

Dust and gas in LAEs at $z = 2-6$

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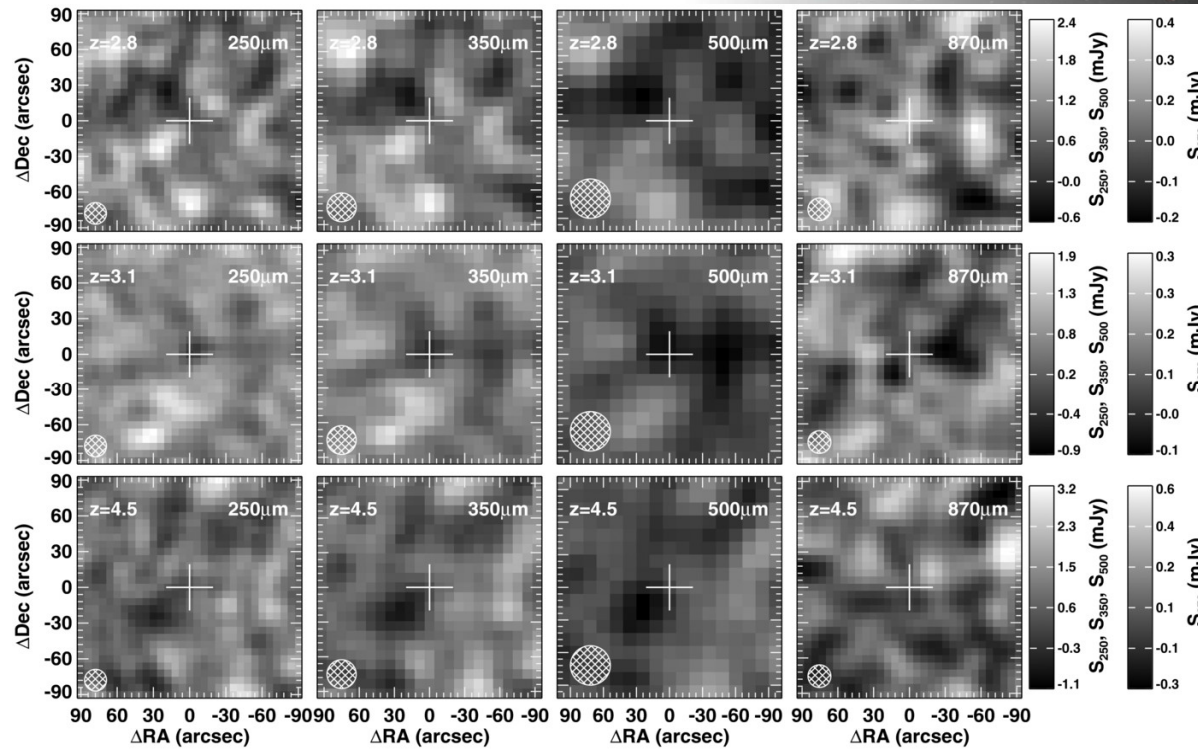


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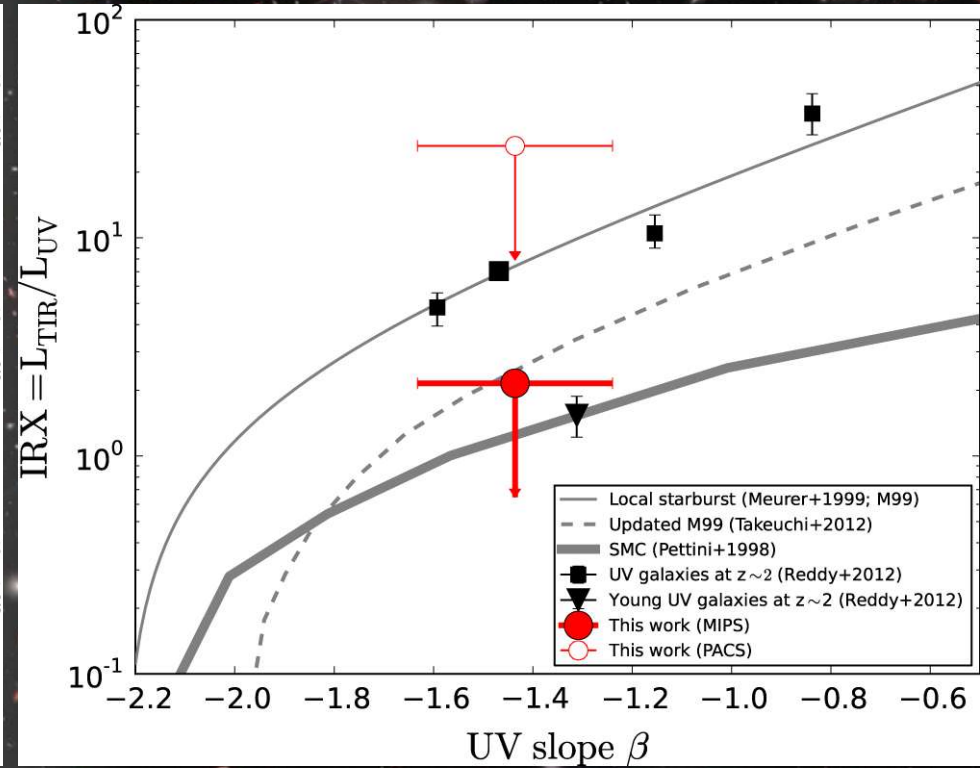


