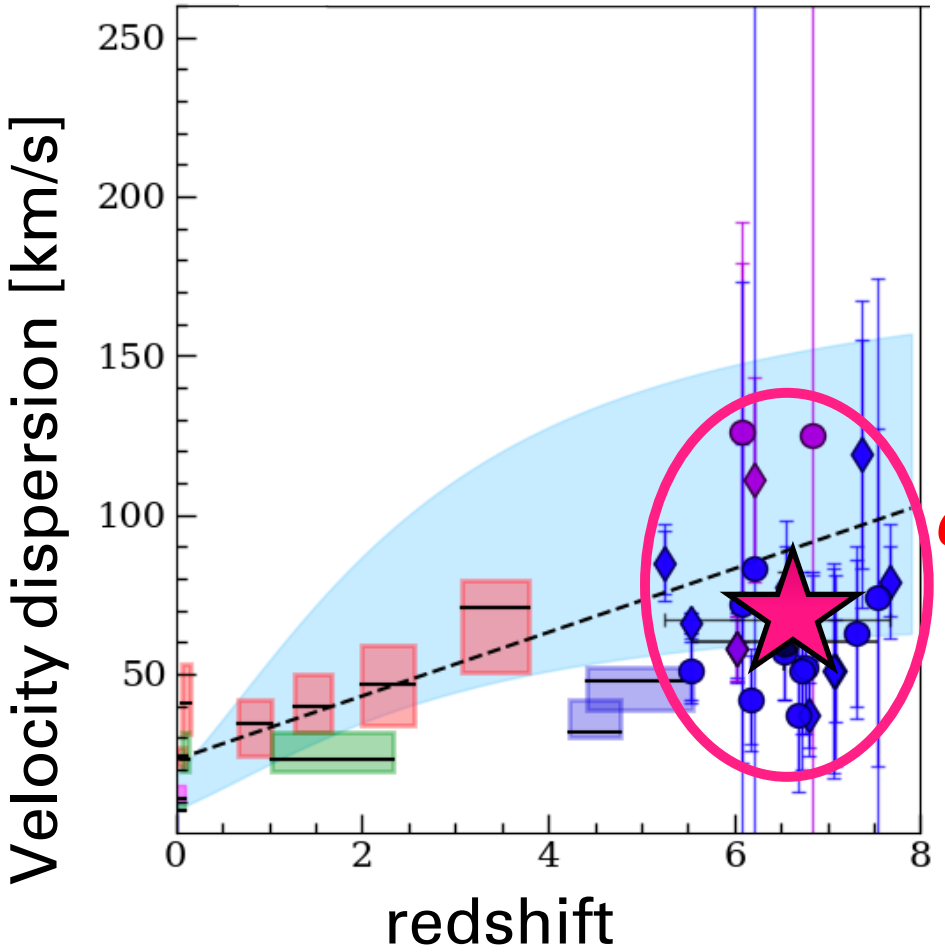
Parlanti+23



Results

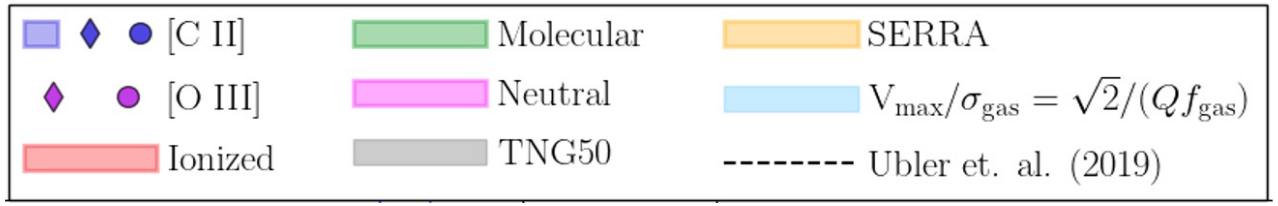


