Mg II Emission from Low Mass Galaxies at Half the Age of the Universe: Implications for Reionization

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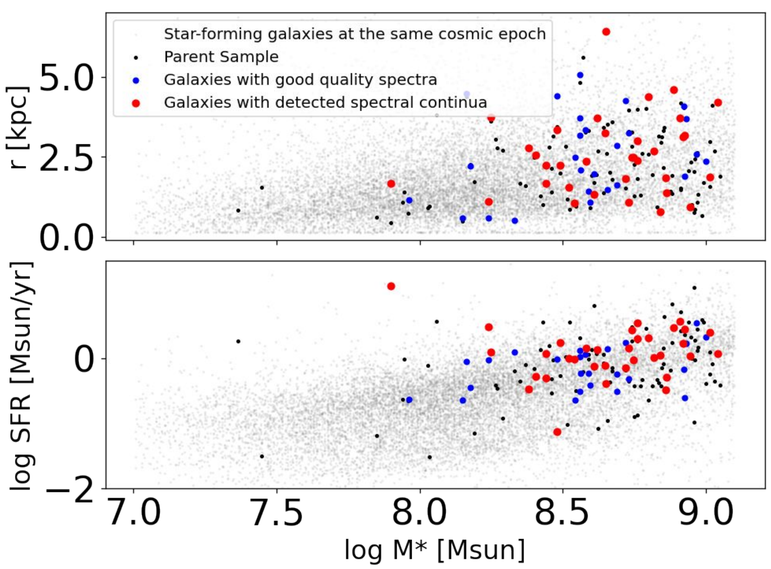
Overview

- Cosmic reionization is a phase transition that happened in the Universe 13 billion years ago when the neutral gas between galaxies was ionized.
- Galaxies with Mg II emission tend to emit ionizing photons that contribute to cosmic reionization.
- Low mass galaxies (galaxies below 10^9 Msun) are more likely to have Mg II emission (Finley et al., 2017).
- Galaxies 8 billion years ago are likely analogs of the low mass galaxies at the epoch of cosmic reionization 13 billion years ago.
- We stack the spectra of 30 low mass galaxies 8 billion years ago. We use the resulting stacked spectrum to measure emission fluxes. From this we learn that 10% of Mg II photons leak out of galaxies.

Sample



Sample selection unbiased against galaxy size (r) and star formation rate (SFR)

Additional questions? Email yqin16@jh.edu

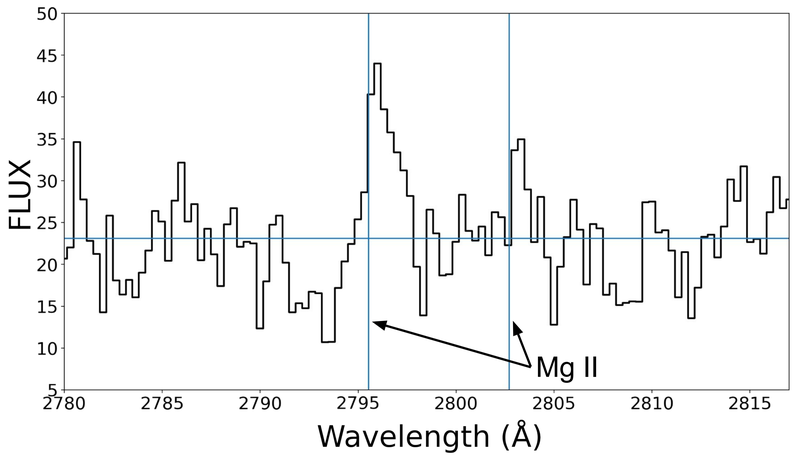
Sample (cont.)

- 148 galaxies observed by the Keck Observatory.
- Stellar mass (M*) below 10^9 Msun.
- Galaxies that are at 8 billion years ago (z~1).

Methods

- Select 33 galaxies with good quality spectra and detected spectral continua.
- Stack spectra from the 30 galaxies with the highest signal-to-noise ratio.

Results



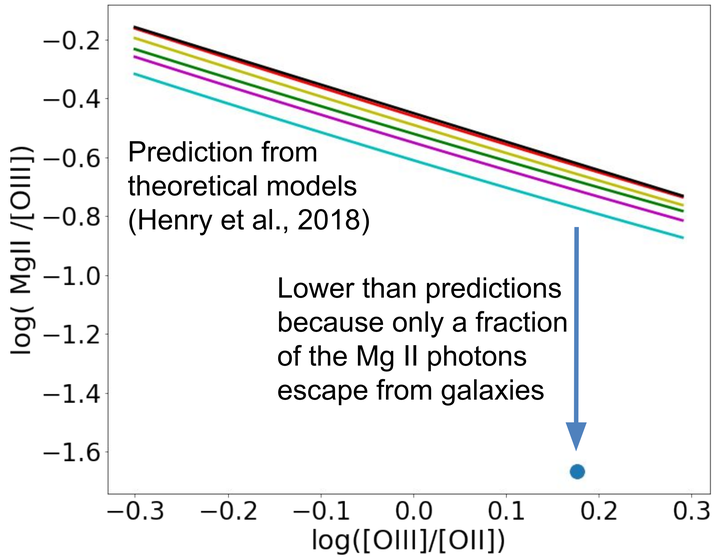
Stacked Spectrum of 30 Galaxies

- Significant Mg II line emission is detected from the stacked spectrum.

Ongoing and Future Work

- O II and O III emission can predict the intrinsic emission flux of Mg II. Together with observed Mg II emission flux, the fraction of Mg II photons that leak out of galaxies (escape fraction) can be calculated. This number is important for reionization.
- We measure the Mg II, O II, and O III emission fluxes from the stacked spectrum and predict Mg II intrinsic flux using theoretical models (Henry et al., 2018).

Ongoing and Future Work (cont.)



Infer the Mg II escape fraction from the emission line ratios by comparing observations with theoretical models

- The observed Mg II line flux is about 10% of the intrinsic flux predicted by models.
- Next steps:
  - Improve emission flux measurements by correcting for dust attenuation.
  - Calculate the contribution of low mass galaxies to reionization using the number density of the these galaxies during the epoch of cosmic reionization.
- Future Work:
  - Analyze low mass galaxies during the cosmic reionization using James Webb Space Telescope.

References

Finley, H. et al 2017 A&A 608 A7
Henry, A. et al 2018 ApJ 855 96
Reference data set from which these data are taken: HALO7D