Traversing the Star-Forming Main Sequence with Molecular Gas Stacks of z~1.6 Cluster Galaxies

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The Star-Forming Main Sequence

Galaxy scaling relation

Relates a galaxy's stellar mass to its Star-Formation Rate (SFR)

0.3 dex scatter on relation

Define:

$$\Delta MS = \log(SFR_{measured}/SFR_{MS})$$

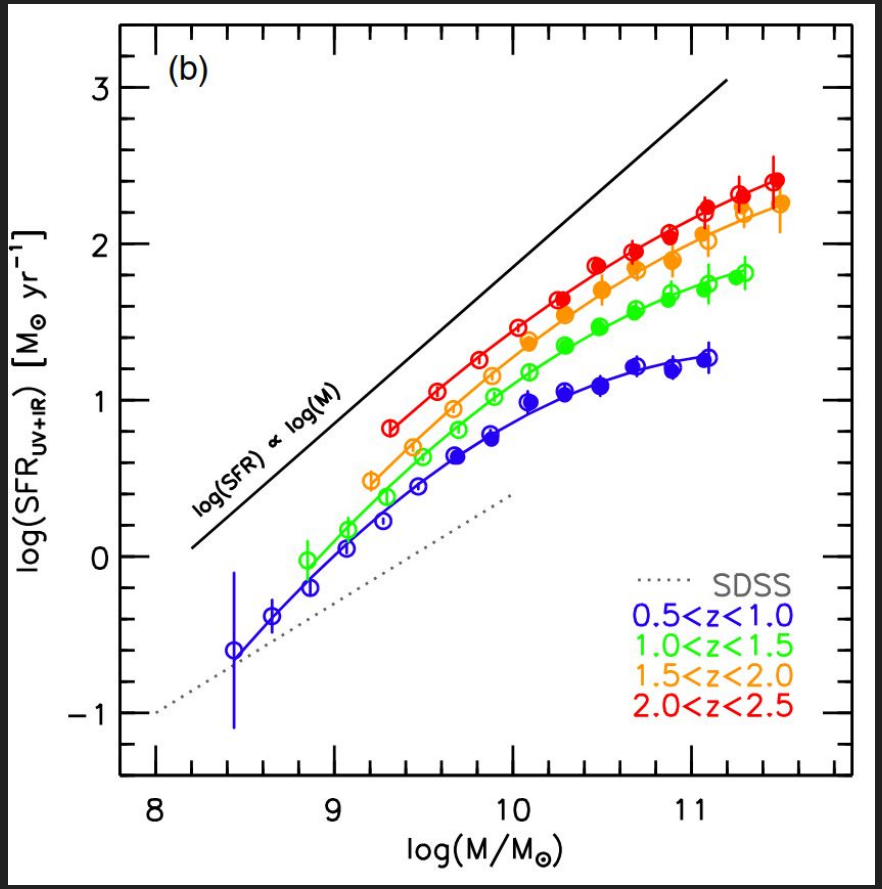


Figure credit: Whitaker+14

Molecular Gas: The raw fuel of Star-Formation

Inherent link between SFR - M_* - M_{mol}

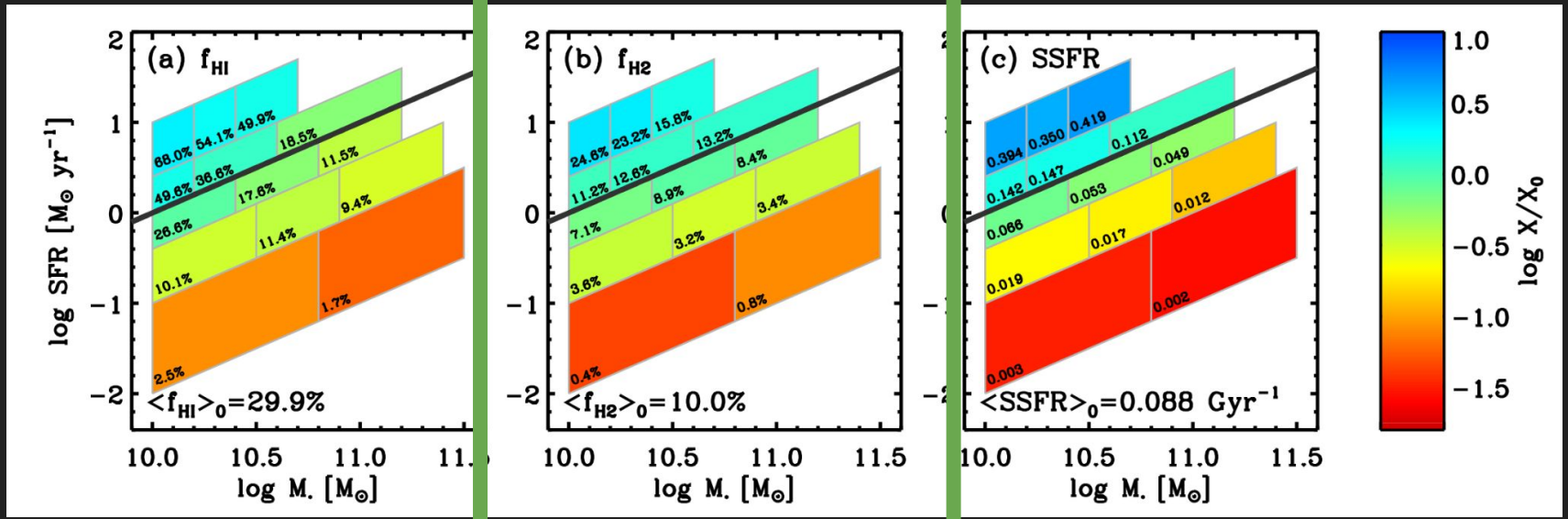


Figure credit: Saintonge+16

Molecular Gas

Tacconi+18:
Mathematical Relation between
SFR - M_* - M_{mol}

0.1 dex scatter on $\log(M_{mol}/M_*)$ given:

