A Close Relationship between Mg II and Lyα in Green Pea Galaxies

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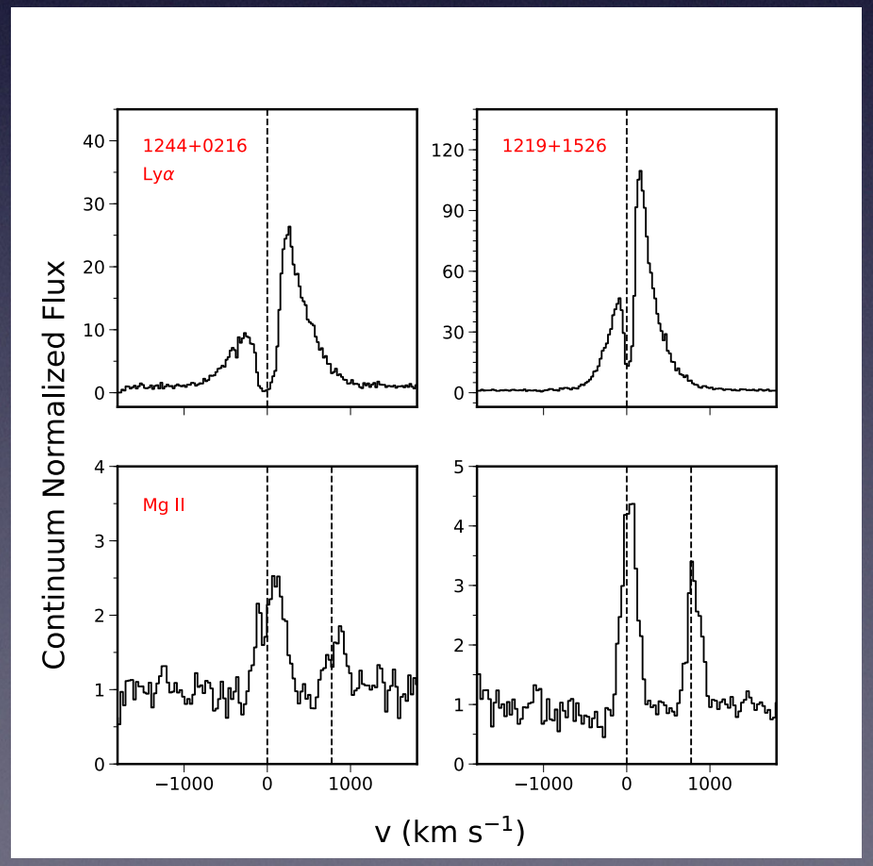
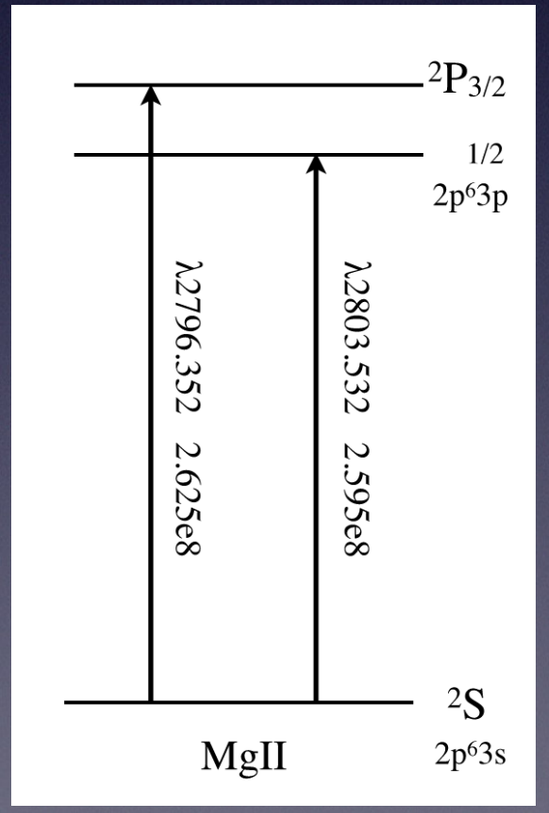
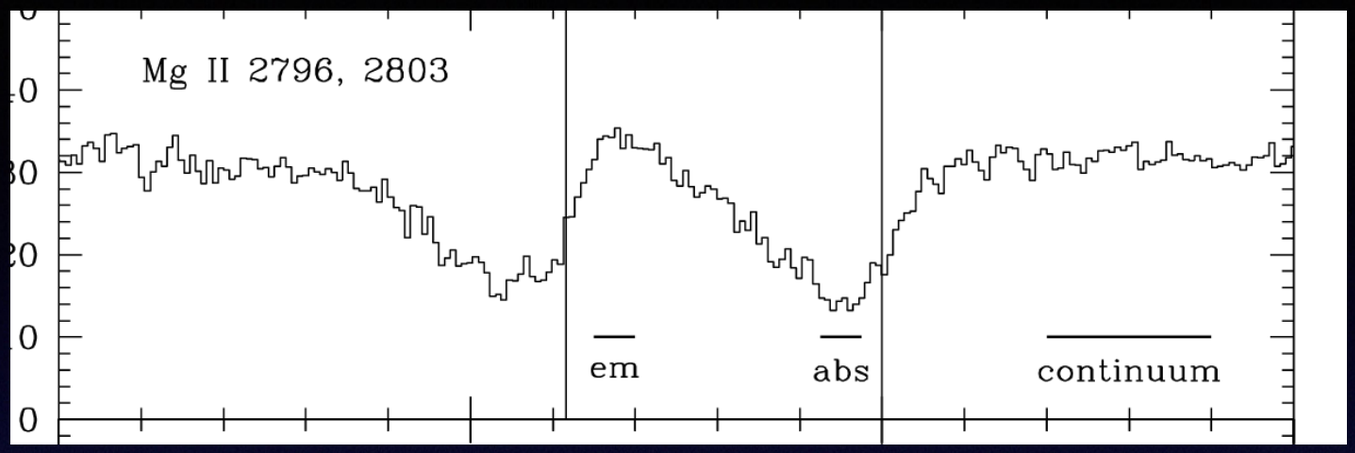


(Henry et al. 2018; ApJ, 855, 96)



(Mg II resonant trapping; from Prochaska et al. 2011)