Parlanti+23

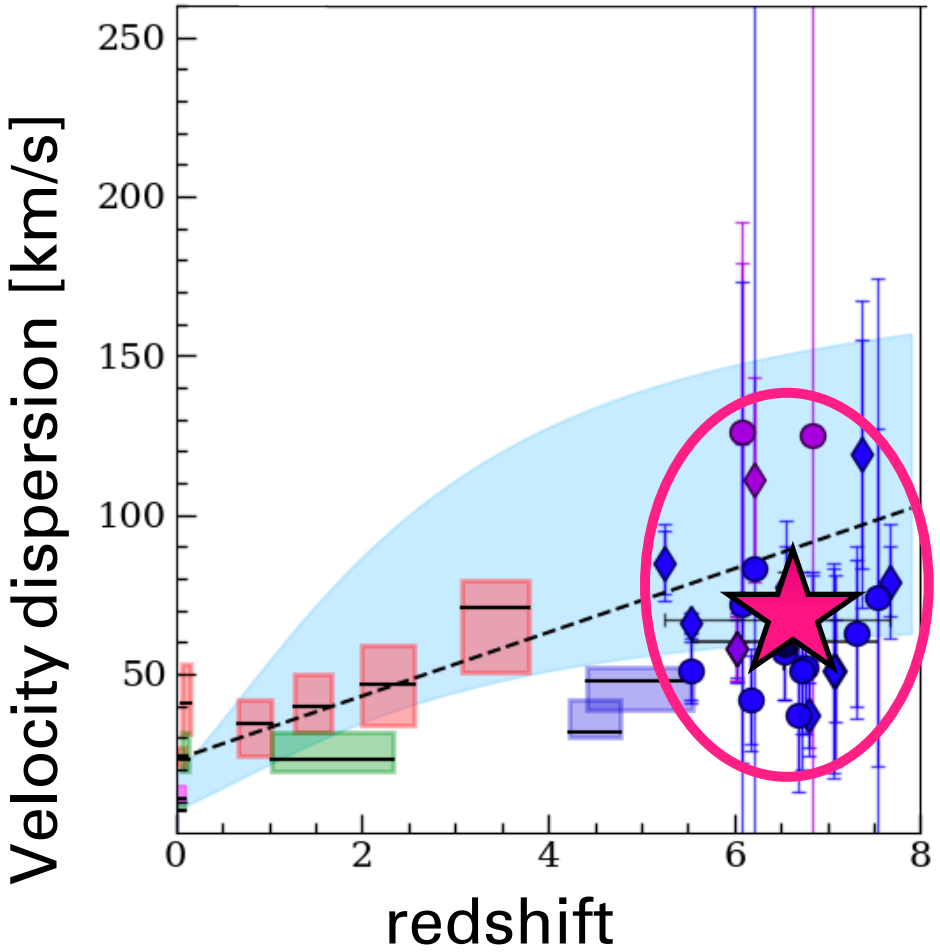


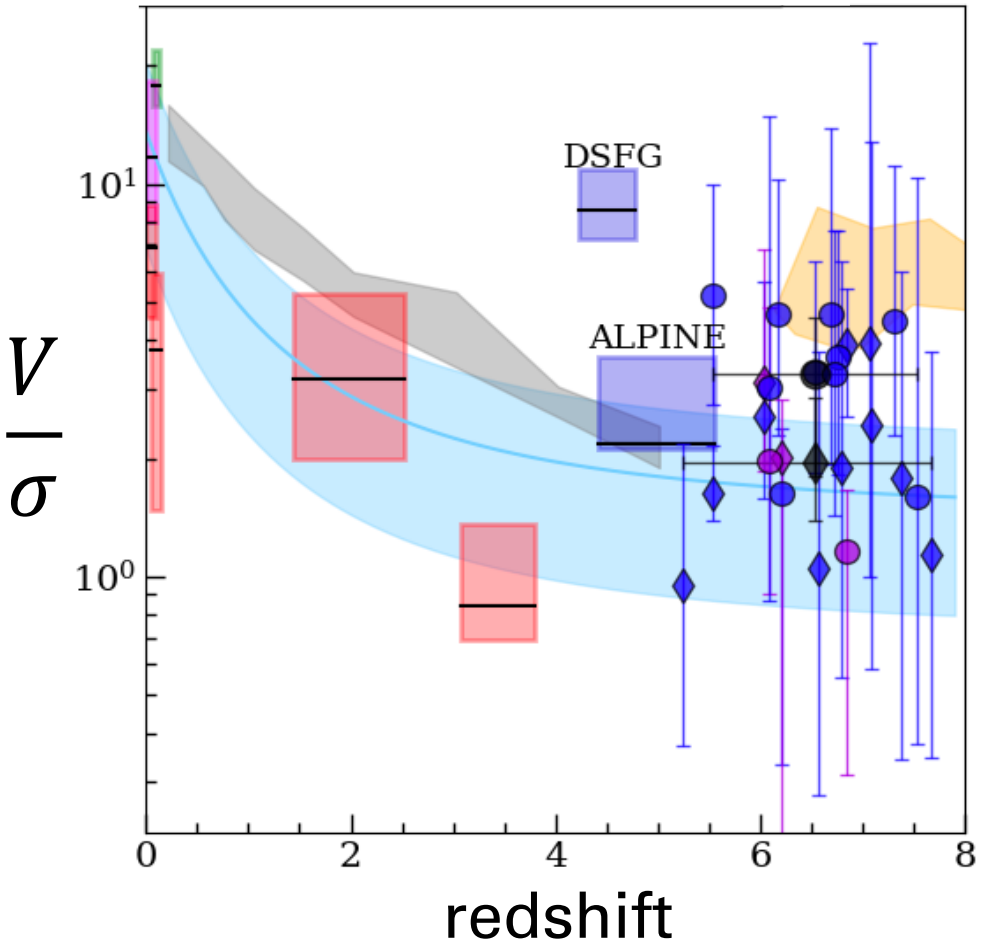
$\sigma = 60 - 70\ km/s$