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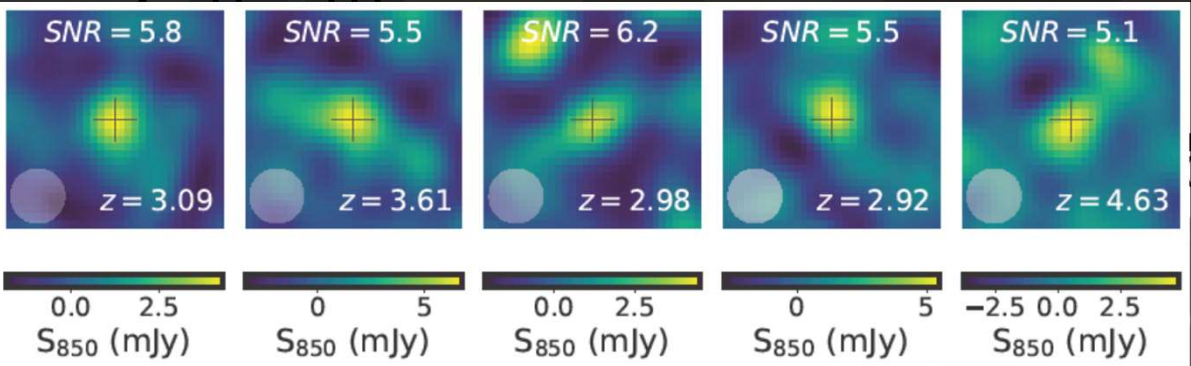
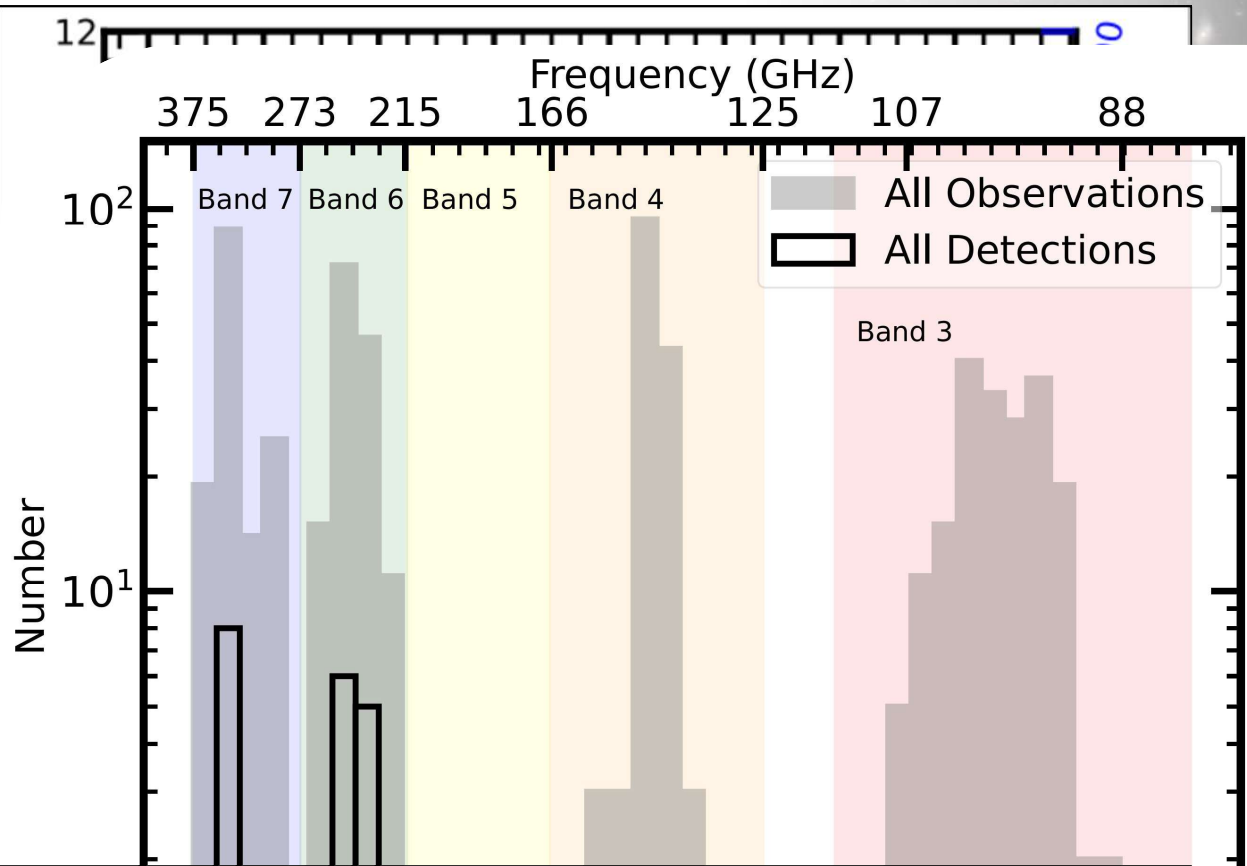
Dust in LAEs