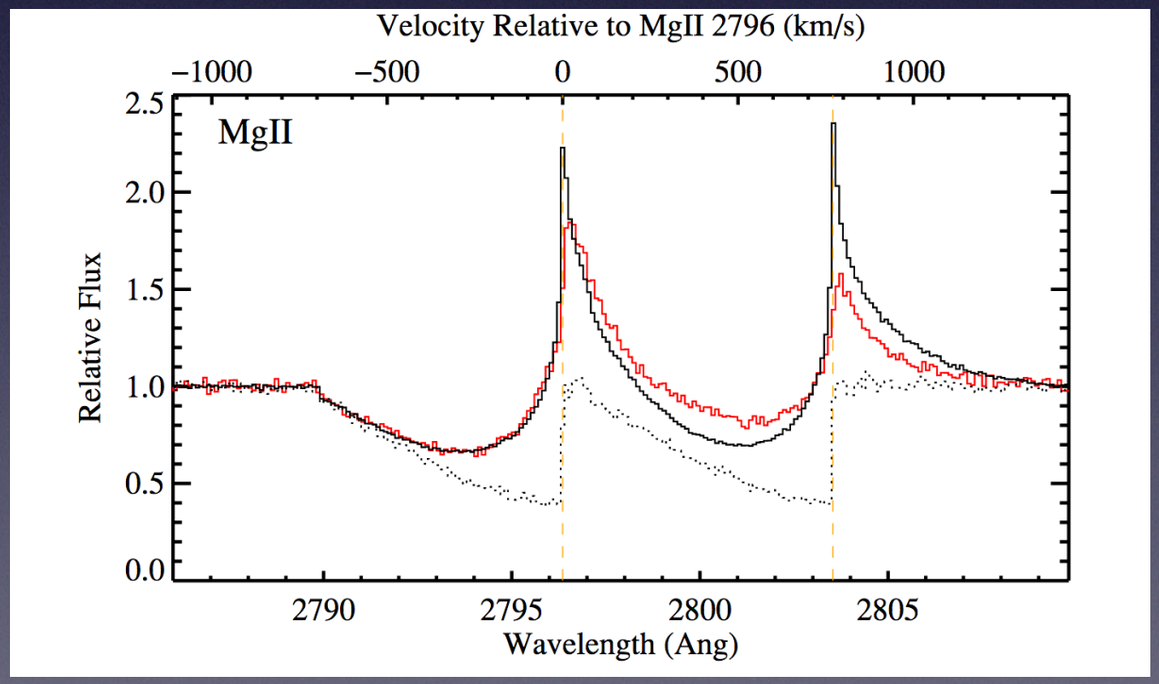
Mg II: an outflow probe…?



mostly absorption (z~1.4, 1406 galaxy stack, Weiner et al. 2009)

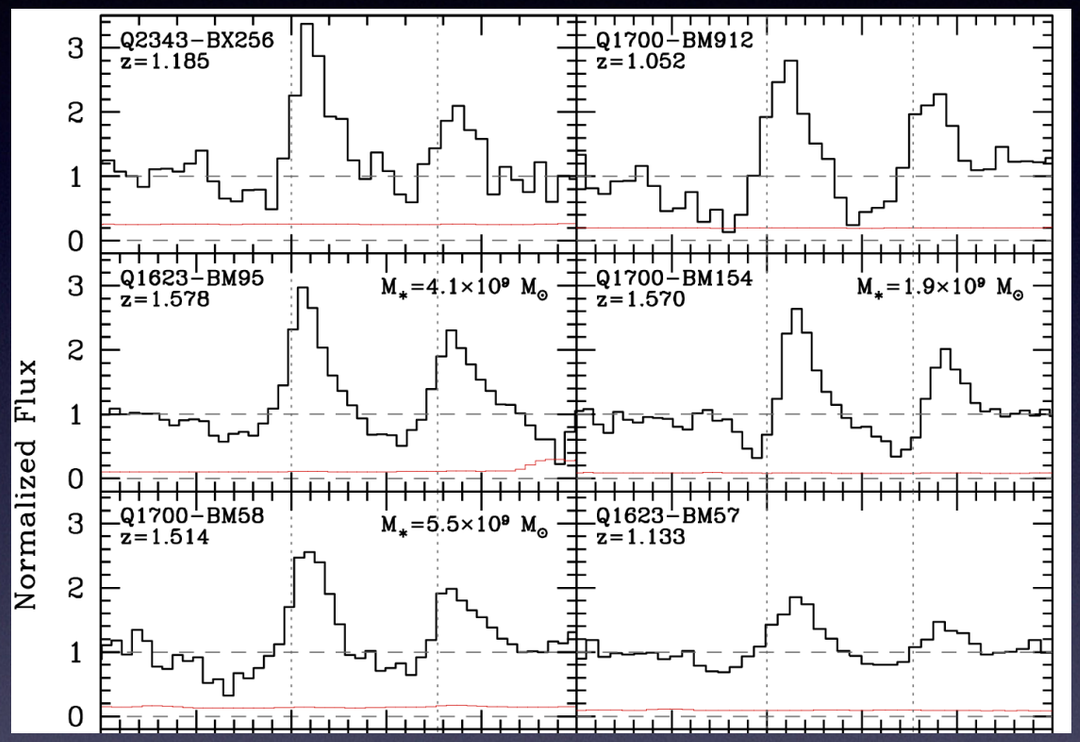
also: Rubin et al. 2010; Coil et al. 2011; Erb et al. 2012, Martin et al. 2012; Tang et al. 2014; Zhu et al. 2014; Bordoloi et al. 2016; Finley et al. 2017

also: Scarlata & Panagia 2015; Zhu et al. 2015; Bordoloi et al. 2016; Carr et al. 2018