Results



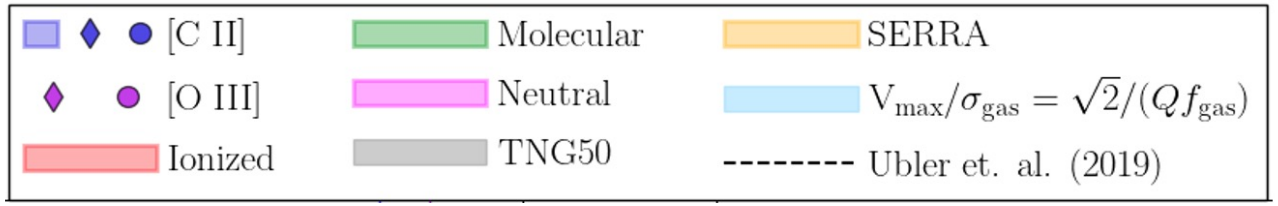
Parlanti+23



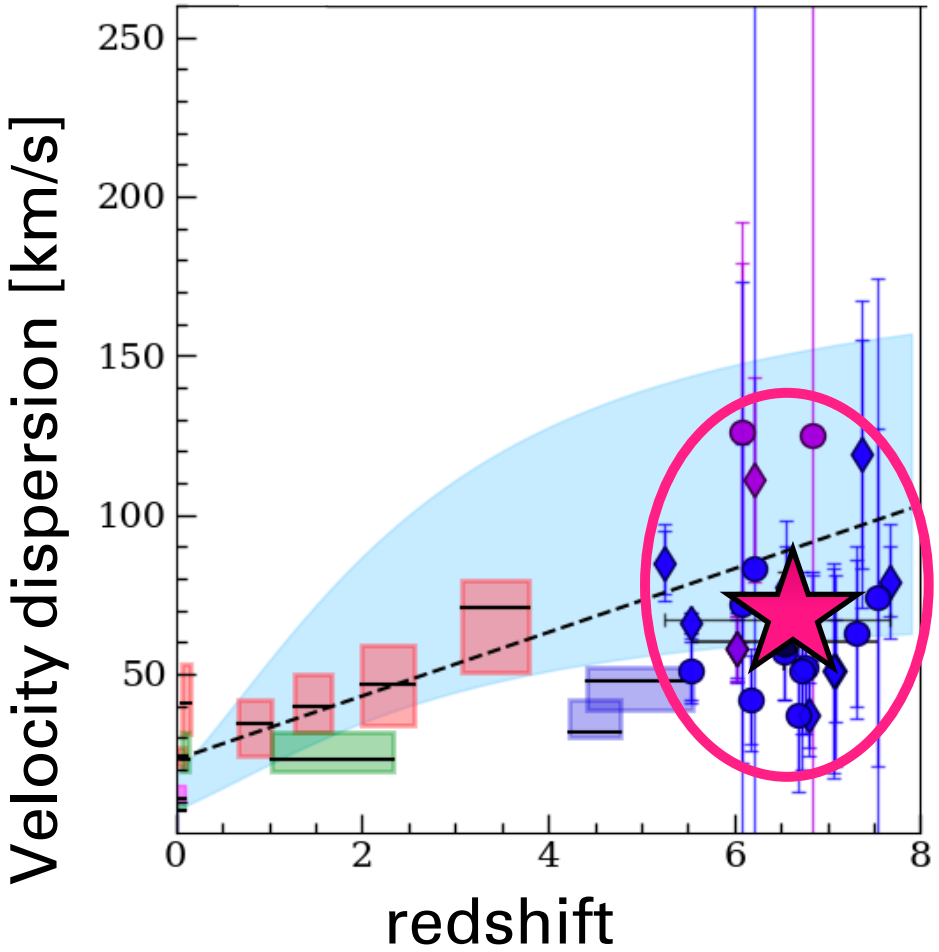


