EXPO-Keck Spectroscopic Campaign

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EXPOsing the Emission-line Properties of Distant Galaxies to Roman

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Topping et al. (2021a)

Topping et al. (2021b)
Roman HLSS

• High Latitude Spectroscopic Survey (HLSS)
• ~2000 square degrees
• ~$10^7$ H$\alpha$ redshifts at z=1-2, ~$10^6$ [OIII] redshifts at z=2-3
• Grism 1.0-1.93 $\mu$m, 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 H$\alpha$ SFRs: deblending [NII] and H$\alpha$!
[NII]/Ha Blending

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

Martens et al. (2018)
Past Work on [NII]/Ha Blending and Roman

- 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).

Faisst et al. (2018)
Past Work on [NII]/Ha Blending and Roman

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

Faisst et al. (2018)  
Martens et al. (2018)
Past Work on $[\text{NII}]/\text{Ha}$ Blending and *Roman*

- Previous attempts at measuring $[\text{NII}]/\text{Ha}$ vs. $M^*$ at $z=1-2$ did not agree on magnitude of blending effect.
MOSDEF and $[\text{NII}]$/H$_\alpha$ at $z \sim 1.5$

- MOSDEF survey: 1500 galaxies at $z=1.4$-$3.8$ with rest-optical Keck/MOSFIRE spectra.

- 238 $z \sim 1.5$ galaxies in 8 bins of $M^*$, spanning $\sim 10^9$-$10^{11}$ M$_\odot$.

Topping et al. (2021b)
MOSDEF and $[\text{NII}]/\text{Ha}$ at $z \sim 1.5$

Topping et al. (2021b)

- Also bin in SFR and $H_{AB}$.
MOSDEF and [NII]/Ha at $z \sim 1.5$

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

Hα  [NII]  [SII][SII]

Original MOSDEF spectrum

Deeper spectrum obtained 3/2020

AEGIS-26142 z=1.468
Examples of Progress

COSMOS-22221 z=1.433

Original MOSDEF spectrum

Deeper spectrum obtained 1/2021
Detection of Ionized Carbon at $z=8$

Topping et al. (2021a)
Detection of Ionized Carbon at $z=8$

- AEGIS-33376 was observed for 13.4 hours in H.
- [CIII] 1906 line detected at $z=7.945$ with $F=2.24\times10^{-18} \text{ erg/s/cm}^2$.
- Assume [CIII] 1906/[CIII] 1908 ratio=$1.5$ $\rightarrow$ EW(CIII])=$33.7\pm10.8 \text{ Å}$.

Topping et al. (2021a)
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Topping et al. (2021a)
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.