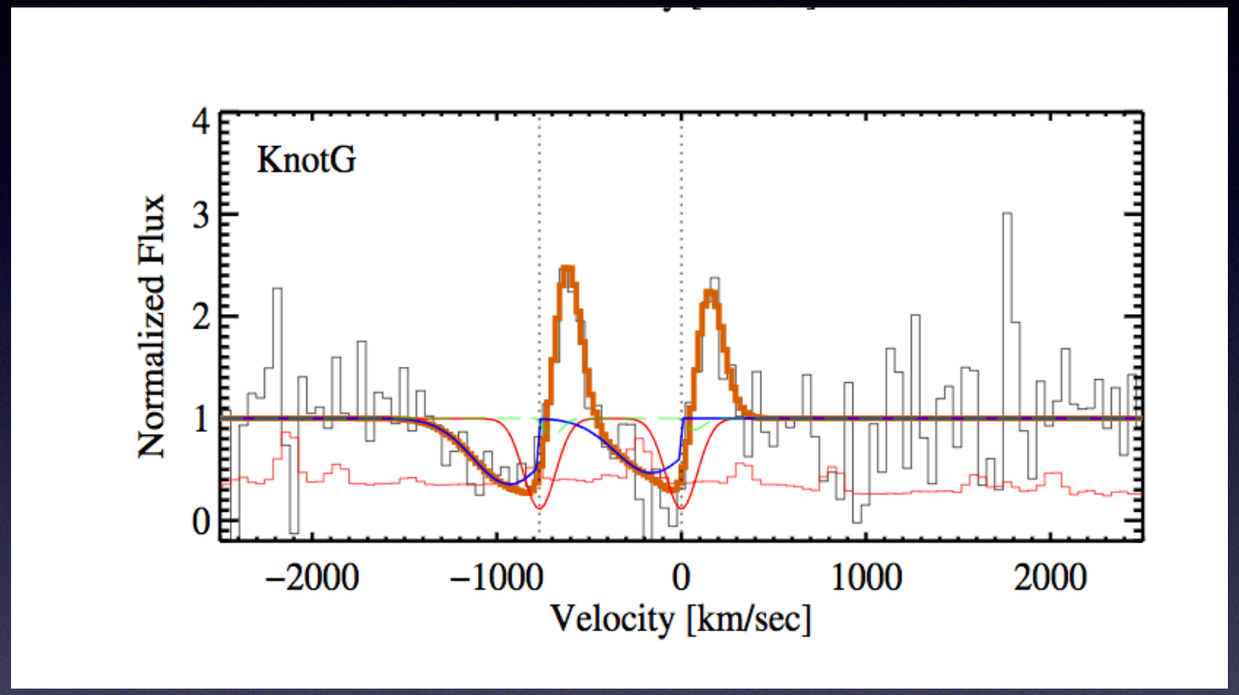


models show P-Cygni emission from scattered photons (Prochaska et al. 2011)

Indeed, Mg II does appear in emission in some high-z galaxies



(Erb et al. 2012; w/AH)



(Bordoloi et al. 2016)

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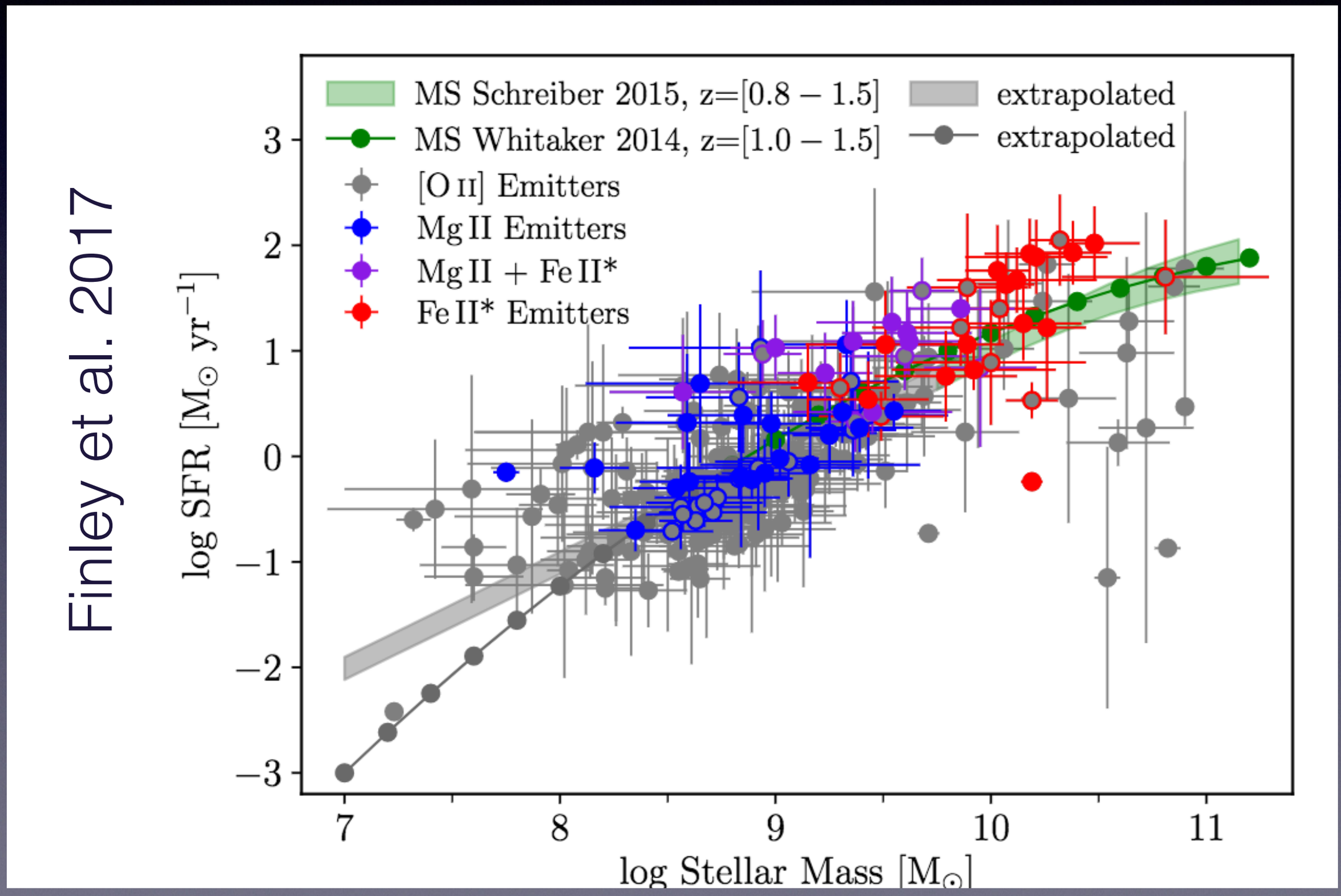