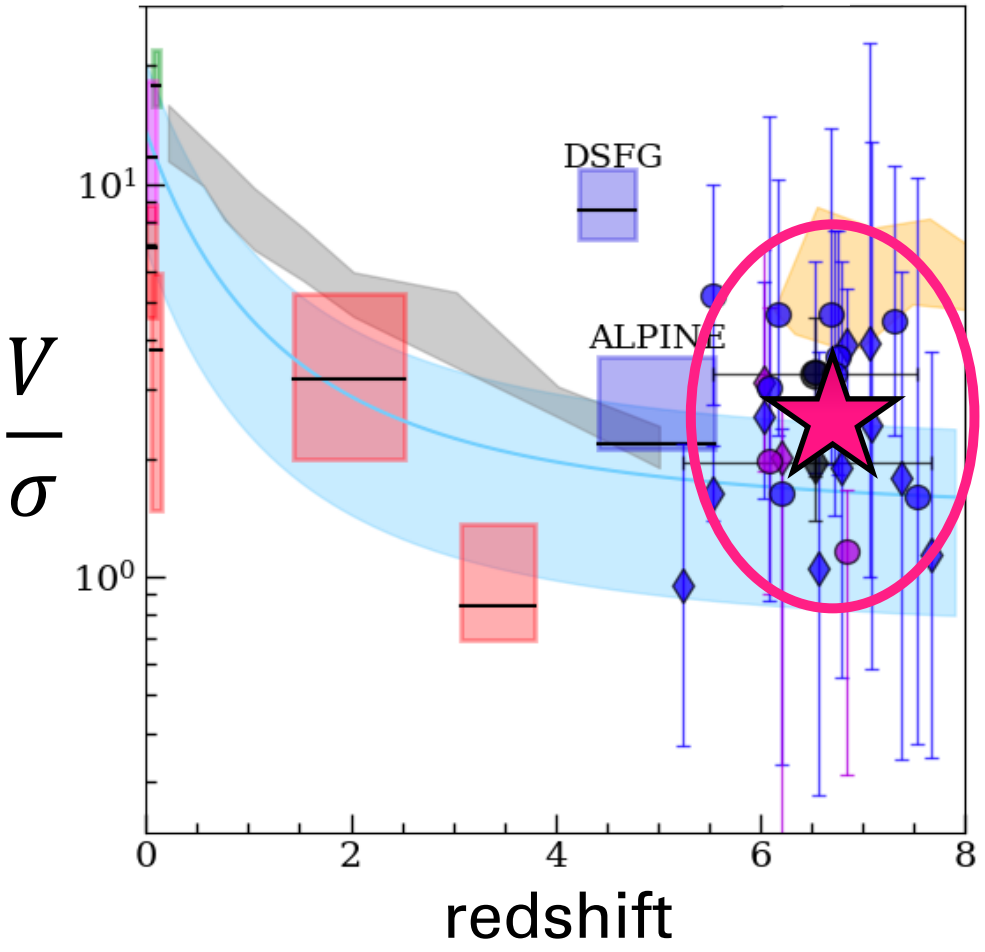
Phillephich

Results



Parlanti+23



