Lyα Emission at z ≥ 7 from HST Spectroscopy in the Grism Lens-Amplified Survey from Space

Charlotte Mason[1,2], Kasper B. Schmidt[1]*, Tommaso Treu[1,2] and the GLASS team
[1]UCSB, [2]UCLA, *kschmidt@physics.ucsb.edu
http://glass.physics.ucsb.edu

Survey Overview

The **Grism Lens-Amplified Survey from Space** (GLASS, GO-13459, PI: Treu) is a cycle-21 *HST* Large Program allocated 140 orbits of Grism spectroscopy assisted with *HST* optical and infrared imaging.

- **Survey Area:** the core and infall regions of 10 massive clusters, including 8 targeted by CLASH and 6 Hubble Frontier Fields (4 overlaps)
- **Filters:** each cluster is scrutinized by 10 visits of WFC3/G102+F105W and 4 visits of WFC3 G141+F140W on the central region at two almost orthogonal orientations, as well as 14 visits of ACS/G800L+F814W in offset parallel fields.
- **Timeline:** All clusters have been observed. First data release September 2015 (Treu et al. 2015)

First Data Release

The GLASS data products, including the GLASS redshift catalogs, for the four clusters MACS1423, MACS2129, RXJ1347, and RXJ2248 are now available on the GLASS MAST webpage:
https://archive.stsci.edu/prepds/glass

Key Science Drivers

1. To shed light upon the role of galaxies in reionizing the universe, the topology of high redshift intergalactic/interstellar medium and on Lyman alpha escape fraction.
2. To study gas accretion, star formation and outflows by mapping spatially resolved star formation and metallicity gradients in galaxies at z = 1.3 - 2.3.
3. To study the environmental dependence of galaxy evolution, by mapping spatially resolved star formation in galaxies in the cluster cores and infalling regions.

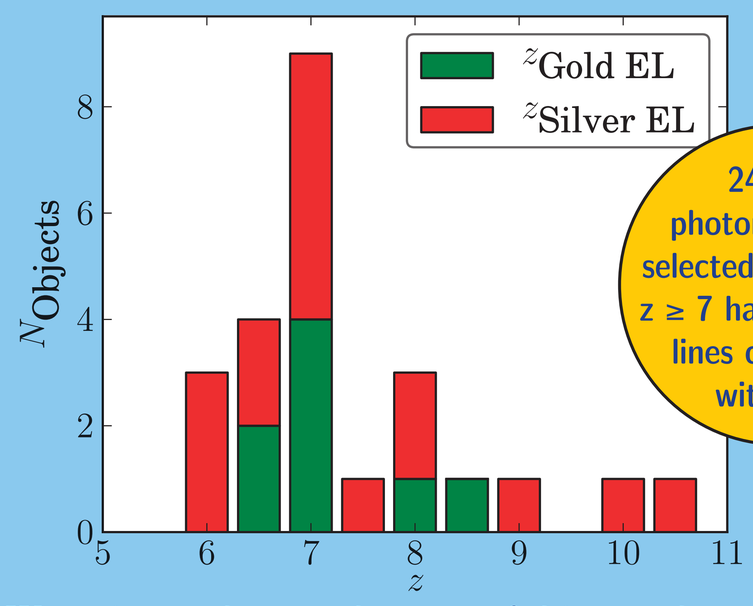
Lyα Emission as a Probe of Reionization

- The low probability of detecting Lyα in Lyman break galaxies, could be interpreted as the result of an increased optical depth in the IGM due to a significant fraction of neutral hydrogen.
- The conditional probability of Lyα emission for LBGs is potentially a powerful probe of the physics of the IGM and CGM and their neutral fraction at these redshifts (e.g., Dijkstra 2014) provided that large enough spectroscopic samples can be gathered (Treu et al. 2012).
- Many efforts are underway to increase the spectroscopic samples, but progress from the ground is fundamentally limited by the Earth's atmosphere.