Indeed, Mg II does appear in emission in some high-z galaxies

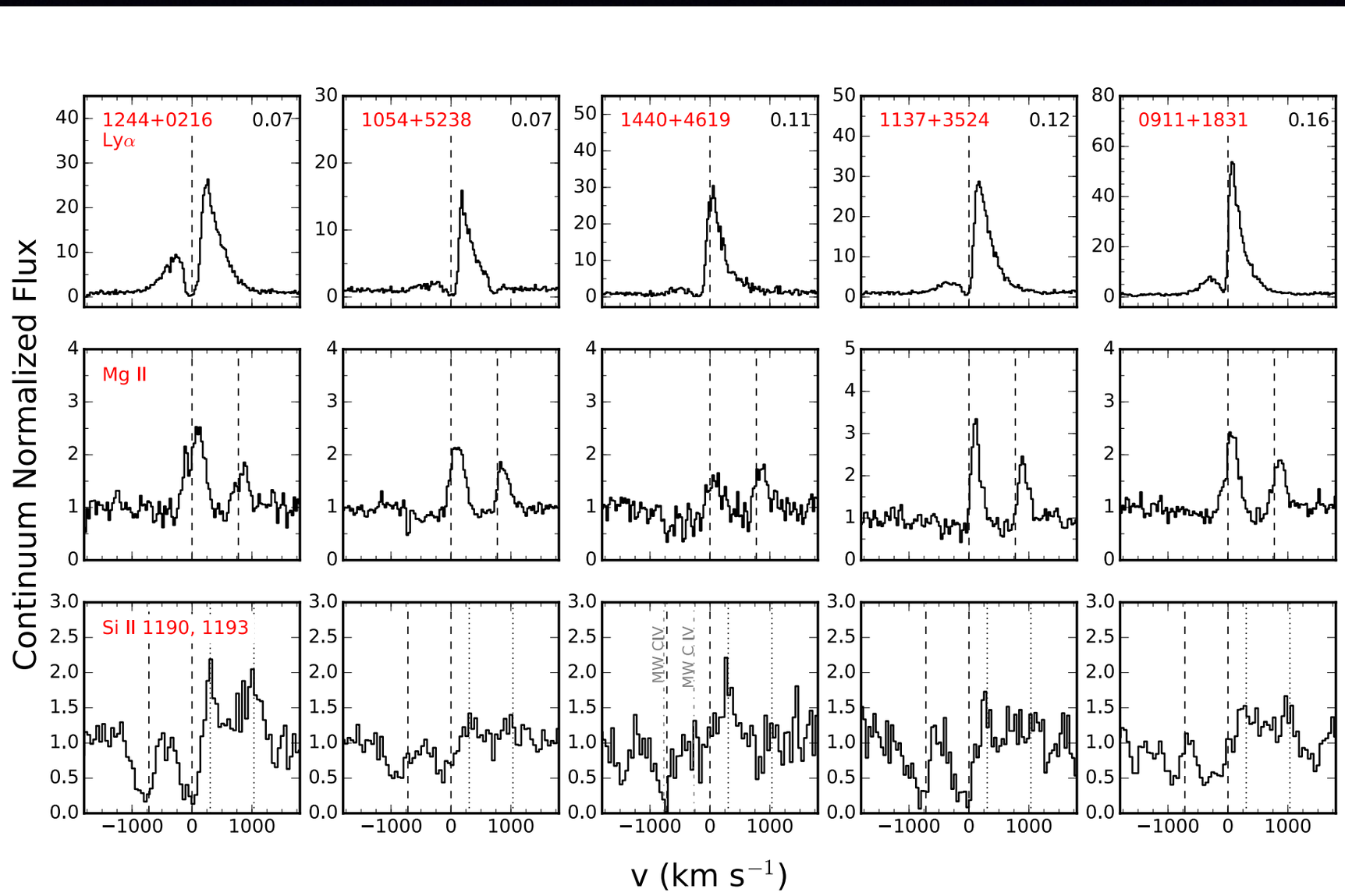
In comparison: Lyα photons scatter, sometimes Lyα appears in emission and other times in absorption or P-Cygni. Emission favors bluer, lower mass, high sSFR galaxies. **Might there be a relation between Lyα and Mg II?**

We decided to look at Mg II from Green Pea galaxies, since we love their strong Ly α lines!

Ly α

Mg II

Si II



Only a nebular origin **and low optical depth ISM** can make these Mg II spectra.