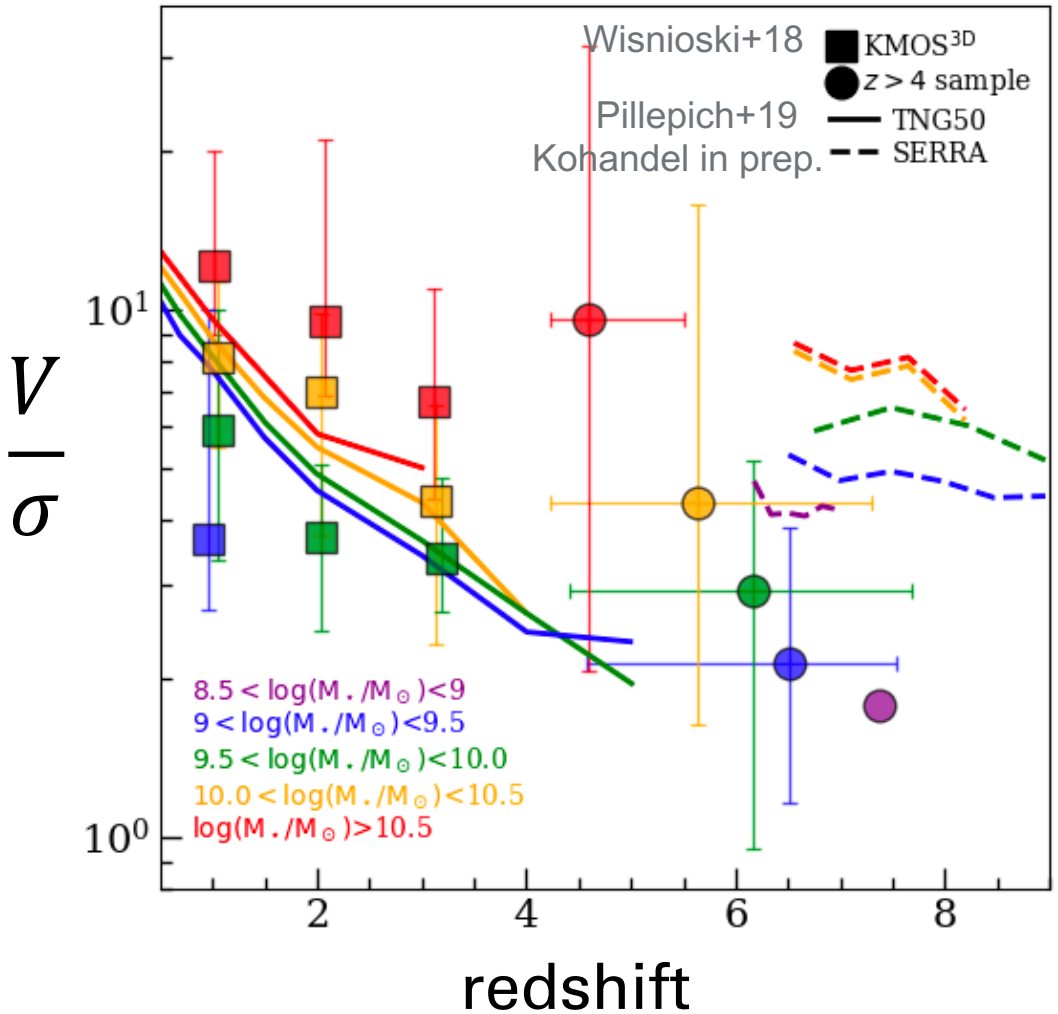


$\frac{V_{rot}}{\sigma} \sim 2 - 3$

Results

Turbulence depends on the stellar mass!