- Stellar Mass
- SFR
- Redshift

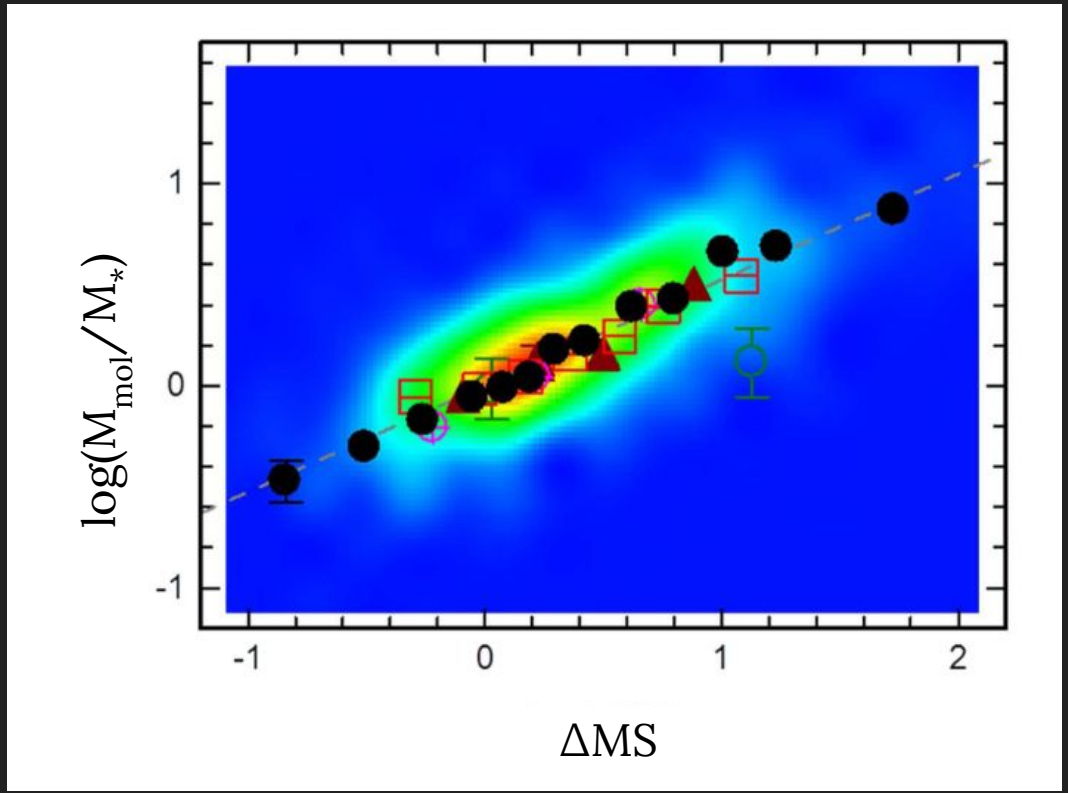
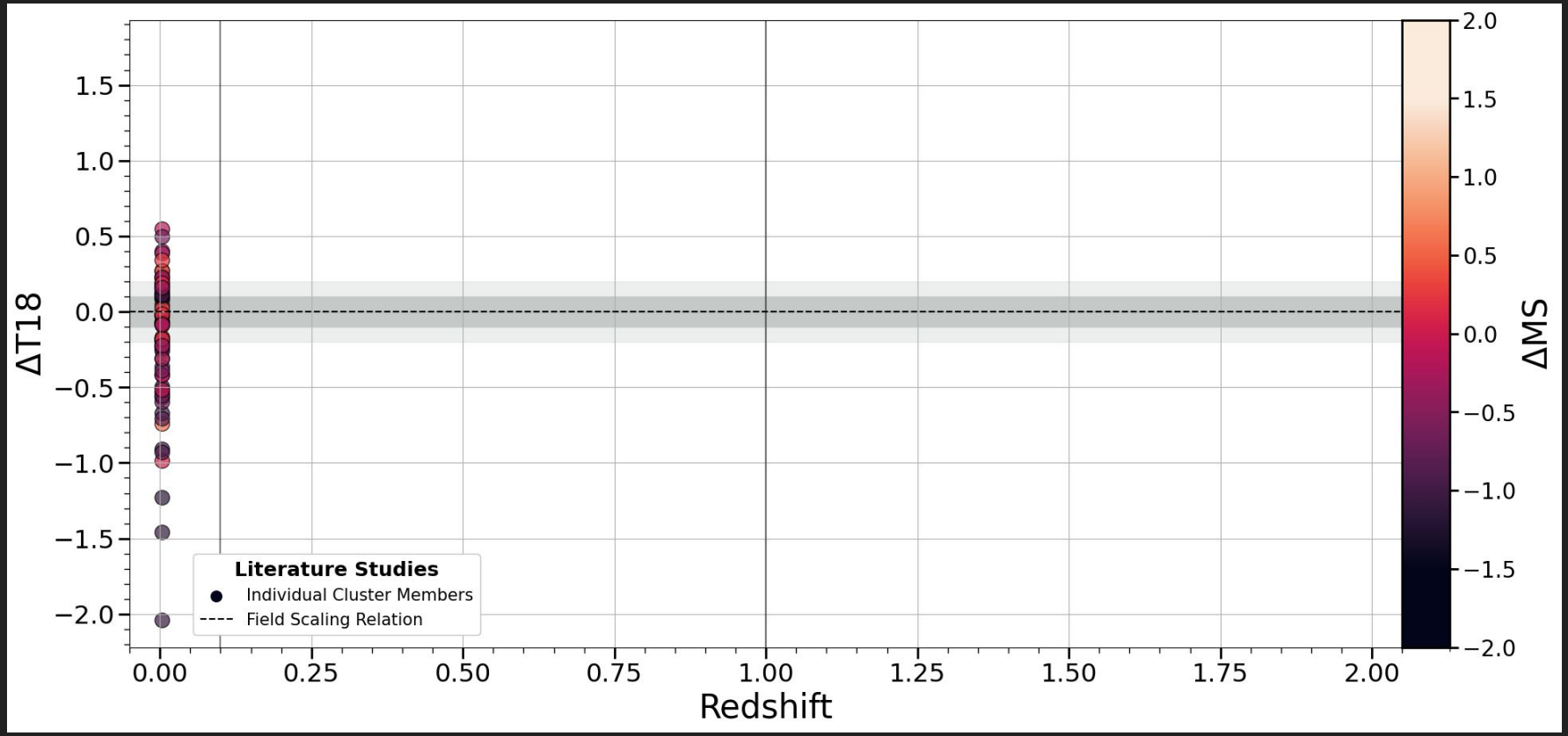