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Ly α

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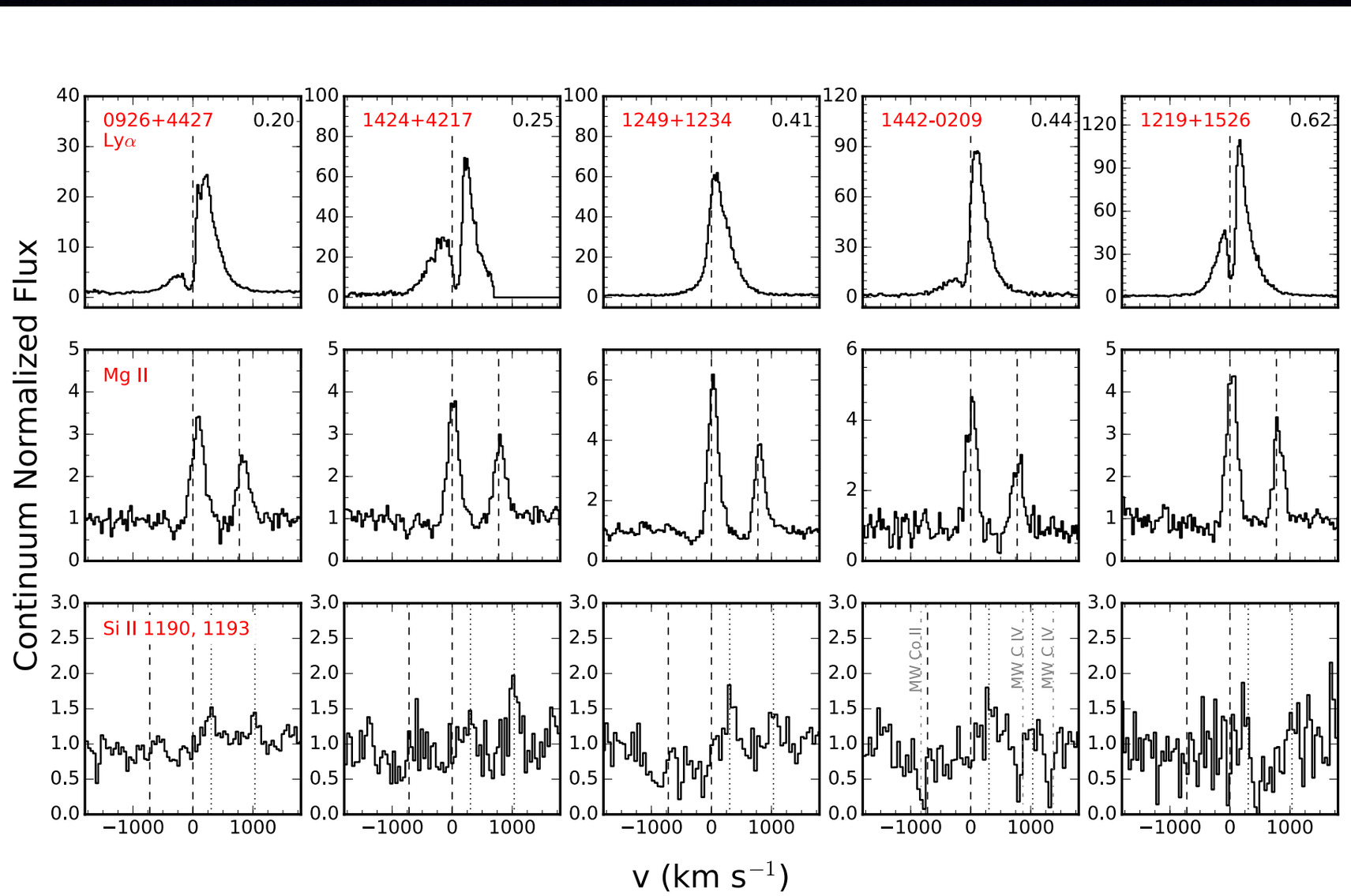
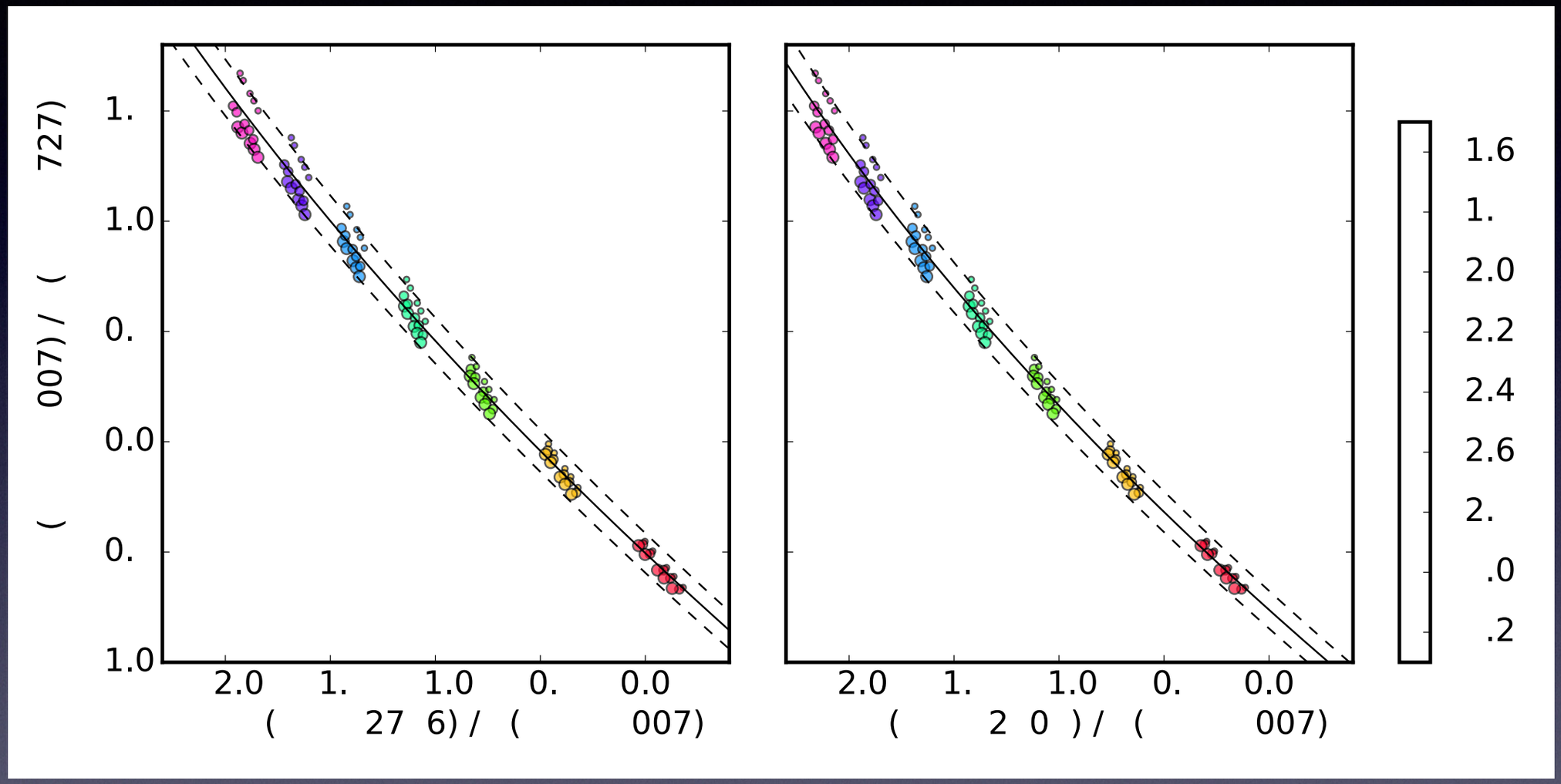