Parlanti+23

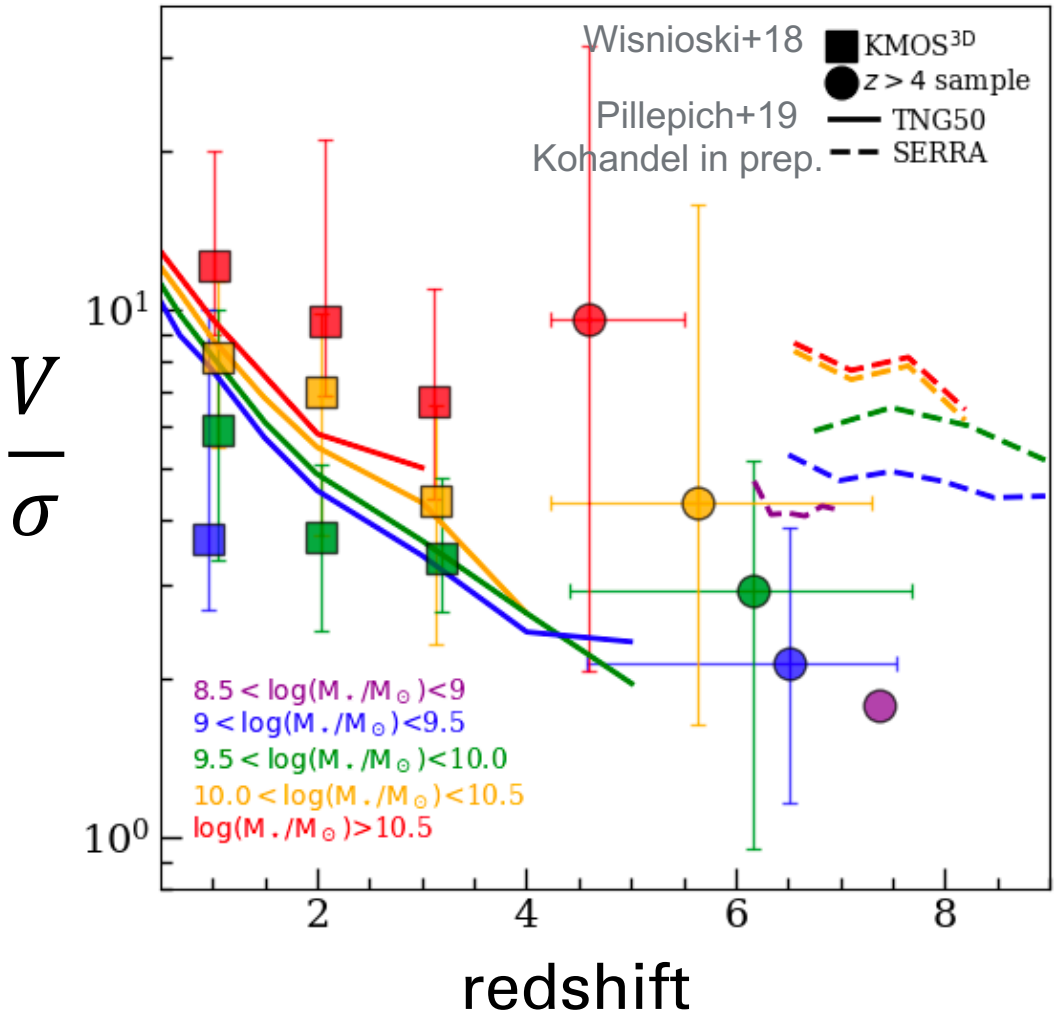


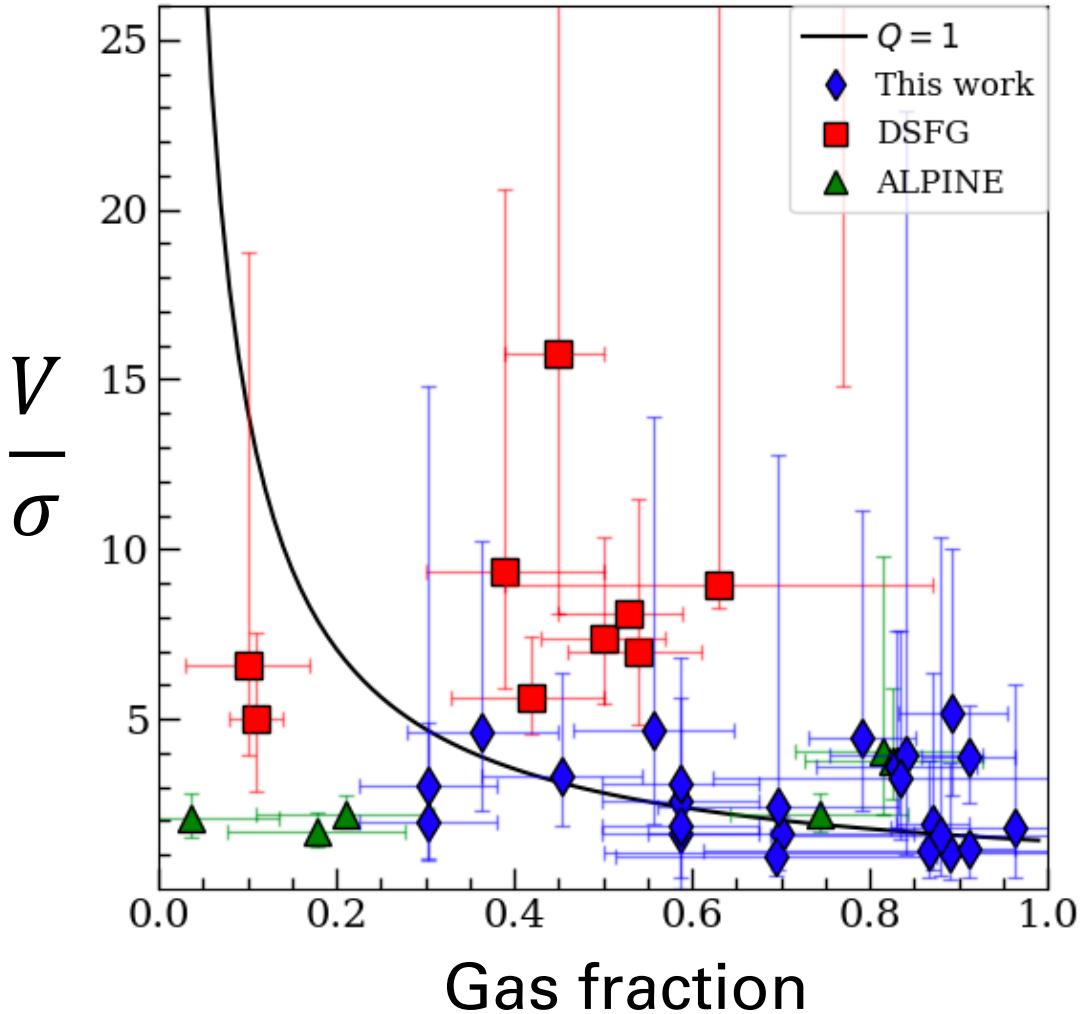
Massive galaxies have a more regular rotating disk!

Results

Turbulence depends on the stellar mass!
But it does not depend on the gas fraction!

Parlanti+23





Conclusions

- Our sample has high-velocity dispersion and low V_{rot}/σ compared to the literature.

- We need more statistics and more high-resolution and high S/N data!
- Sinergy with ALMA and JWST