Herschel/SPIRE and LABOCA 870 μ m
Wardlow et al. 2014



Spitzer/MIPS 24 μ m and *Herschel*/PACS
Kusakabe et al. 2015



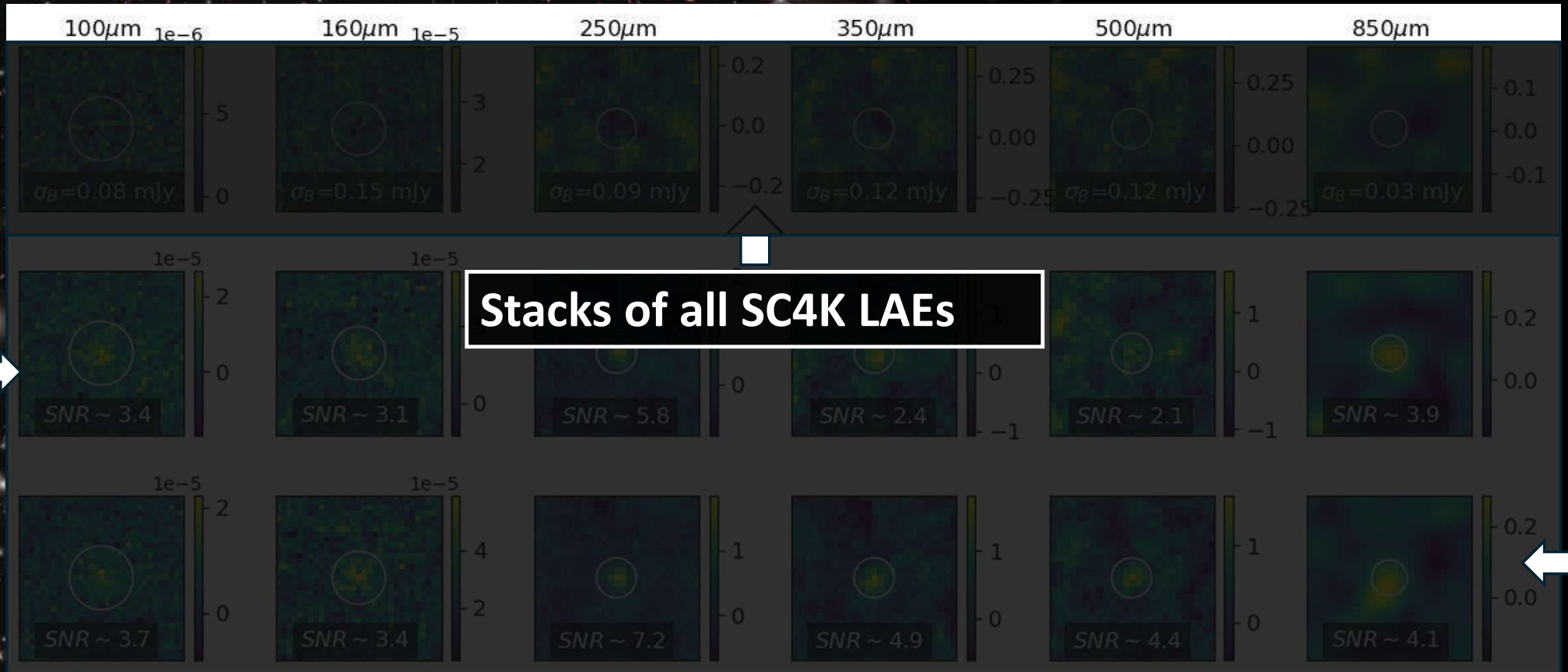
Dust emission from Individual LAEs

ALMA: The distribution of ALMA observations and detections for SC4K LAEs.