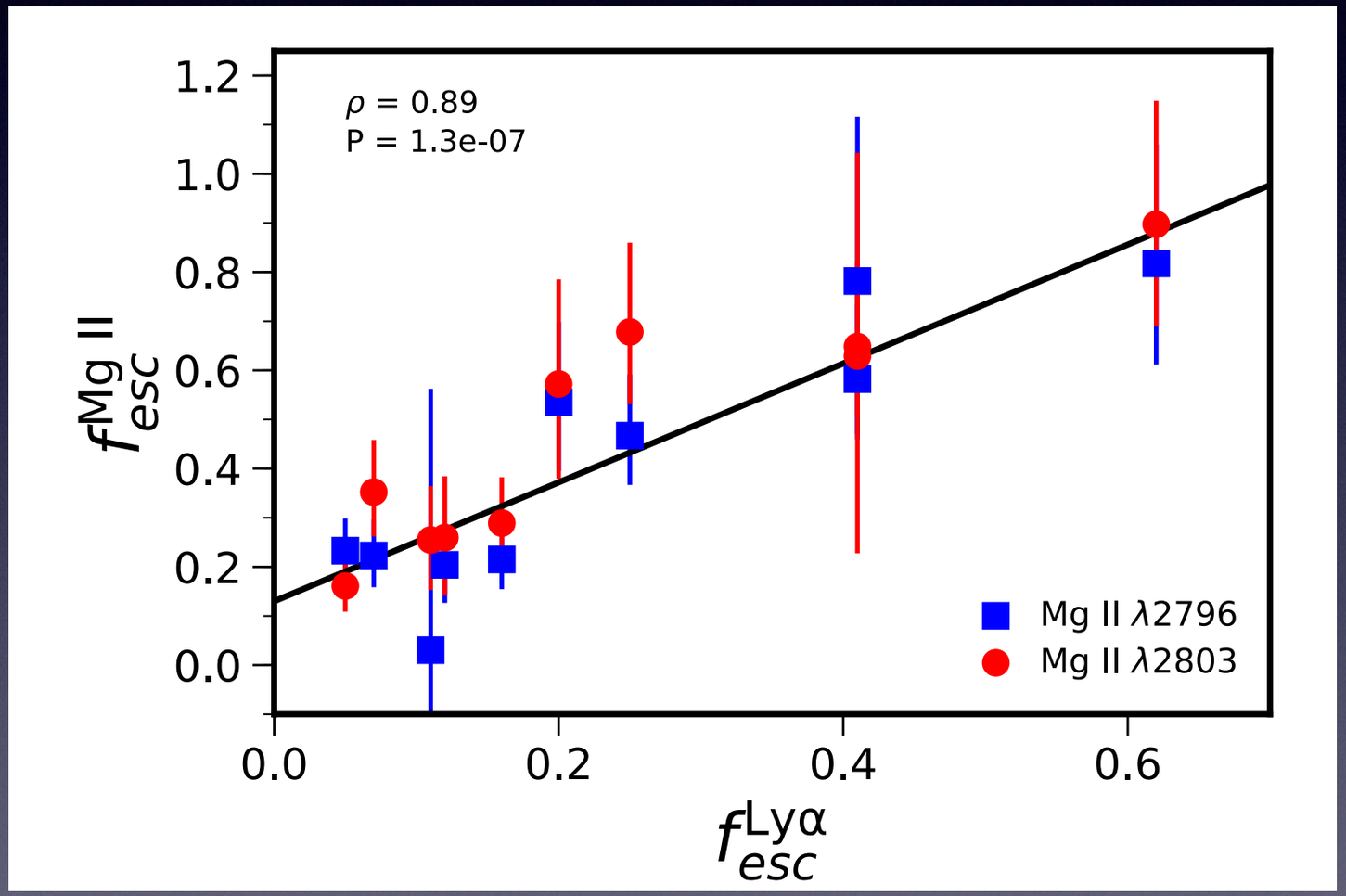
Only a nebular origin **and low optical depth ISM** can make these Mg II spectra.

Cloudy models can predict the strength of *intrinsic* nebular Mg II to ~0.1 dex.



We tried **many** different stellar ionizing spectra (e.g. BPASS, SB99, varied IMFs and stellar Z) — Mg II/ [OIII] moves *along* this sequence.

Knowing the intrinsic Mg II means that we can calculate Mg II escape fractions— **just like Lyα!**

