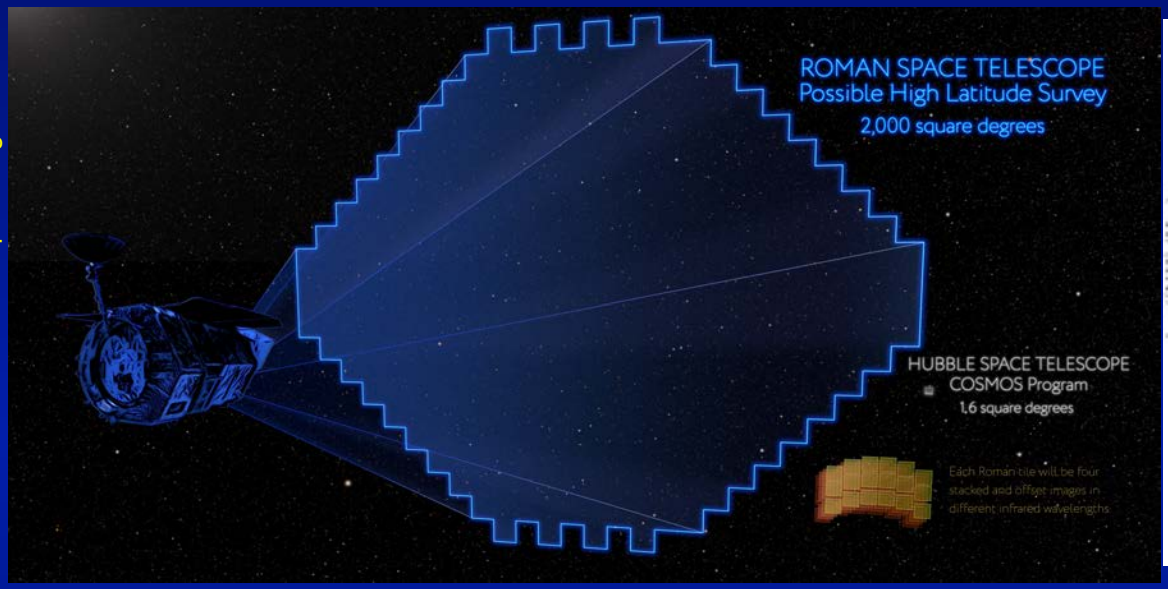
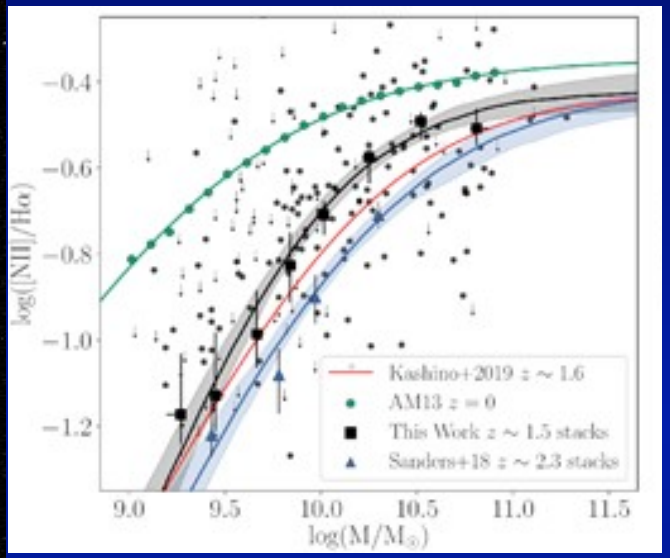
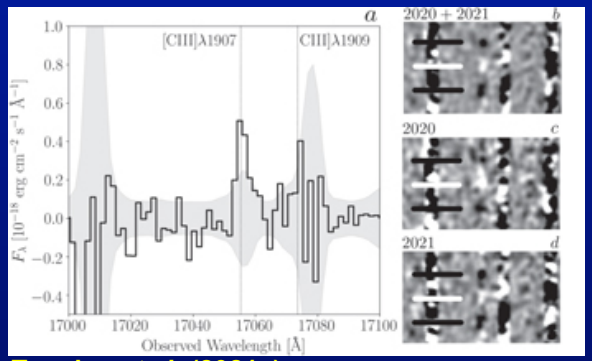
EXPO-Keck Spectroscopic Campaign

Credit: NASA's Goddard Space Flight Center





Topping et al. (2021b)