Single-dish: We detect dust emission from 5 individual LAEs at $850 \mu\text{m}$ (SCUBA-2).

Rana et al. (in prep.-A)

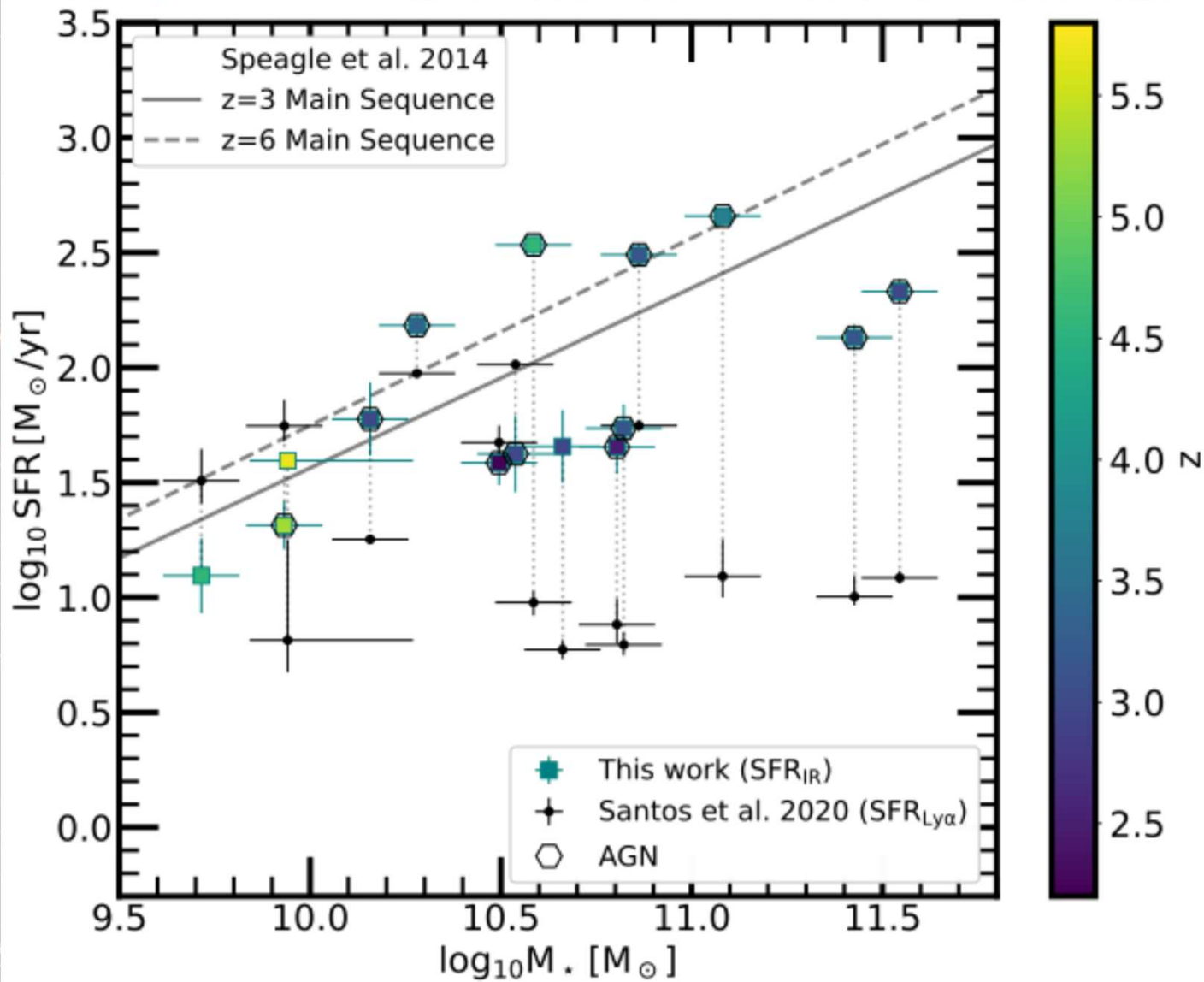
Average Dust Emission from LAEs (Single-dish)