Figure credit: Tacconi+18

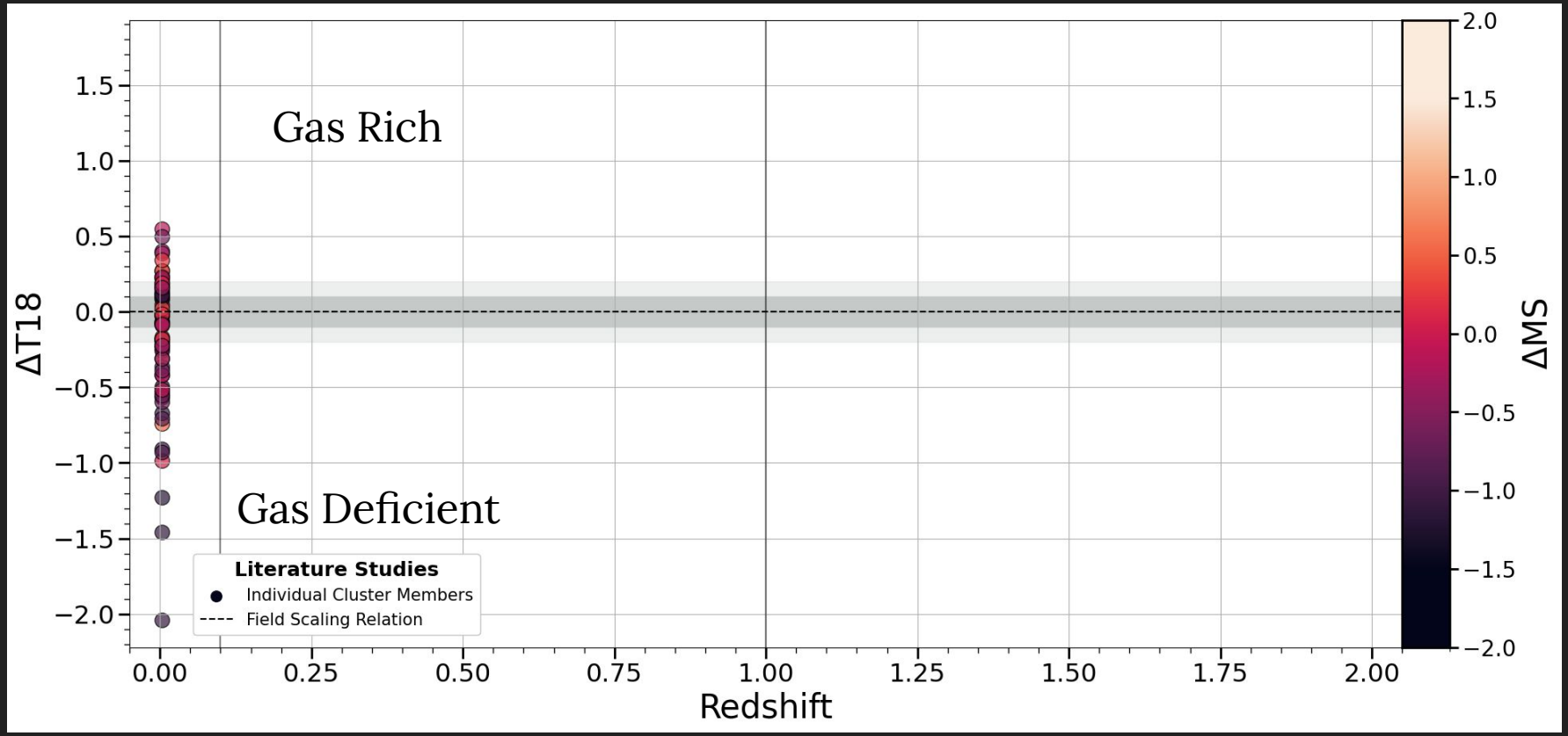
Define:

$$\Delta T18 = \log(M_{mol}/M_*)_{measured} - \log(M_{mol}/M_*)_{Tacconi+18}$$

Cluster Galaxies: Does environment impact M_{mol}?



Cluster Galaxies: Does environment impact M_{mol}? (yes!)



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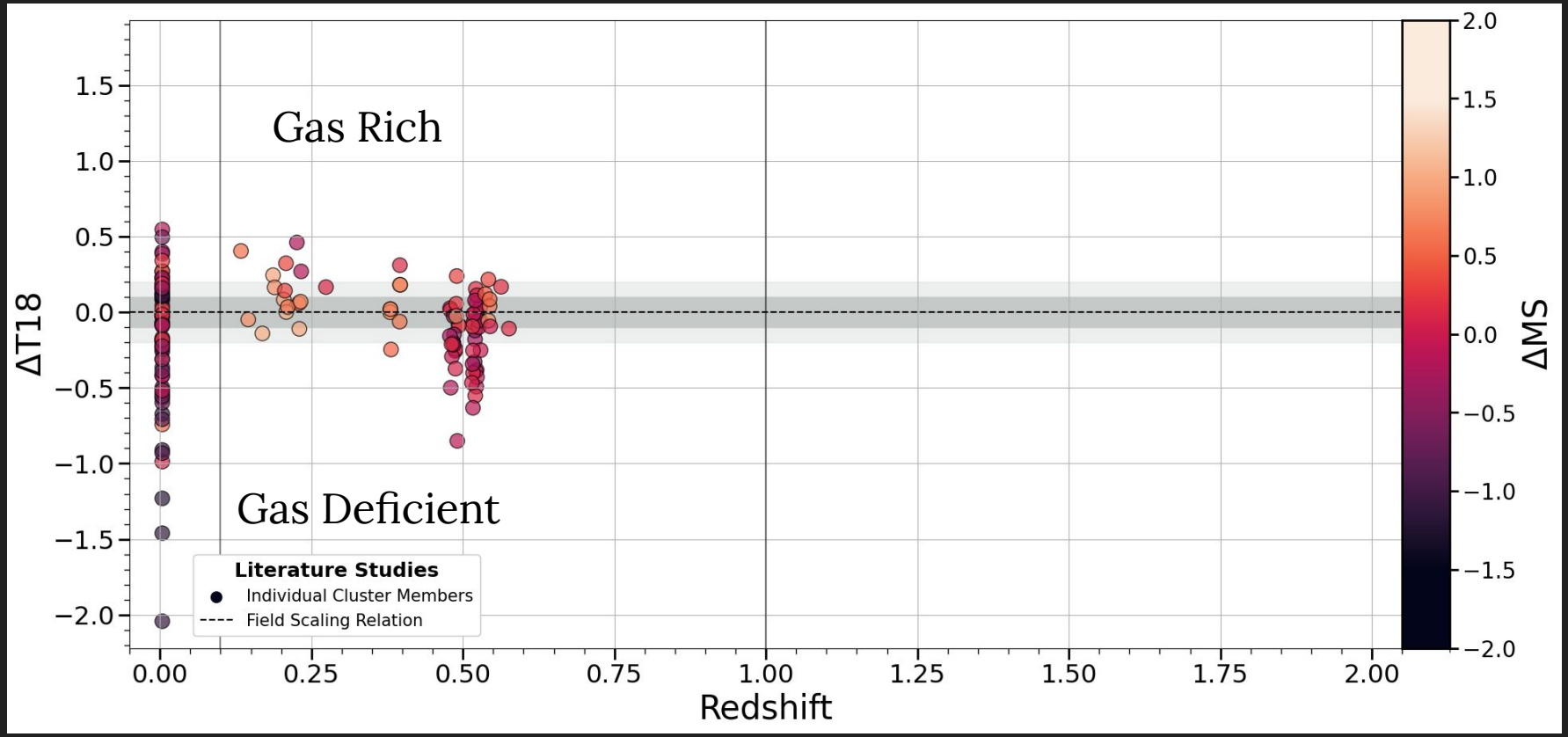