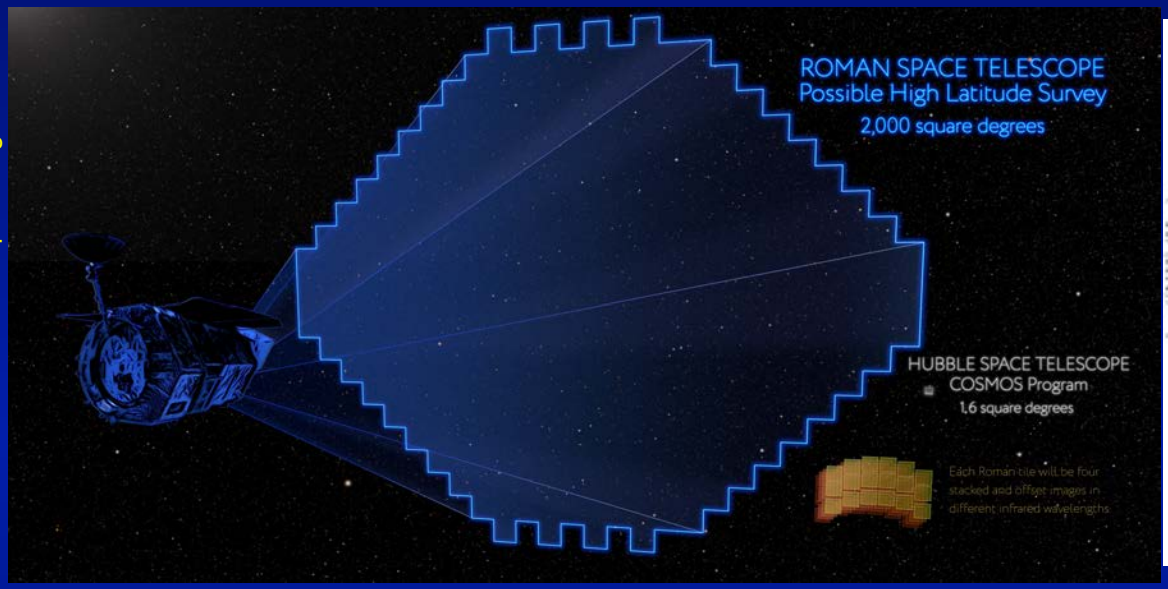


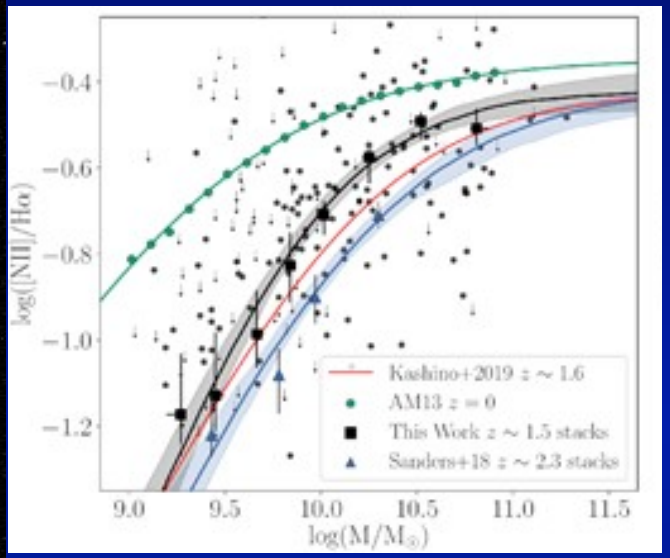
Topping et al. (2021a)

Alice Shapley (UCLA), Michael Topping (Arizona), and the EXPO Team

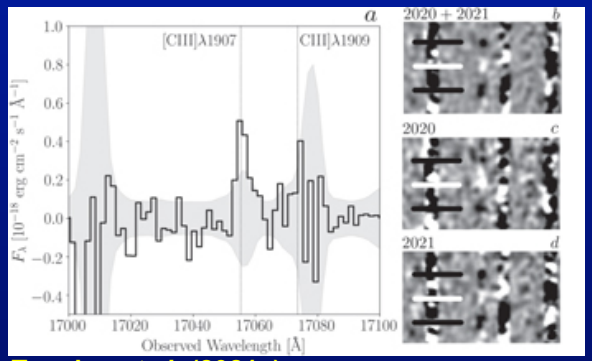
EXPOsing the Emission-line Properties of Distant Galaxies to *Roman*

Credit: NASA's Goddard Space Flight Center





Topping et al. (2021b)



Topping et al. (2021a)

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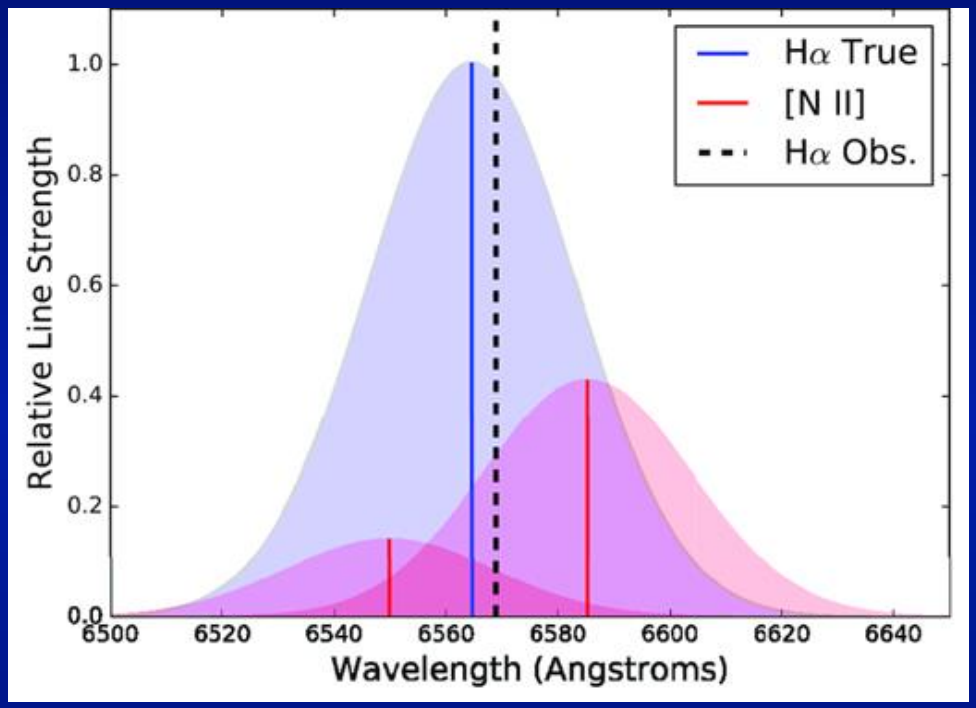
Roman HLSS

- High Latitude Spectroscopic Survey (HLSS)
- ~2000 square degrees
- ~10^7 Hα redshifts at z=1-2, ~10^6 [OIII] redshifts at z=2-3
- Grism 1.0-1.93 μm, R=435-865.
- Limiting line flux 1e-16 erg/s/cm^2 (deep 5-7e-17 erg/s/cm^2).
- HLSS galaxy clustering measures will be used to estimate baryon acoustic oscillations (BAO).
- Crucial for unbiased redshift estimates and Hα SFRs: deblending [NII] and Hα!