AGN (298)

Rana et al. (in prep.-A)

M_{\star} (10^{10} – $10^{12}M_{\odot}$; 669)



SFR–M_★ relation for ALMA-detected LAEs

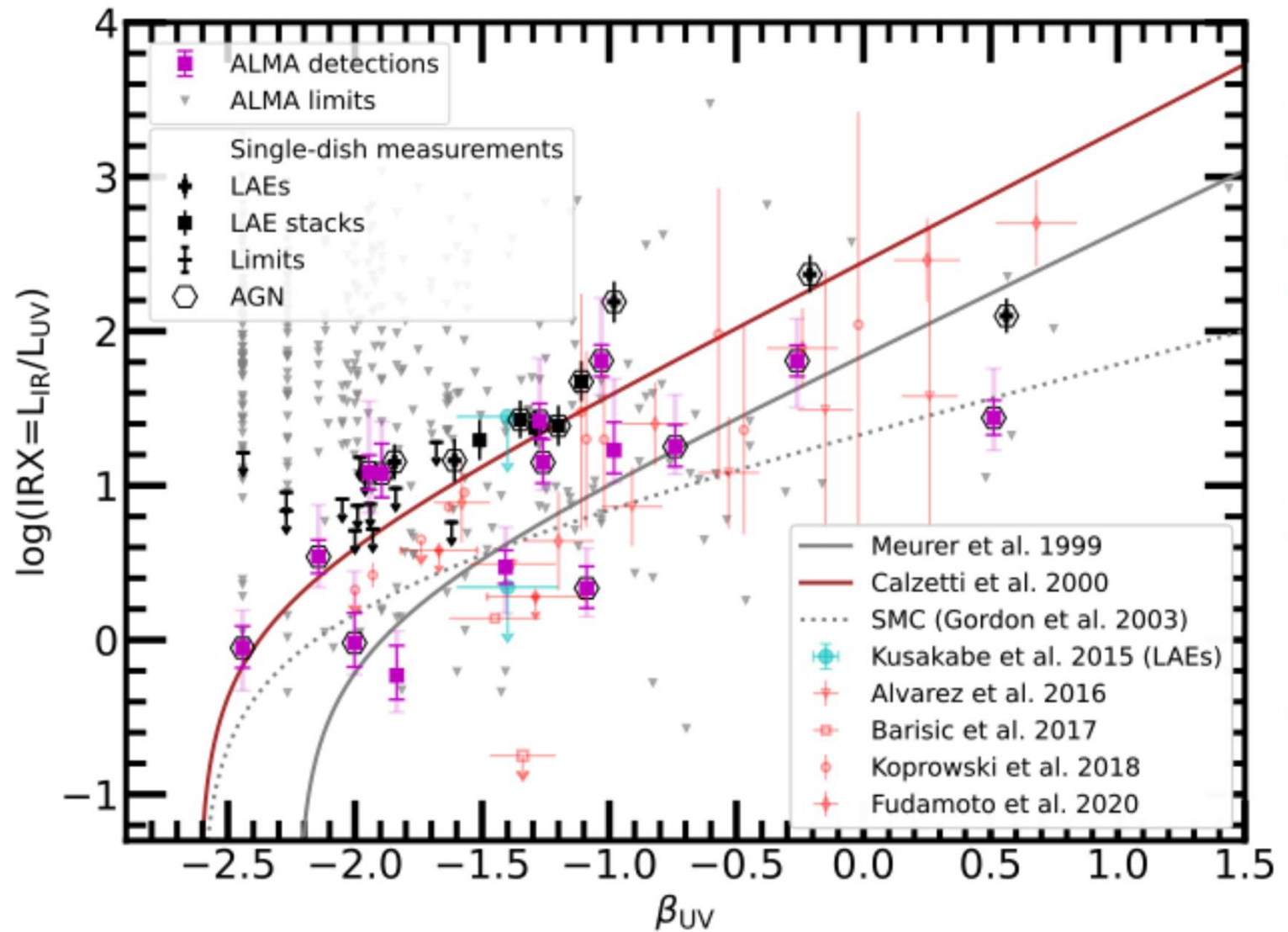
- Comparison of obscured (SFR_{IR}) with dust-corrected SFR_{Lyα}.
- Lyα measurements can underestimate SFR by a factor of ~2 dex.