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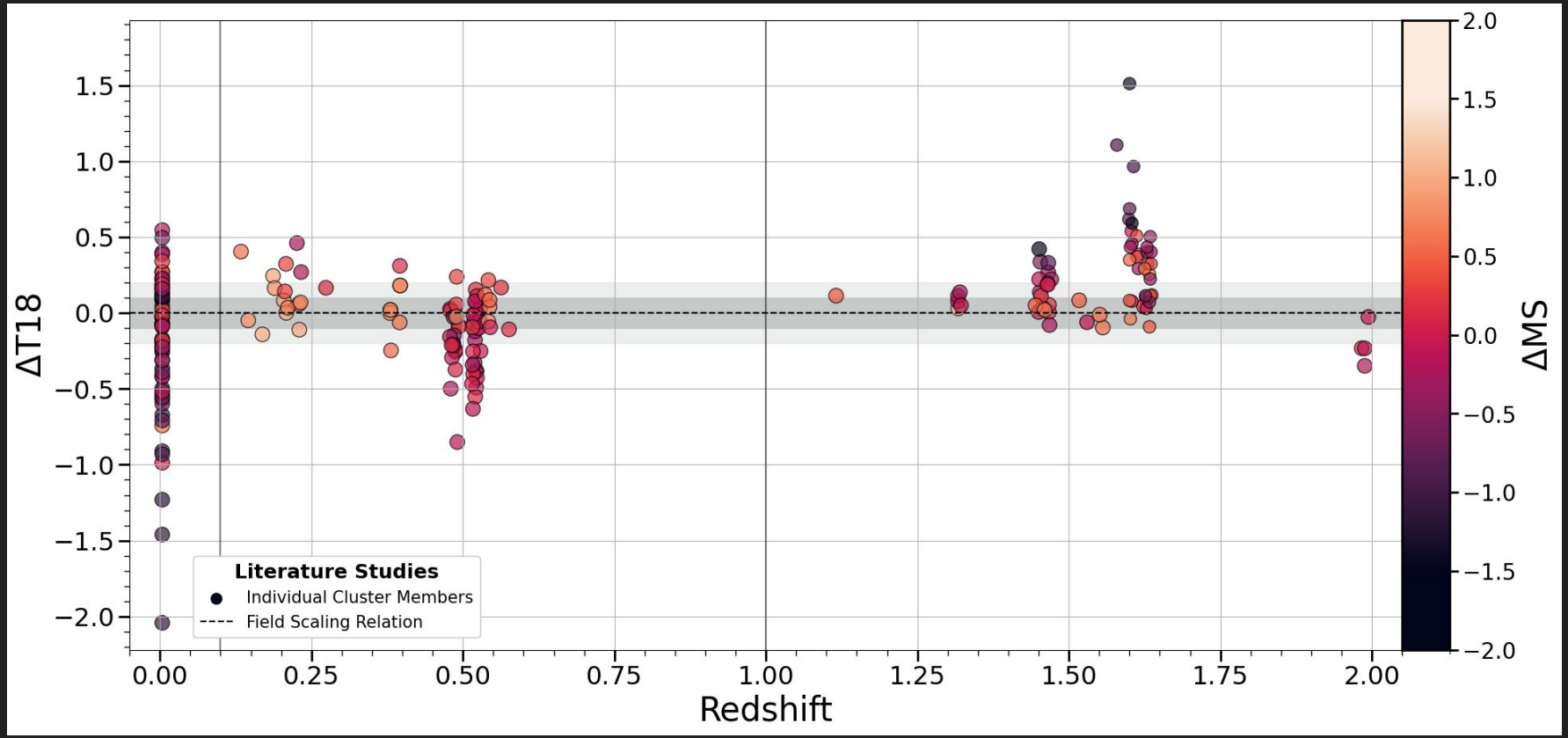