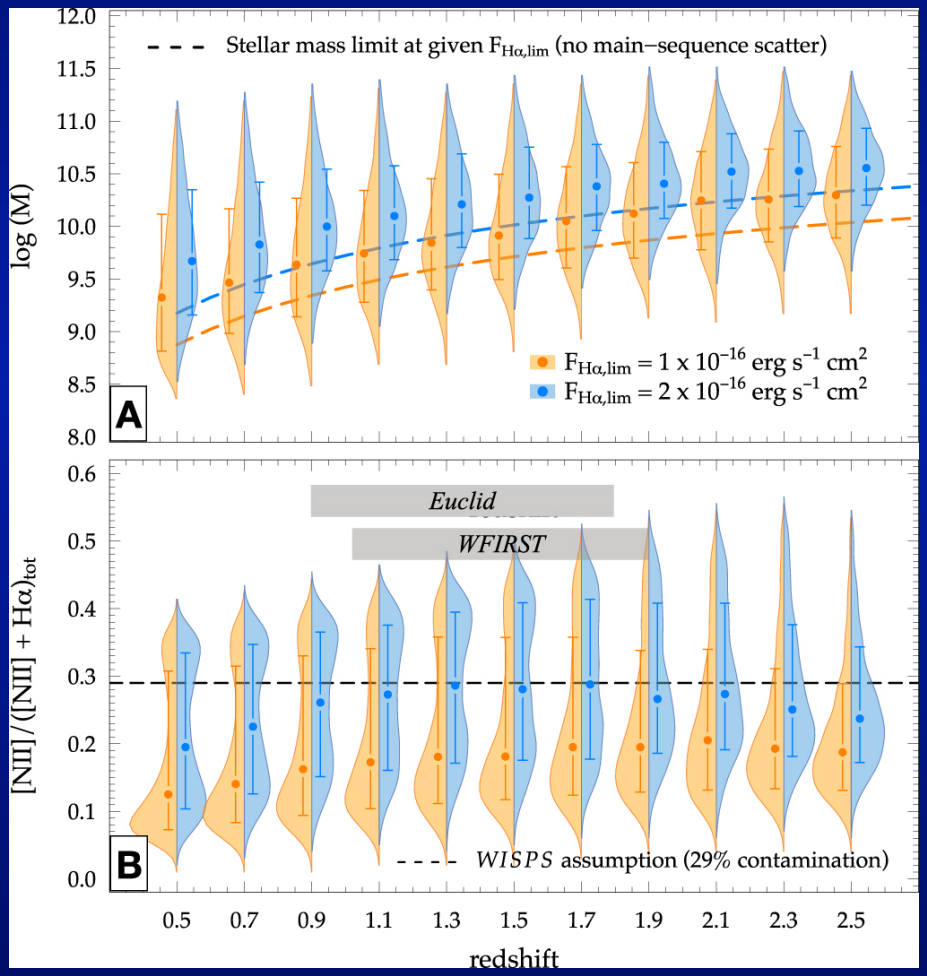
[NII]/Ha Blending



Martens et al. (2018)

- Blending for galaxy with radius=4 kpc, z=1.5, [NII]/Hα=0.4.
- Shift in Hα centroid +4.3 A.
- Shift depends on [NII]/Hα.
- Robust systemic redshifts are a crucial input to BAO measurement.

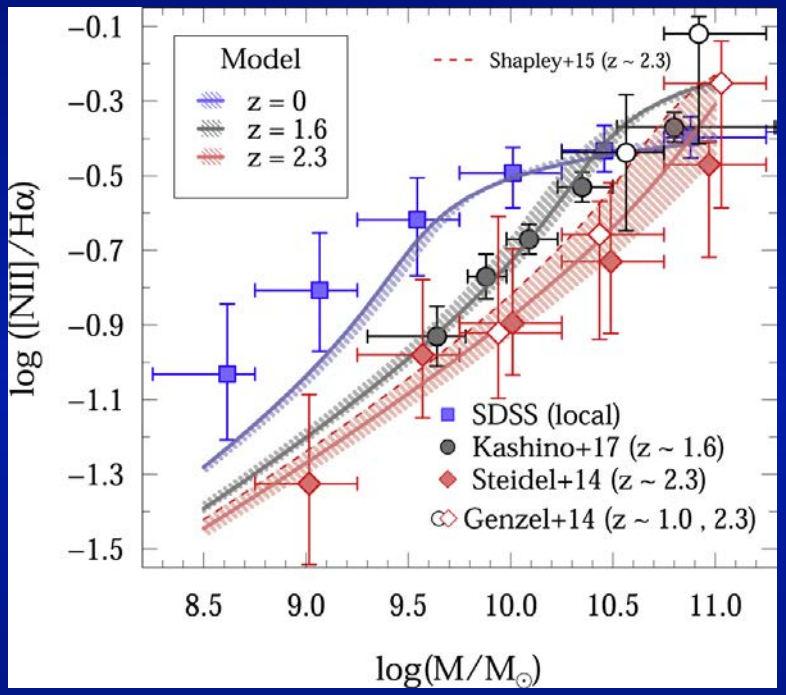
Past Work on [NII]/Ha Blending and *Roman*



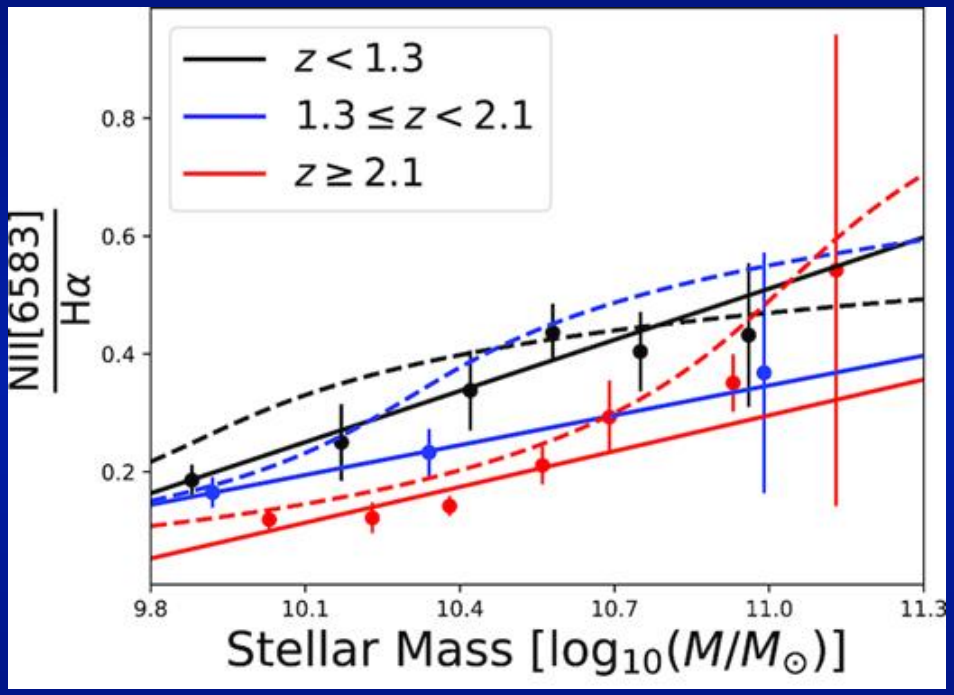
Faisst et al. (2018)

- Determine [NII] contamination fraction as a function of M* (or other observable) and redshift.
- Propagate to error budget on BAO measurements (radial and transverse distance scales, rate of growth of structure).