Census of Lyα z ≥ 7 in 6 Clusters

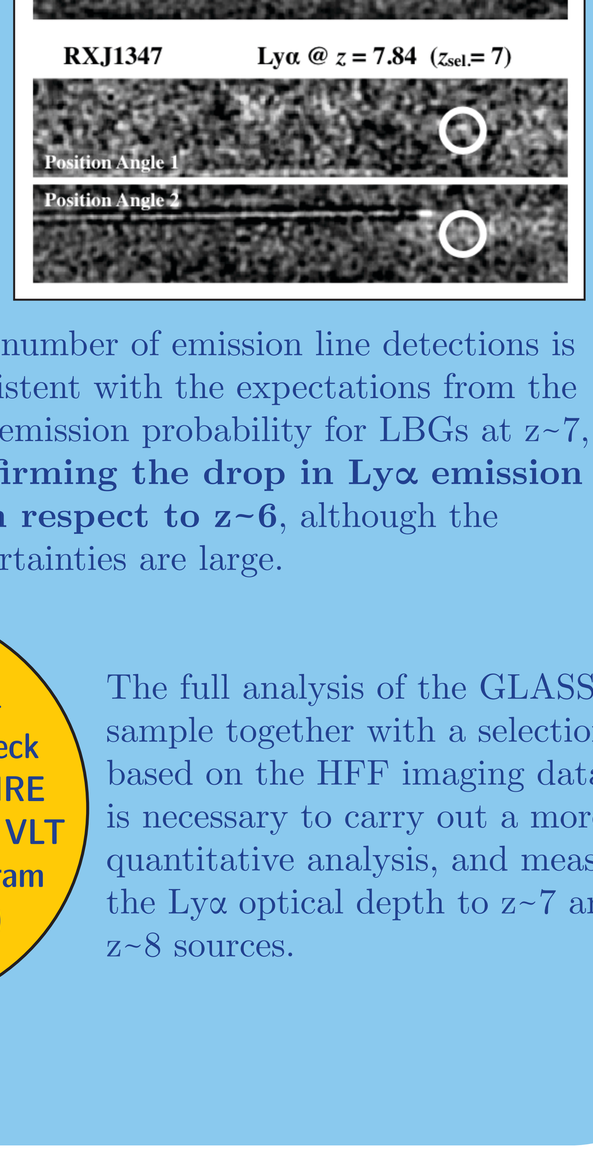
(K. B. Schmidt et al. 2015, submitted)

GLASS combines HST's NIR slitless spectroscopy capabilities with the power of magnification by foreground galaxy clusters to carry out the largest survey of **Lyα emission at z>7 to date**, with an observed (uncorrected for magnification) 1σ flux limit of 5×10^{-18} erg/s/cm^2

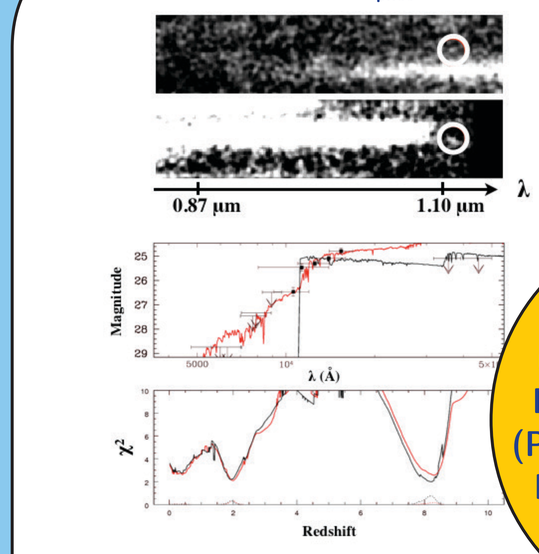


We estimate the completeness of this sample to be 40-100% with a purity of 60-90%. Deeper spectroscopic follow-up is needed to improve the estimates.

One of the candidates has been confirmed spectroscopically with DEIMOS on Keck (Huang et al. 2015). The GLASS grism coverage allows us to confirm lines are Lyα and not [OII] at lower redshifts.



The number of emission line detections is consistent with the expectations from the Lyα emission probability for LBGs at z~7, **confirming the drop in Lyα emission with respect to z~6**, although the uncertainties are large.



The total line flux is $1.0\pm0.3\times10^{-17}$ erg/s/cm^2. Follow-up spectroscopy or deeper imaging is needed to confirm the candidate.

Extensive follow-up ongoing with Keck DEIMOS & MOSFIRE (PI: M. Bradač) and VLT KMOS Large Program (PI: A. Fontana)

The full analysis of the GLASS sample together with a selection based on the HFF imaging dataset is necessary to carry out a more quantitative analysis, and measure the Lyα optical depth to z~7 and z~8 sources.

References

Dijkstra 2014, PASA, 31, 40
Huang et al. 2015, arXiv:1504.02099
Treu et al. 2015, arXiv:1509.00475
Treu et al. 2012, ApJ, 747, 27