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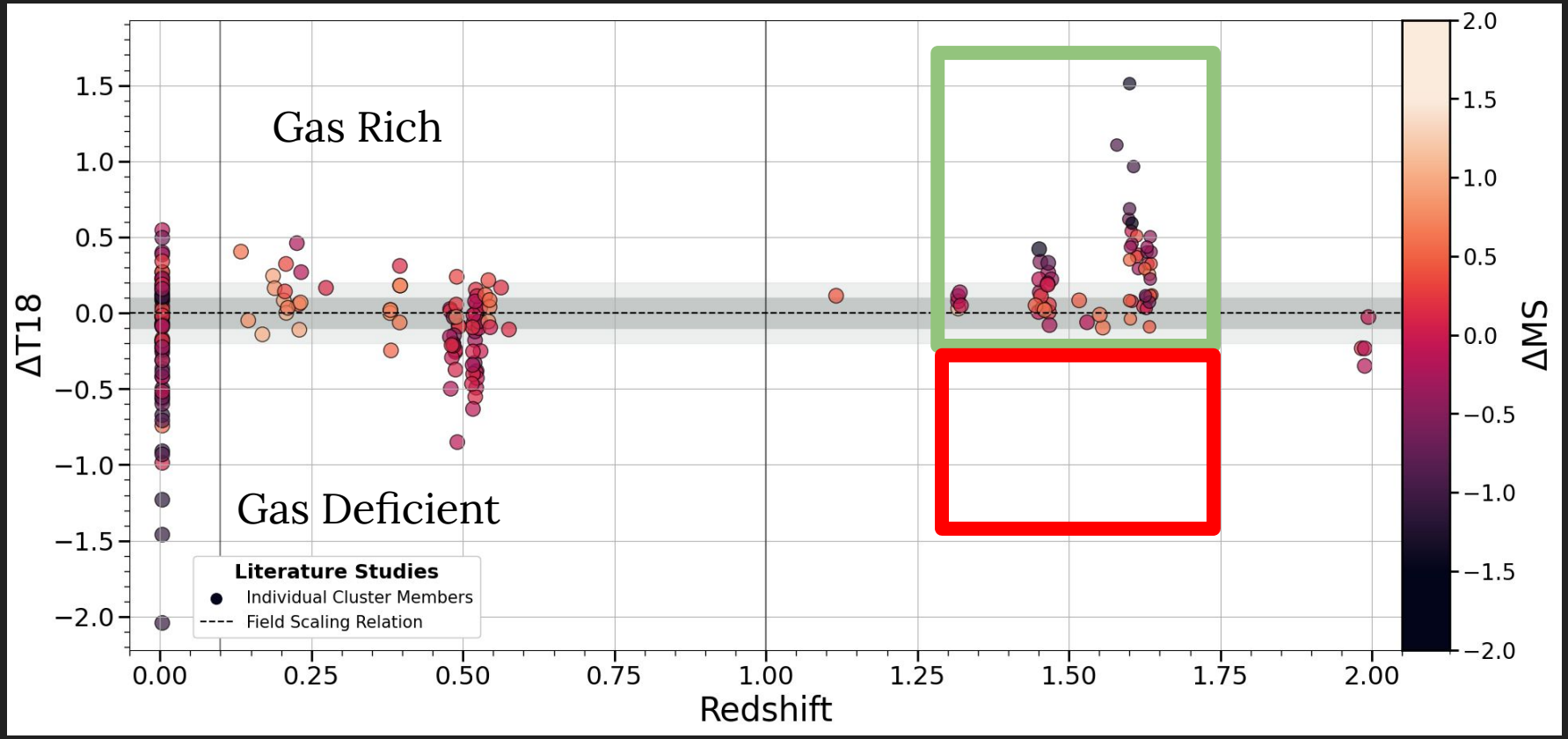
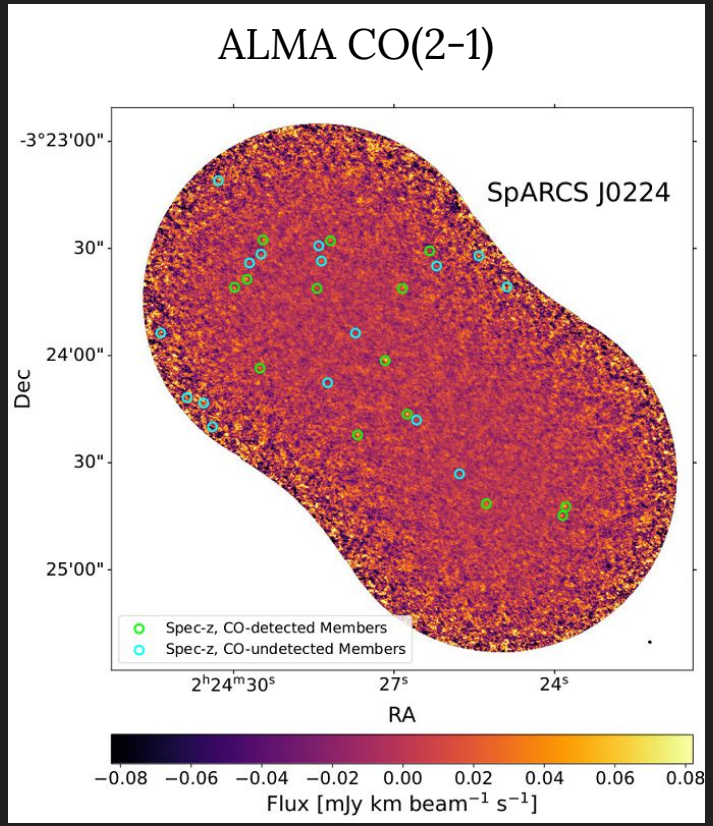


SpARCS z~1.6 Clusters



Galaxy Grouping

To minimize galaxy variation in groupings, galaxies separated based on:

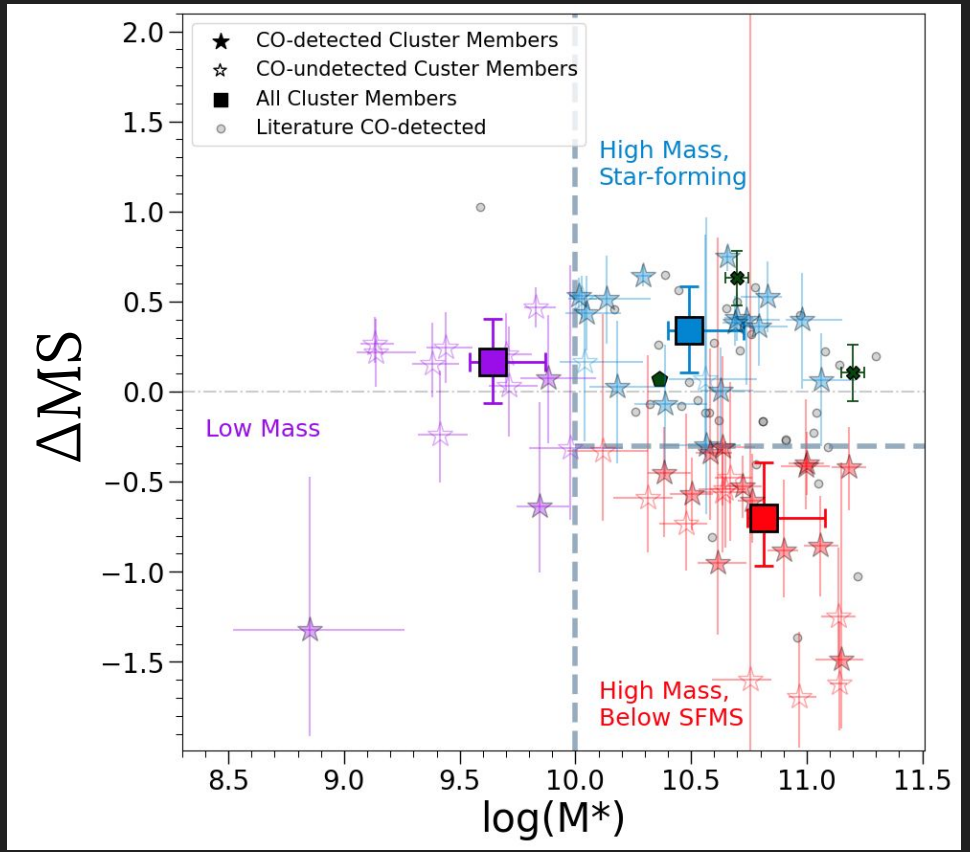
- **Stellar mass**
- **ΔMS**
- **CO-detected vs. CO-undetected**