Past Work on [NII]/Ha Blending and *Roman*



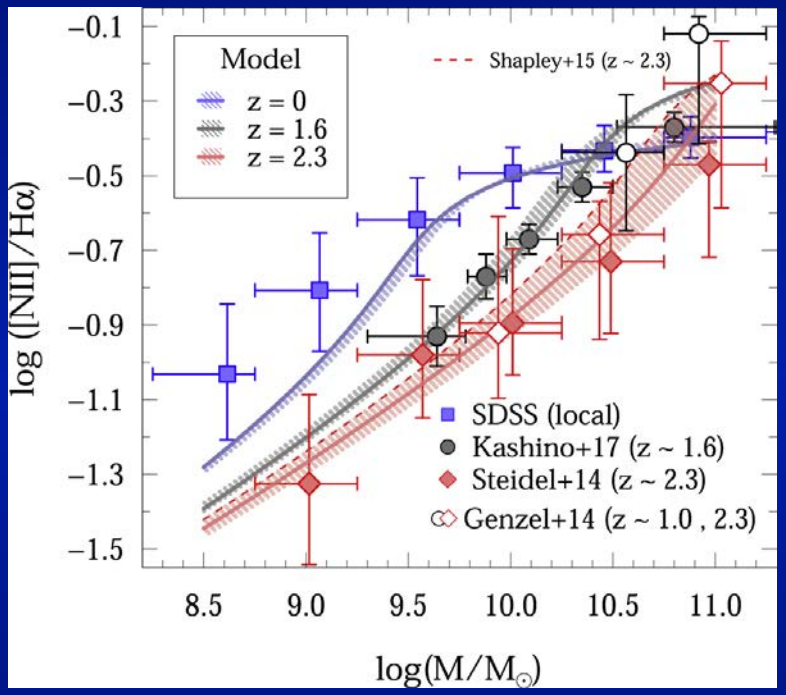
Faisst et al. (2018)



Martens et al. (2018)

- **Both analyses use sub-optimal z~1.5 observational samples (lacking depth or numbers). Unusual behavior at high mass.**

Past Work on [NII]/Ha Blending and *Roman*



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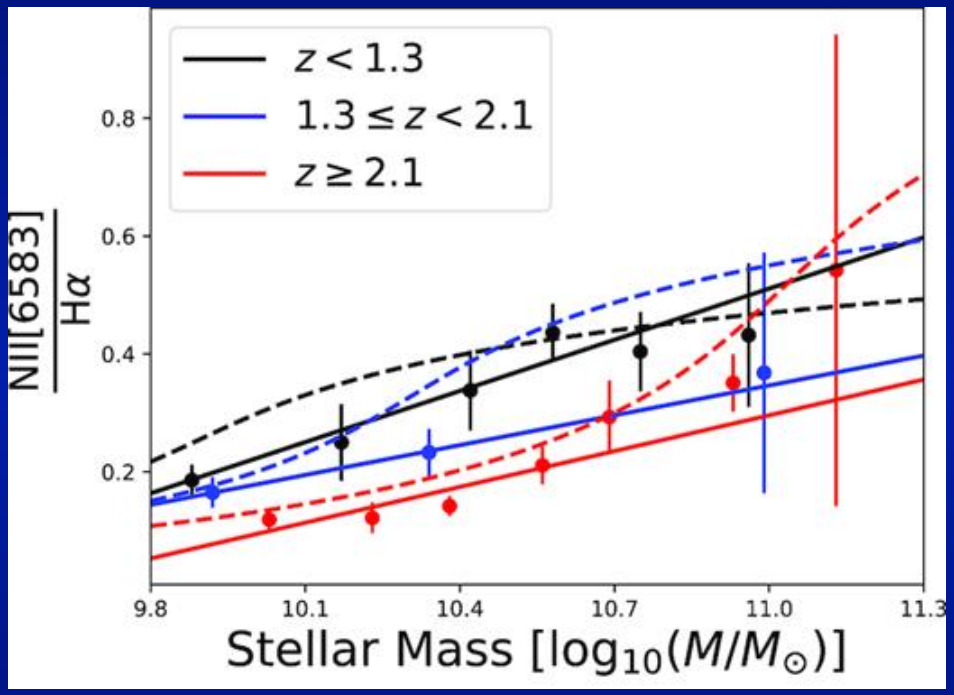
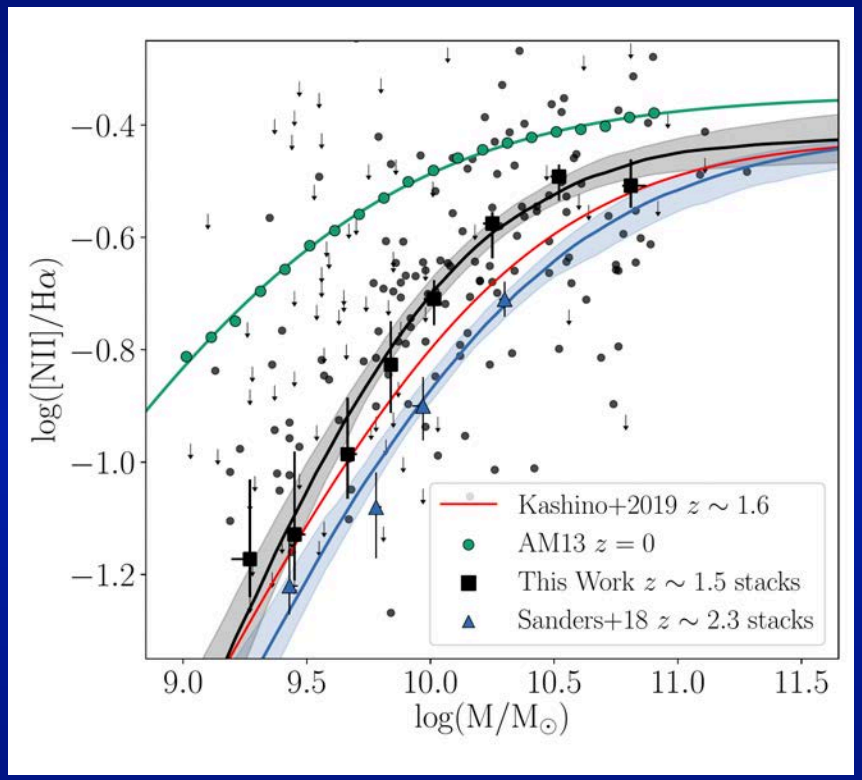