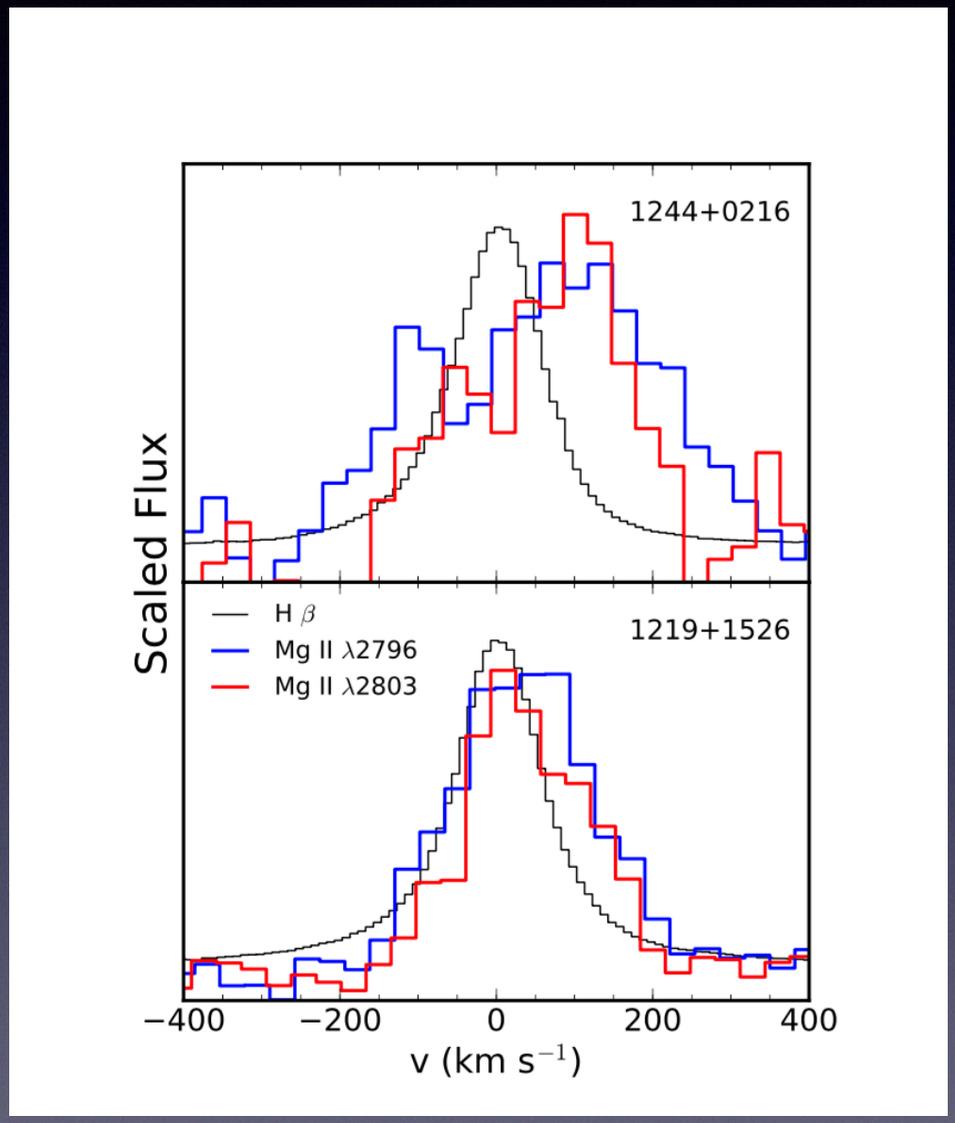


The Lyα and Mg II photons are both created in H II regions, and subsequently scatter in the same low-ionization state gas.

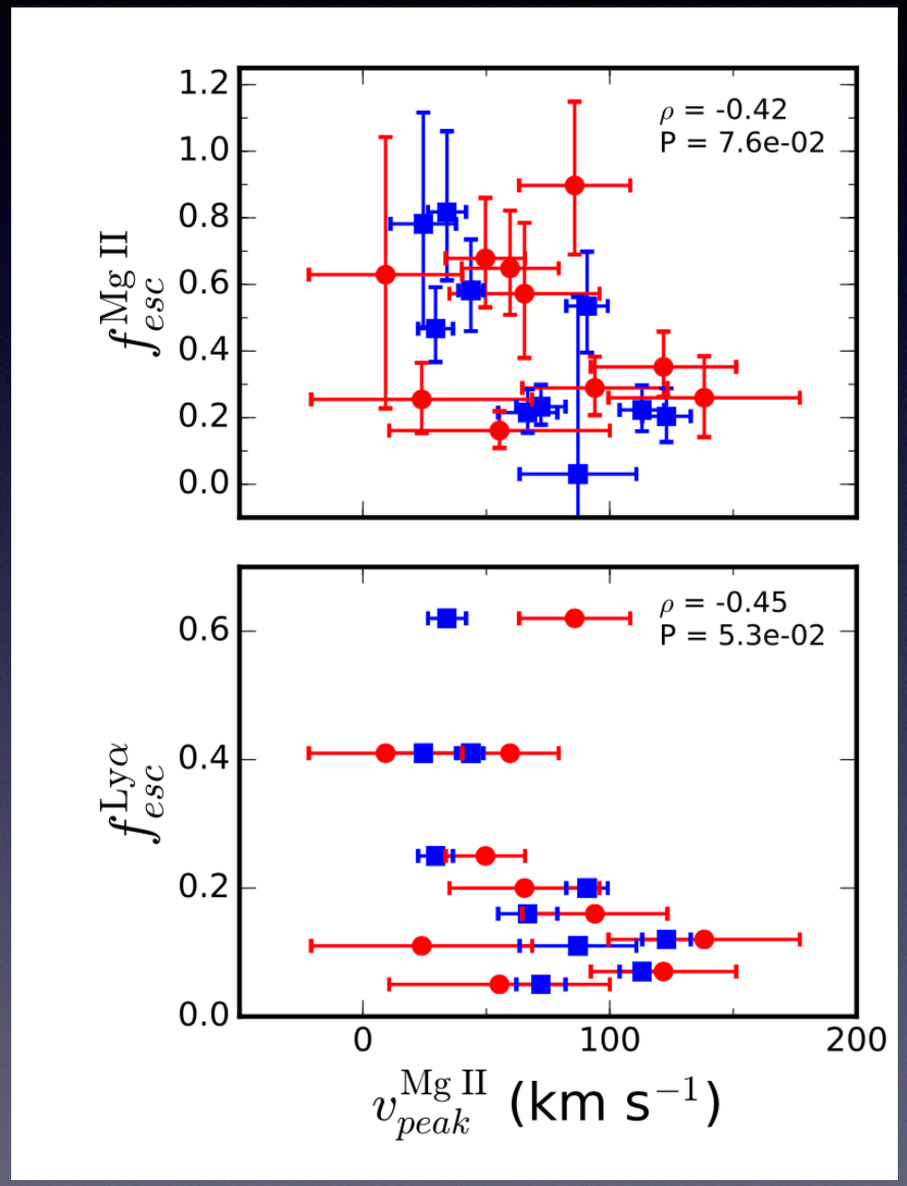
Do resonant scattering effects appear in the velocity structure of the Mg II lines? **(yes)**