Galaxies with $\log(M_*) < 10.0$: **Low Mass**

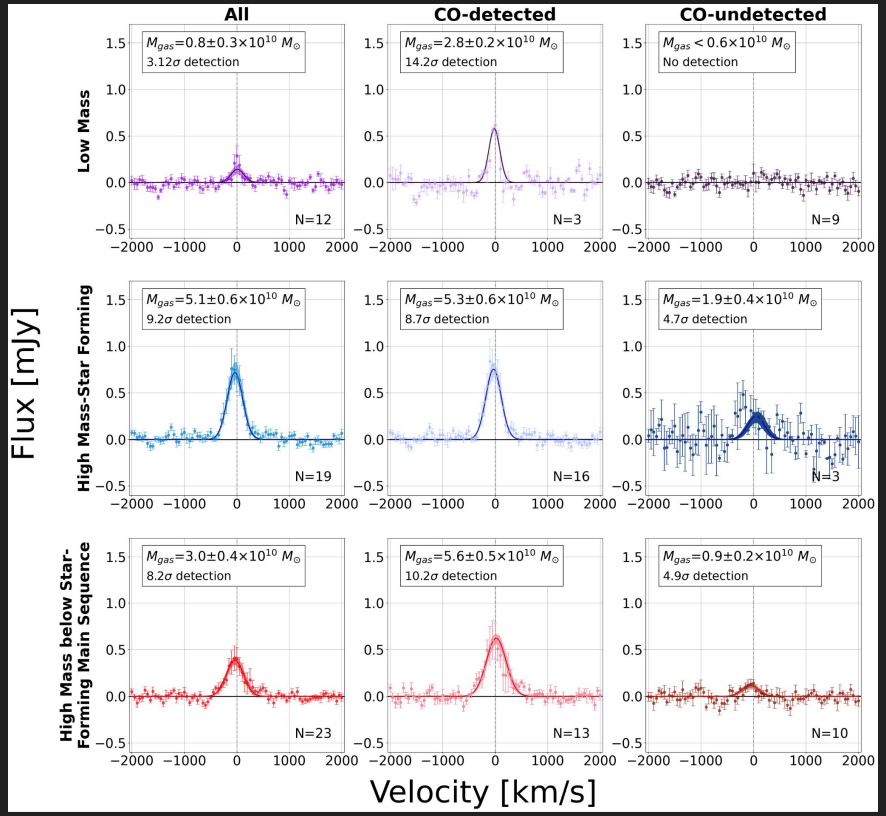
Galaxies with $\log(M_*) > 10.0$ and ΔMS > 0.3 dex: **High Mass Star-Forming**

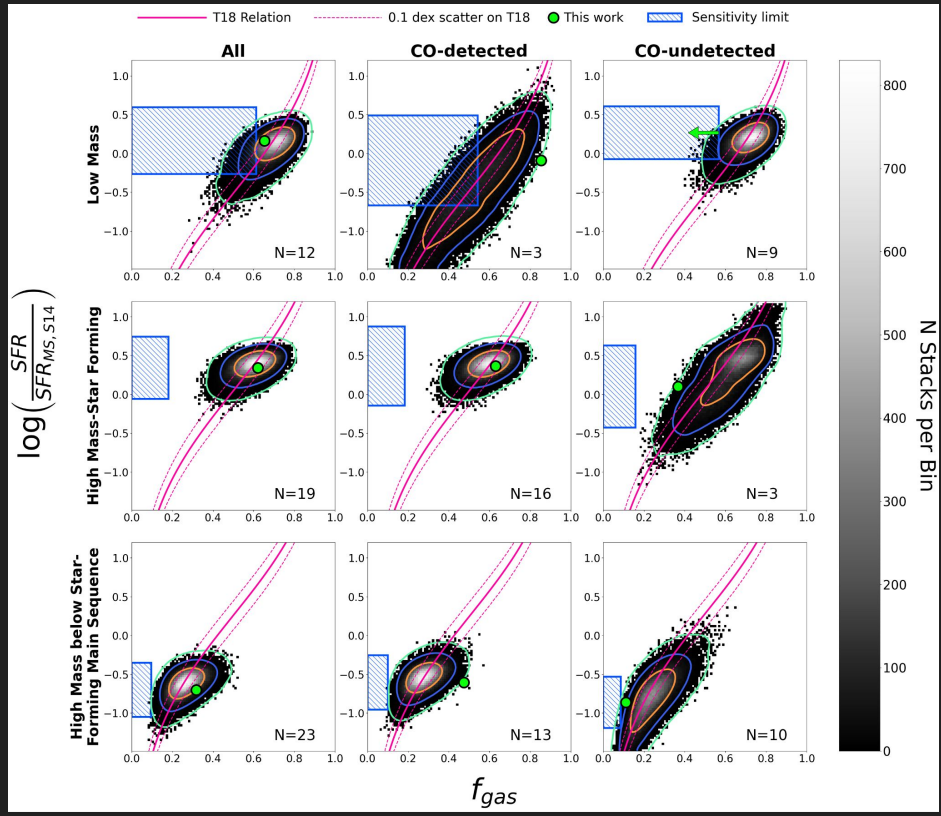
Galaxies with $\log(M_*) > 10.0$ and ΔMS > 0.3 dex: **High Mass below-Main Sequence**