Martens et al. (2018)

- **Previous attempts at measuring [NII]/Ha vs. M* at z=1-2 did not agree on magnitude of blending effect.**

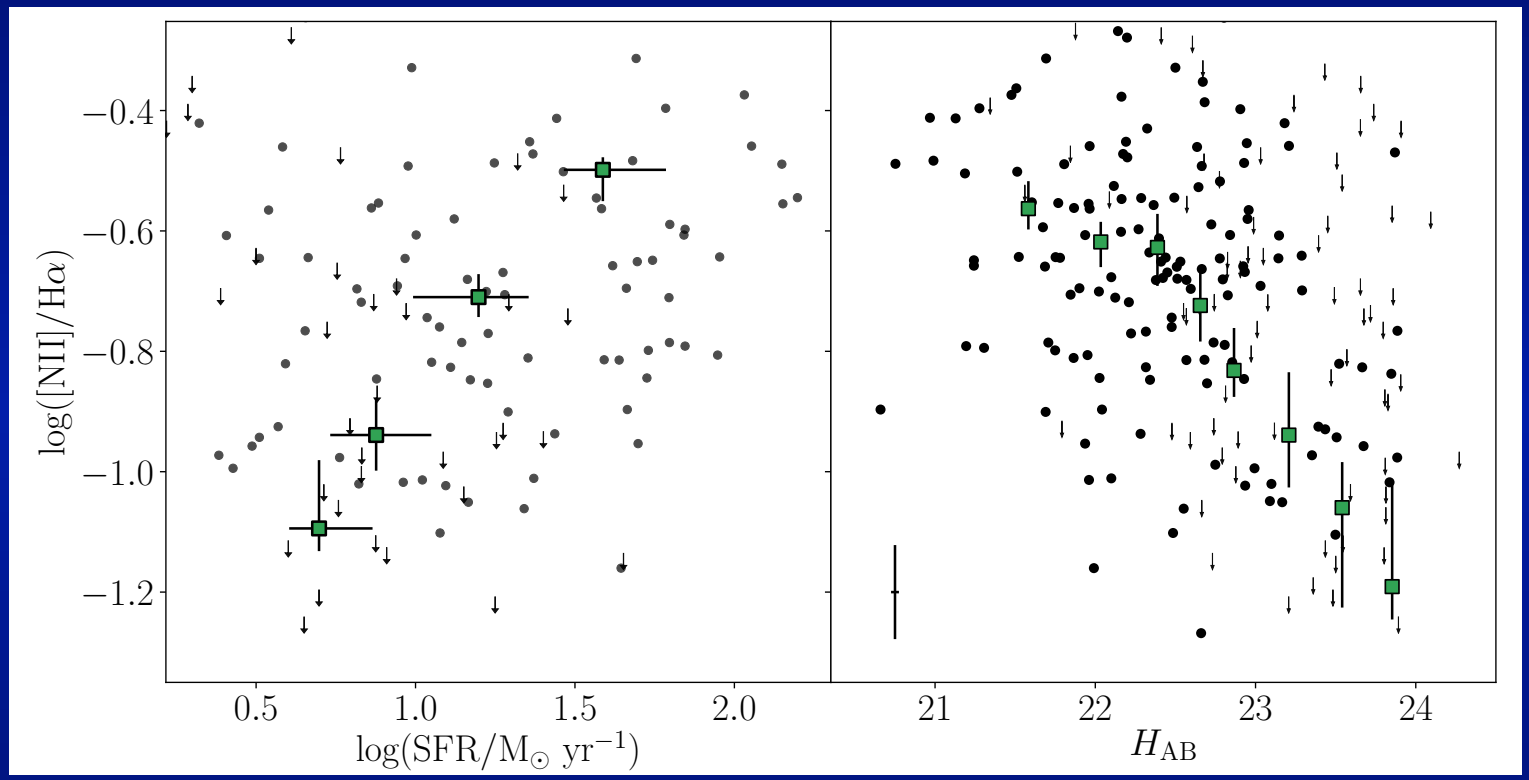
MOSDEF and [NII]/Ha at z~1.5



Topping et al. (2021b)

- MOSDEF survey: 1500 galaxies at z=1.4-3.8 with rest-optical Keck/ MOSFIRE spectra.
- 238 z~1.5 galaxies in 8 bins of M*, spanning ~10^9-10^{11} M_{sun}.