Rana et al. (in prep.– B)

Dust Attenuation in LAEs (IRX- β_{UV})

Infrared excess (IRX) and UV spectral slope (β_{UV}) relation for LAEs.

$$IRX = \frac{L_{IR}}{L_{UV}}$$



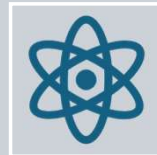
CO Emission Lines



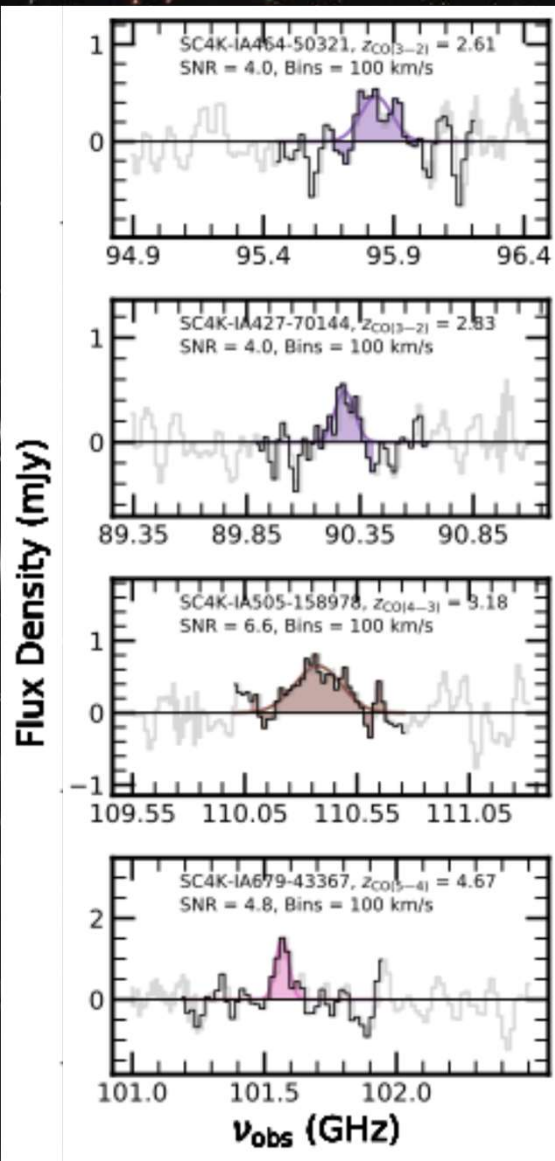
Identified 34 LAEs with ALMA observations.



Detected CO lines in six LAEs.