Create Stacked Spectra of groupings

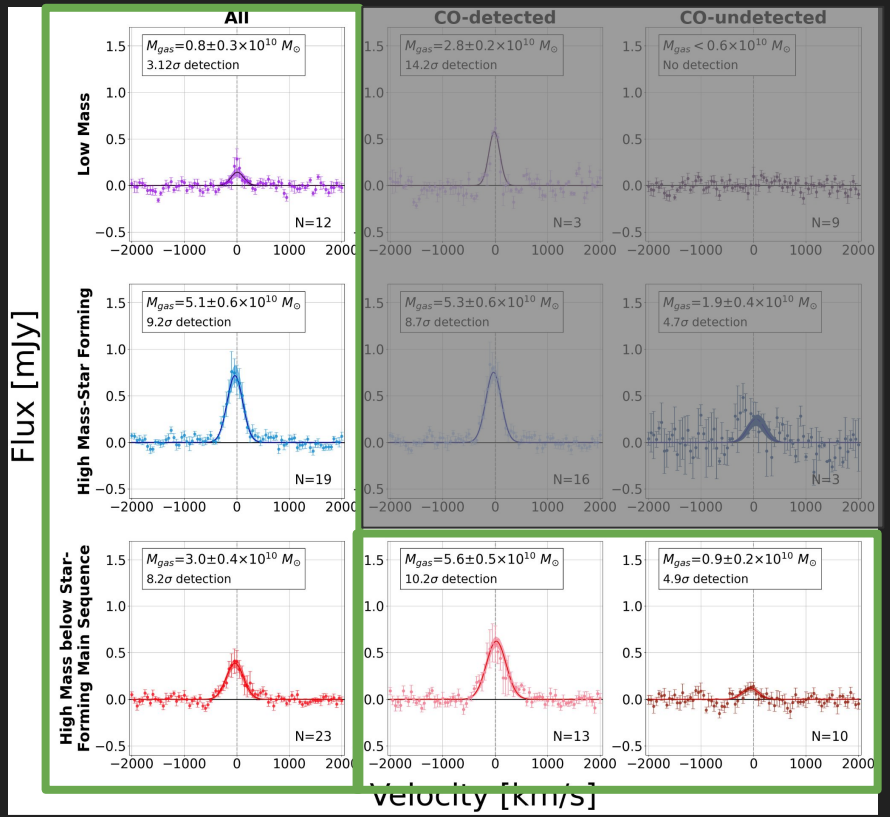


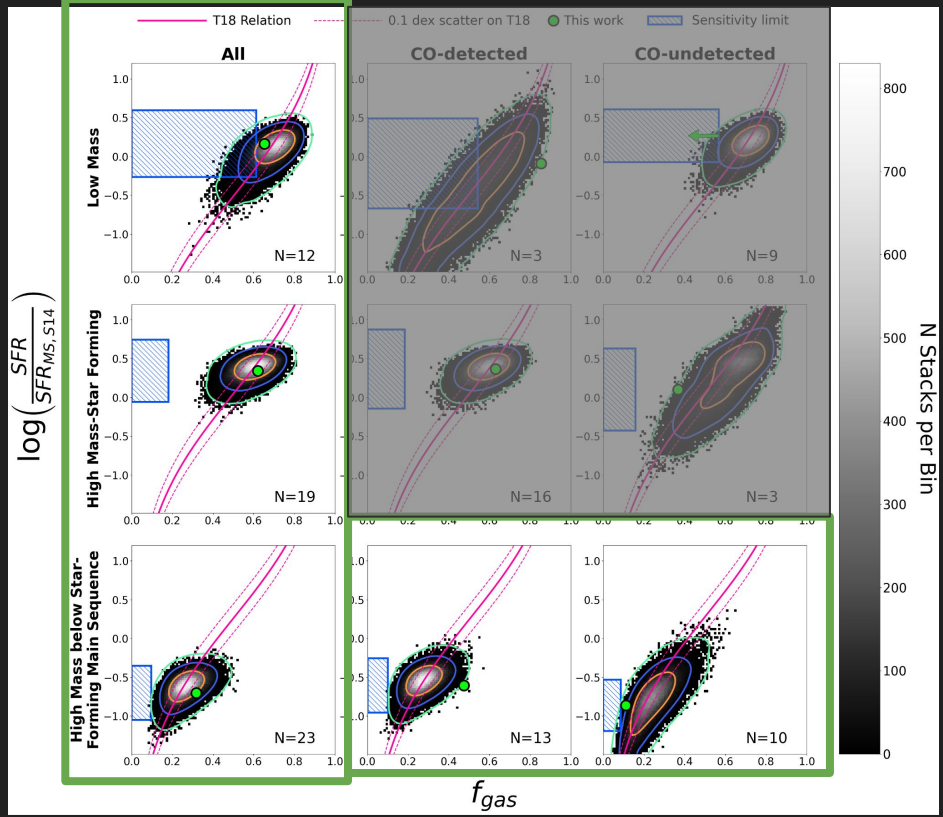
Full Results





Full Results in the Paper!