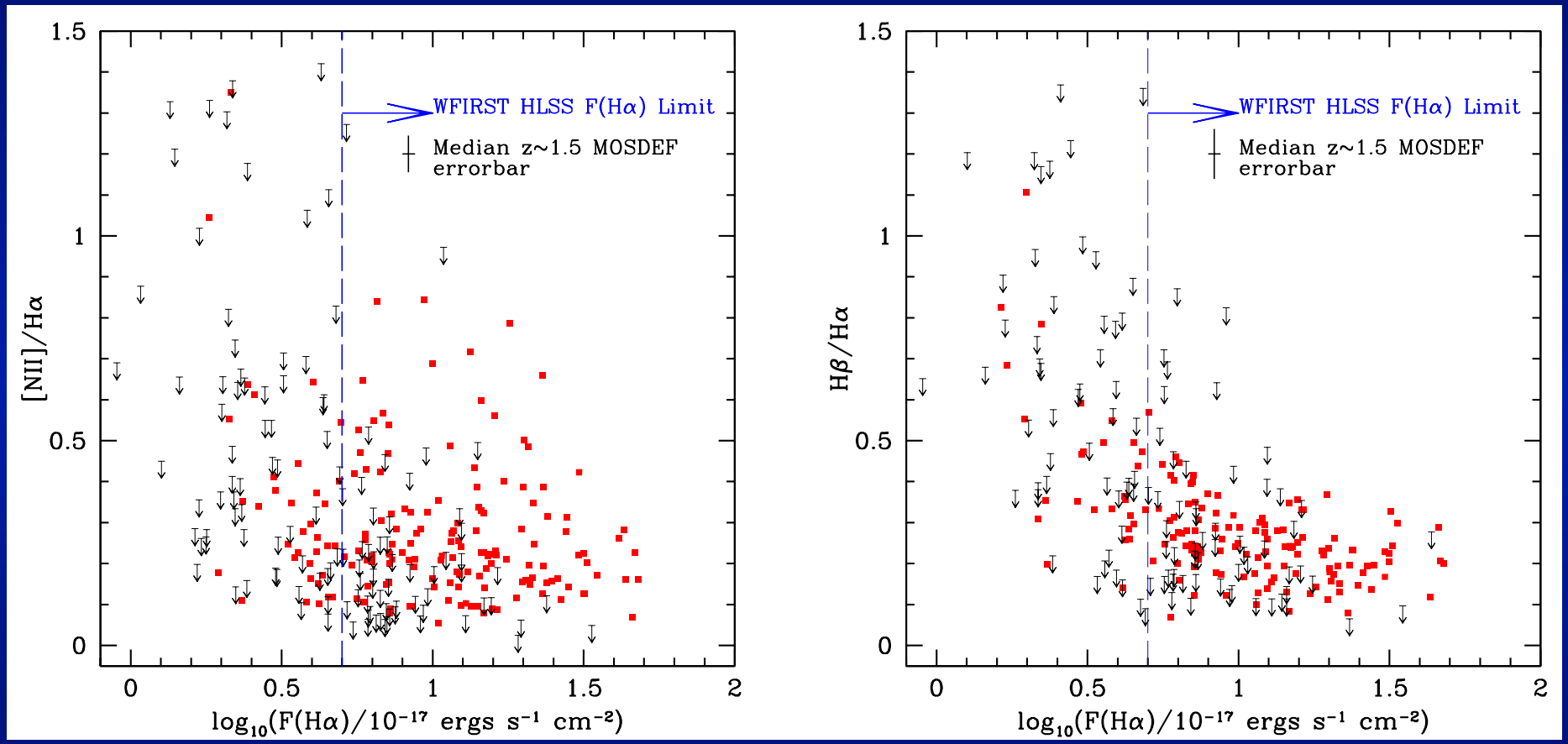
MOSDEF and [NII]/Ha at z~1.5



Topping et al. (2021b)

- Also bin in SFR and H_{AB}.

MOSDEF and [NII]/Ha at z~1.5

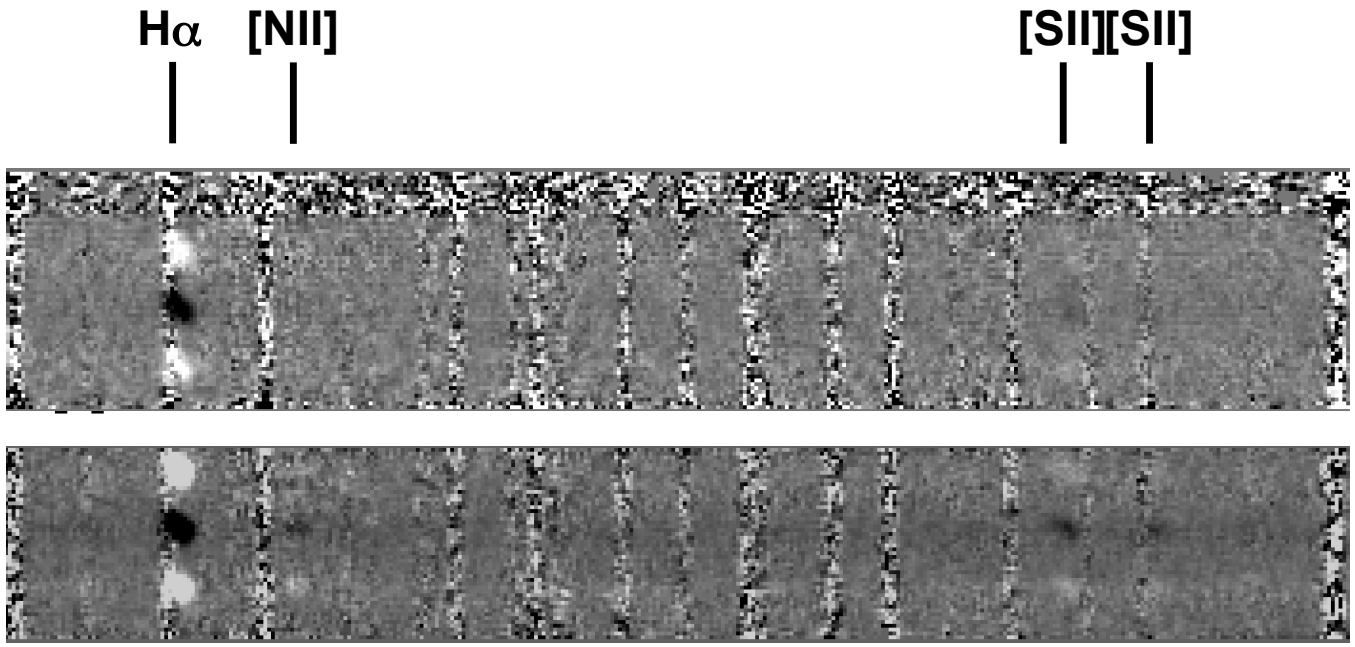


- **Upper limits in [NII]/Ha comprise significant fraction of individual MOSDEF measurements at faint limit of HLSS.**

EXPO-Keck Spectroscopy

- Proposed for 6 clear nights to observe 4 z~1.5 MOSDEF masks (~100 galaxies) to detect [NII] in H and Hβ in J.
- Weather losses in 2020A and 2020B have led to a total of 10 nights being allocated in 2020A, 2020B, 2021A, 2021B.
- Masks observed in the AEGIS, COSMOS, and UDS fields.
- z>6 targets added to masks when possible.