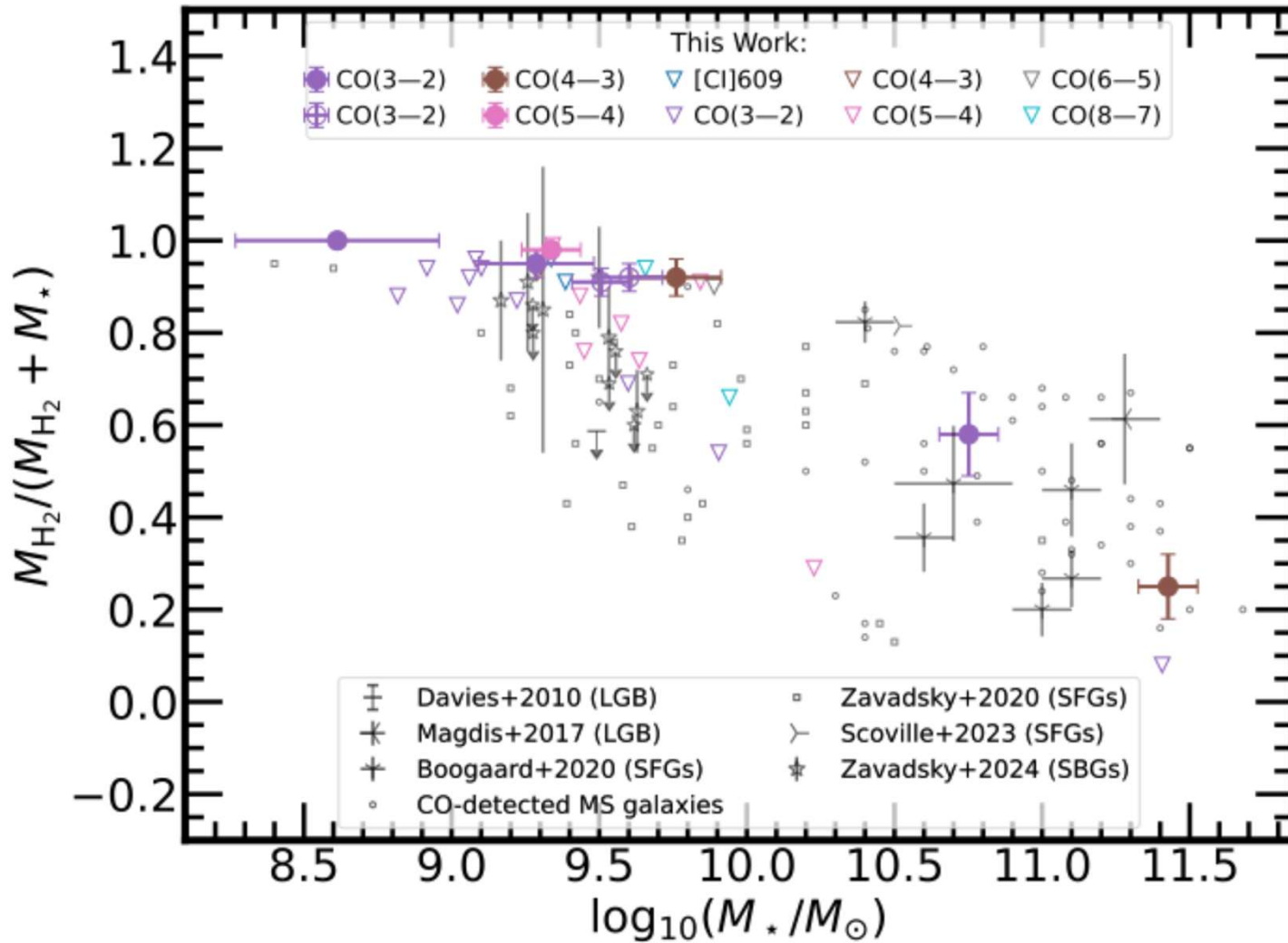


Estimated molecular gas mass from detected CO lines.



Rana et al. (in prep. – C)

Molecular Gas Fraction in LAEs



➤ Low-mass LAEs show relatively higher molecular gas fractions.

➤ High-mass LAEs have gas fractions like normal star-forming galaxies.

Rana et al. (in prep.– C)

Key Takeaways

- A significant portion of star formation in massive LAEs is obscured by dust.
- LAEs follow similar $\text{IRX}-\beta_{\text{UV}}$ relation like other star-forming galaxies.
- Low mass LAEs are gas rich and are likely to evolve into typical star-forming galaxies.