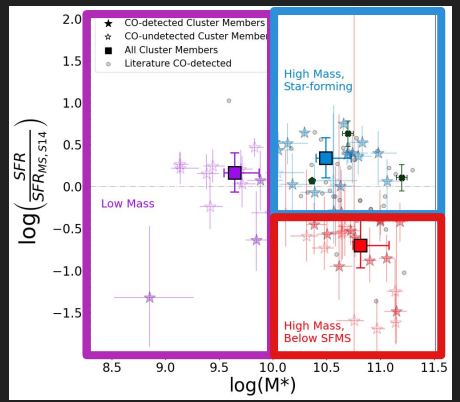


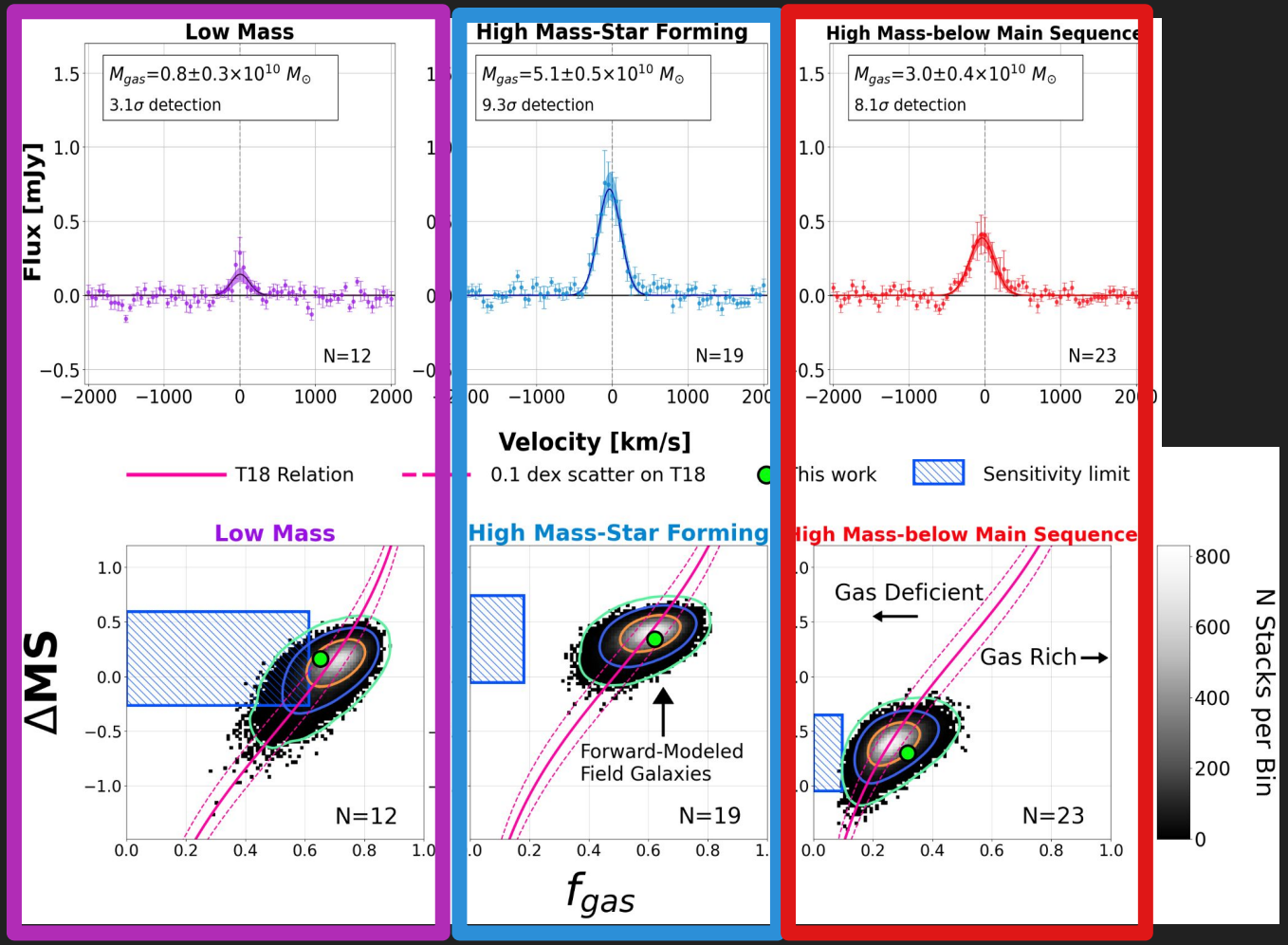


“All” Stacks

Some variation from T18

Overall, stacks are **consistent with coeval field galaxies**

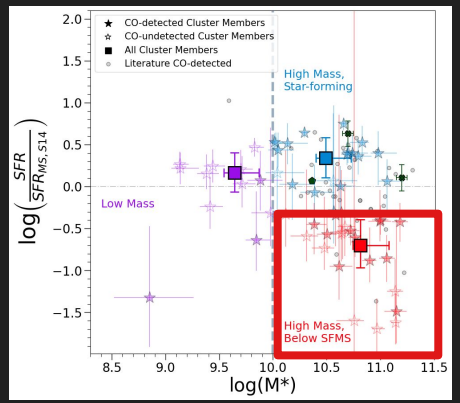


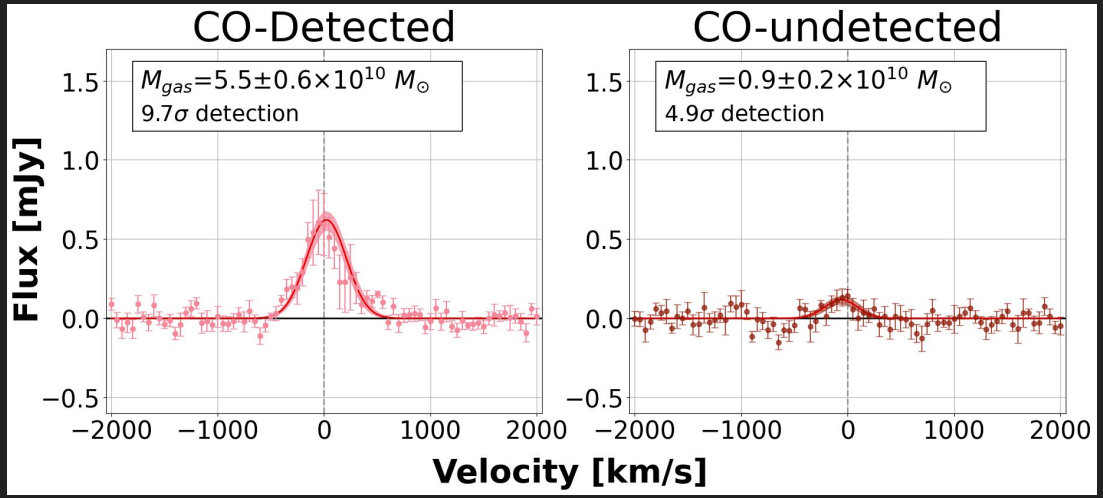


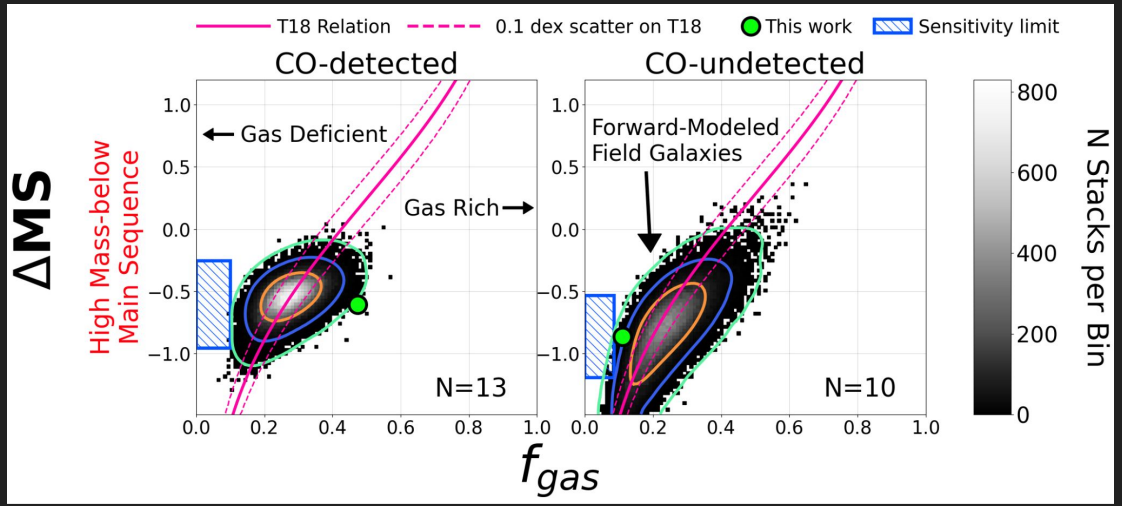
HM-bMS Stacks

"Average" detections a result of Central Limit Theorem?

Possible impacts of environment most strongly shown on galaxies below the Main Sequence







Summary

- We separate 54 cluster members into 9 groupings of galaxies based on Stellar Mass, ΔMS, and whether the galaxies are CO-detected
- On average, **galaxy cluster members have gas fractions consistent with coeval field galaxies**
- **Evidence for environment influencing the gas reservoirs of quenching galaxies**