Examples of Progress

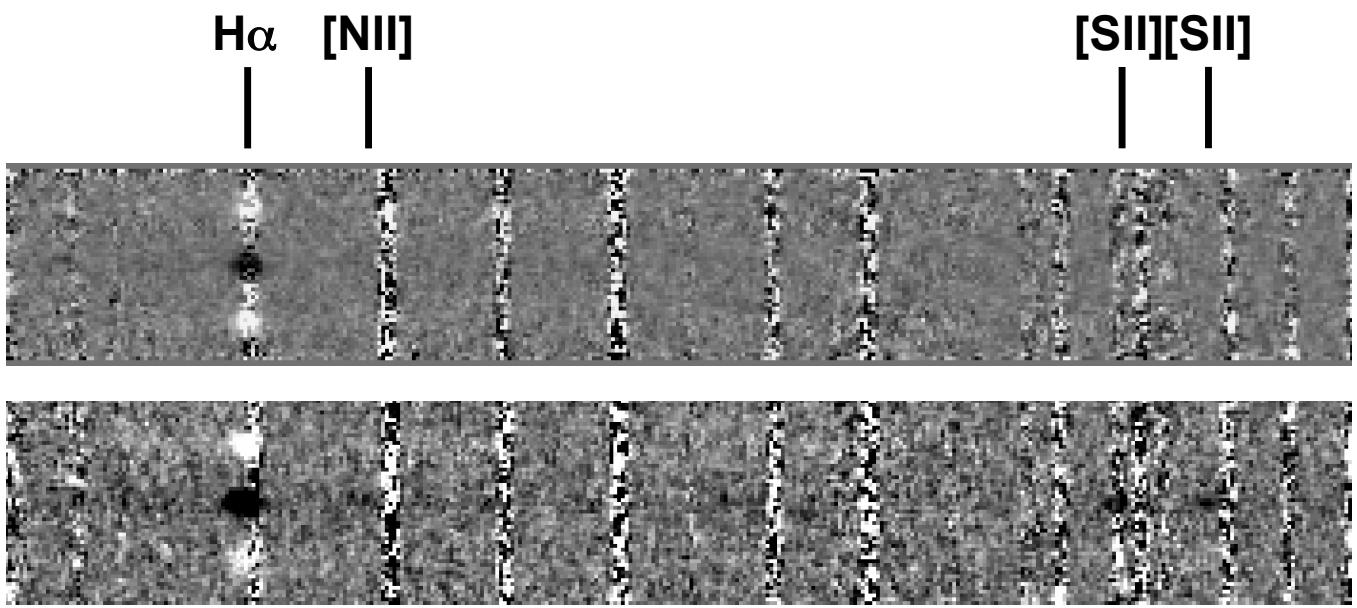


Original MOSDEF spectrum

Deeper spectrum obtained 3/2020

AEGIS-26142 z=1.468

Examples of Progress

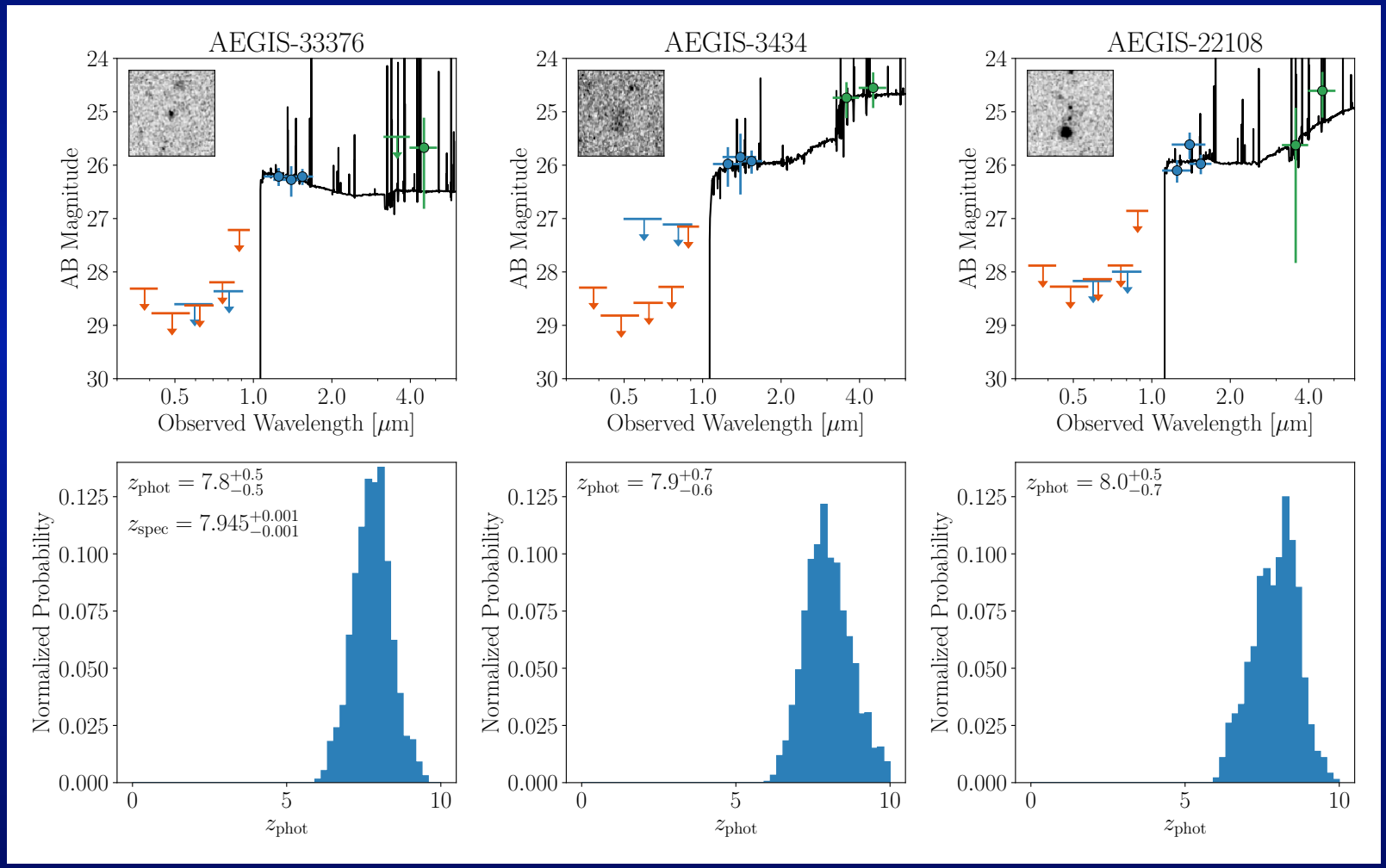


Original MOSDEF spectrum

Deeper spectrum obtained 1/2021

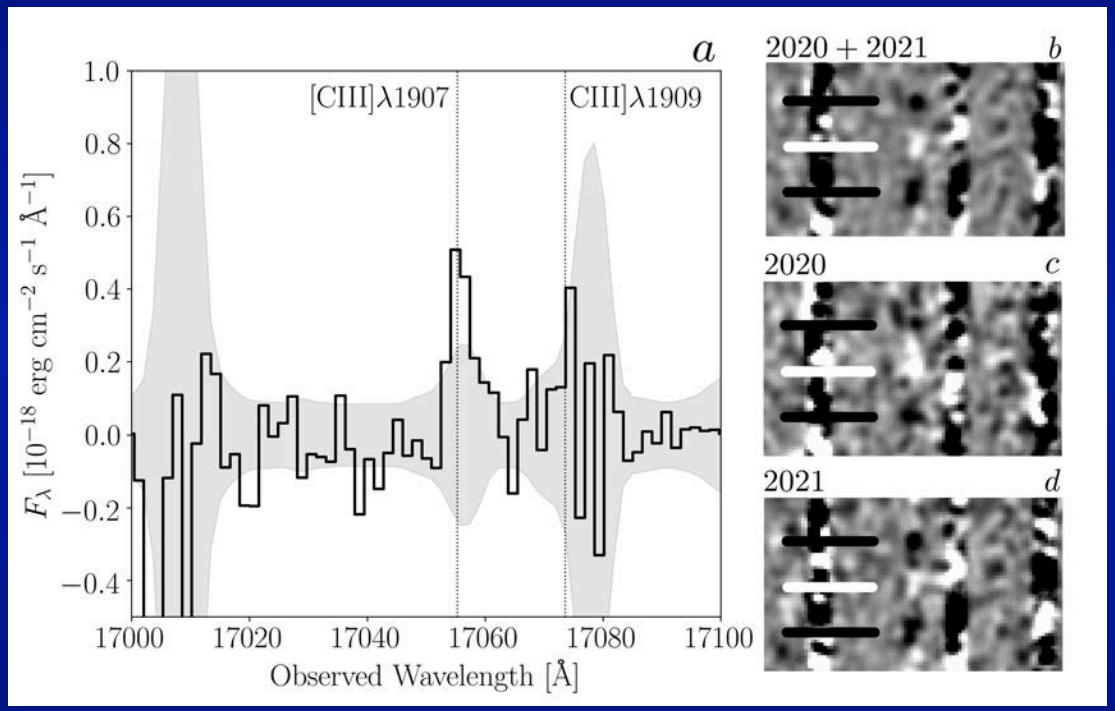
COSMOS-22221 z=1.433

Detection of Ionized Carbon at z=8



Topping et al. (2021a)

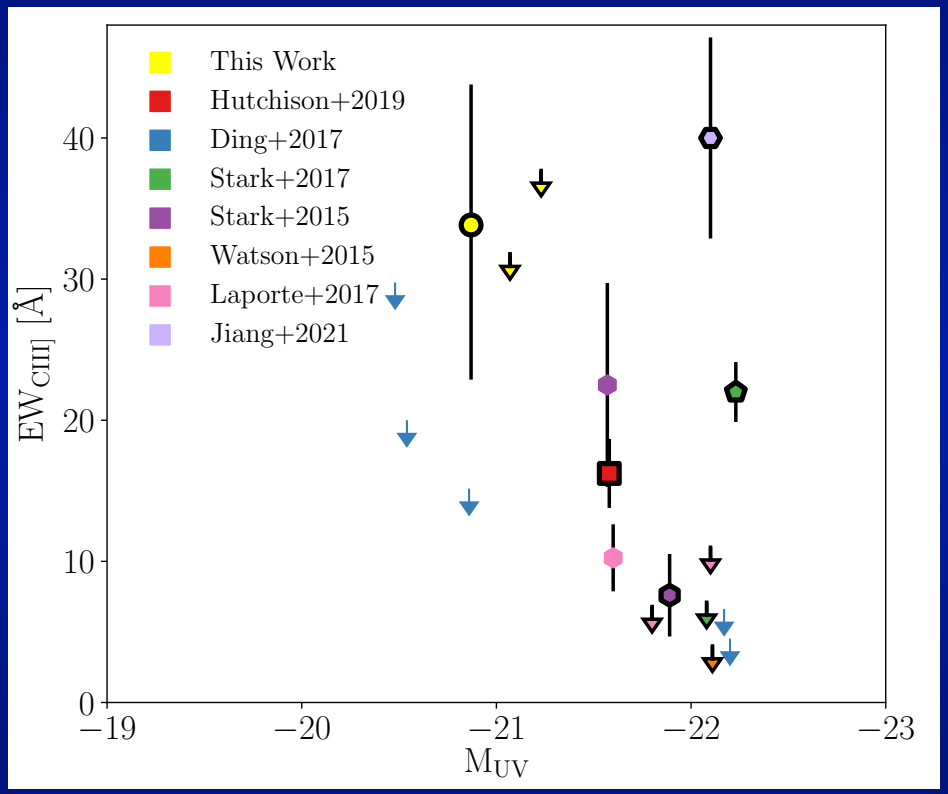
Detection of Ionized Carbon at z=8



Topping et al. (2021a)

- AEGIS-33376 was observed for 13.4 hours in H.
- [CIII] 1906 line detected at z=7.945 with F=2.24e-18 erg/s/cm^2.
- Assume [CIII] 1906/CIII] 1908 ratio=1.5→ EW(CIII])=33.7±10.8 Å.

Detection of Ionized Carbon at z=8



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Future Work

- Complete observations in December 2021.
- Determine uncensored distribution of [NII]/Hα vs. M*, SFR, H_{AB} for individual galaxies.
- Use as significantly improved inputs to the Roman BAO error budget, along with existing MOSDEF dataset.