RECAP Project

Physical properties of the ISM in galaxies during the EoR

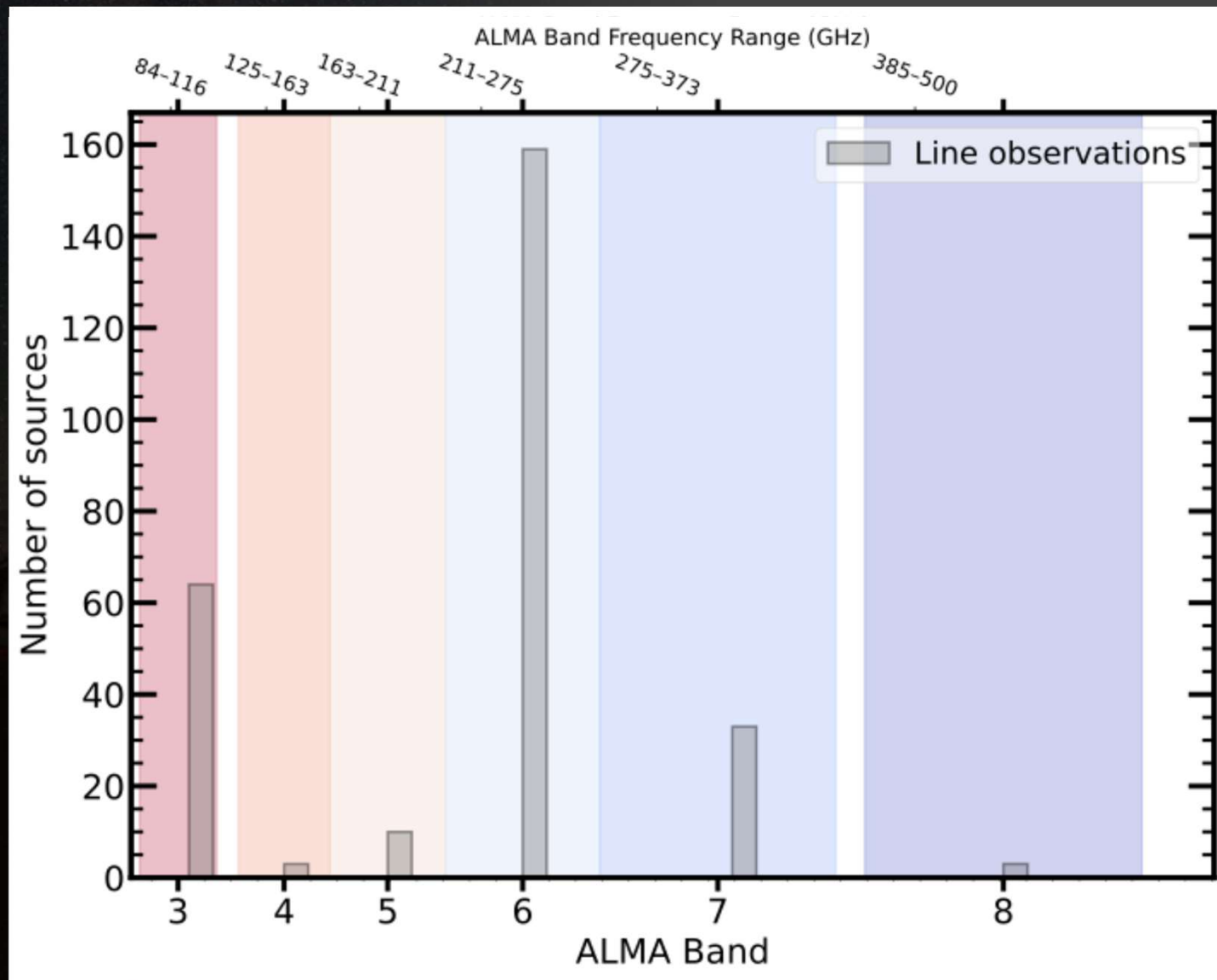
Aims:

- Probe ISM properties: gas, dust, temperature, ionization state
- Assess escape of ionizing photons and their role in reionization.
- Use ALMA and JWST data to study FIR emission lines and continuum.

Progress:

- Combined UNCOVER (Wang et al. 2024), COSMOS-web (Shuntov et al. 2025), ECOGAL(Lee et al. 2025)) for galaxies $z > 5.5$.
- Identified ~ 6000 z_{phot} sources with ALMA coverage for dust continuum stacking.
- Additionally, ~ 178 sources with spectroscopic redshifts have FIR line coverage (272 lines in total).

ALMA Coverage: continuum and FIR lines:



ALMA Coverage: FIR lines:

| Line | # ALMA Observations | # Galaxies Covered |
|--------------|---------------------|----------------------------|
| Cl(370) | 140 | 64 |
| CII(158) | 216 | 130 |
| OI(145) | 61 | 36 |
| OIII(88) | 8 | 7 |
| NII(122) | 19 | 12 |
| NII(205) | 27 | 23 |
| Total | 471 | 178 sources with 272 lines |