low Mg II/Lya fesc

high Mg II/Lya fesc

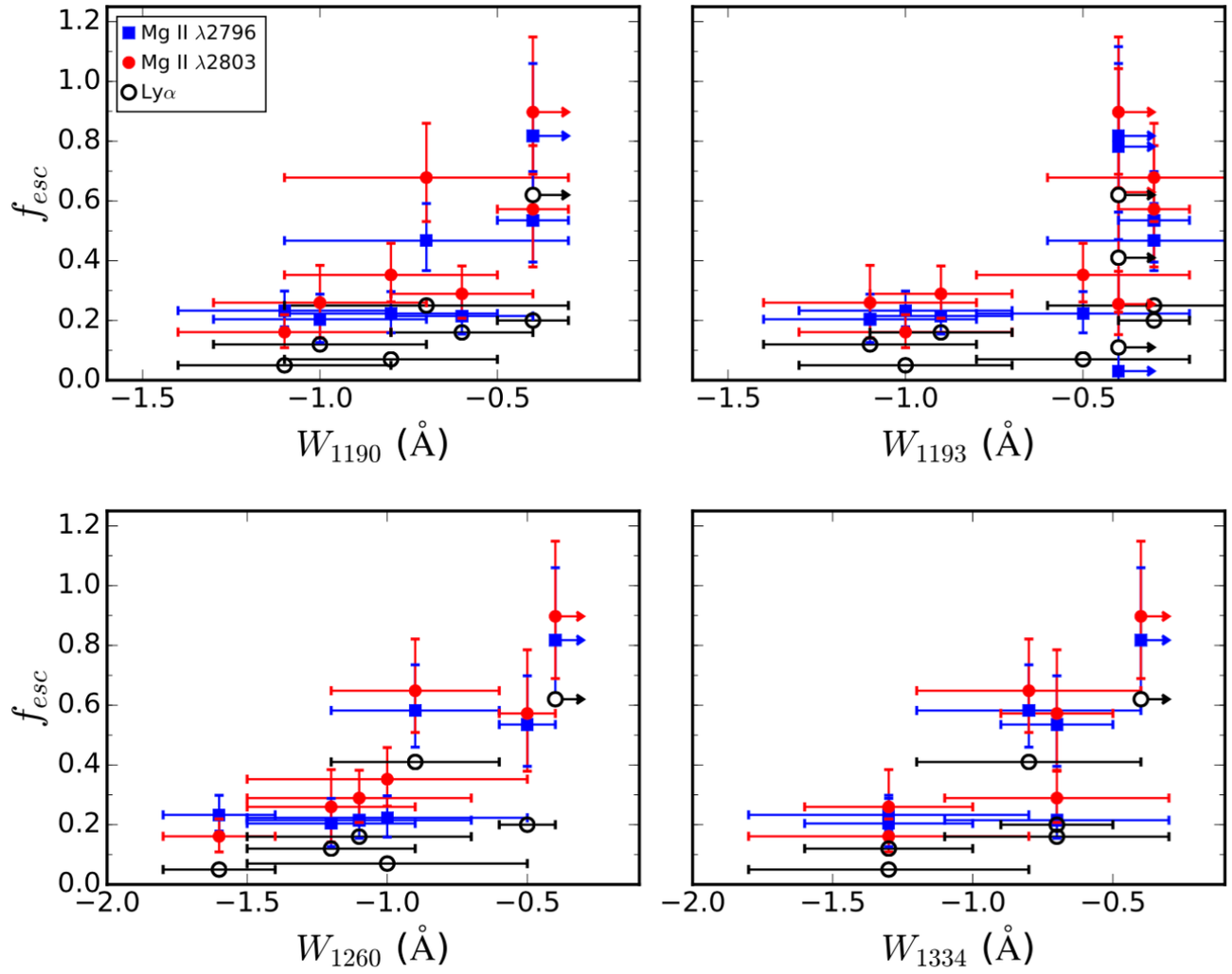


peak splitting, broadening (top panel)



redshifted Mg II emission

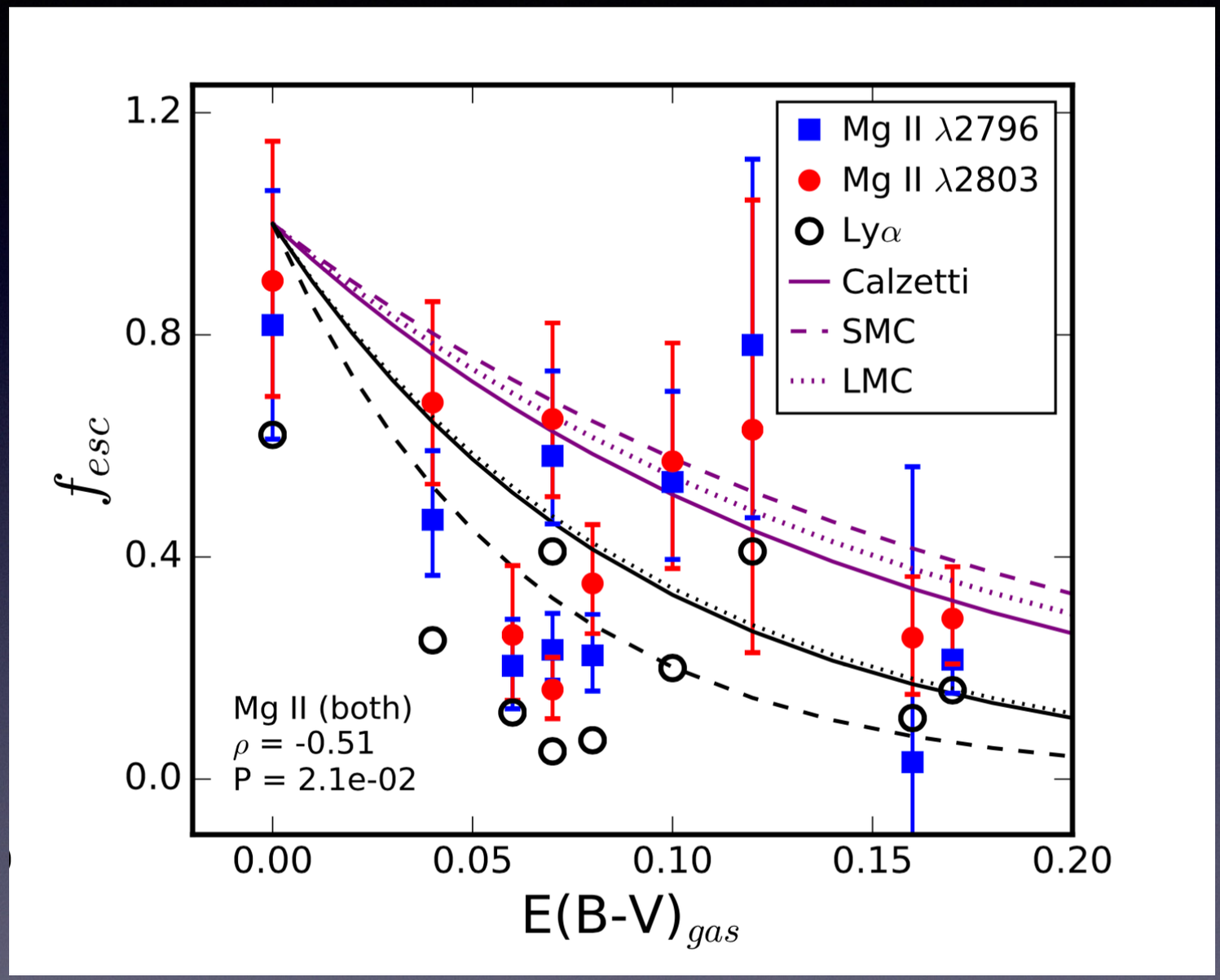
What about the other low-ionization metal lines?



Many studies have looked at the correlation between low-ionization state metals (LIS) lines and Lyα (e.g. Shapley et al. 2003, Chisholm et al. 2017)

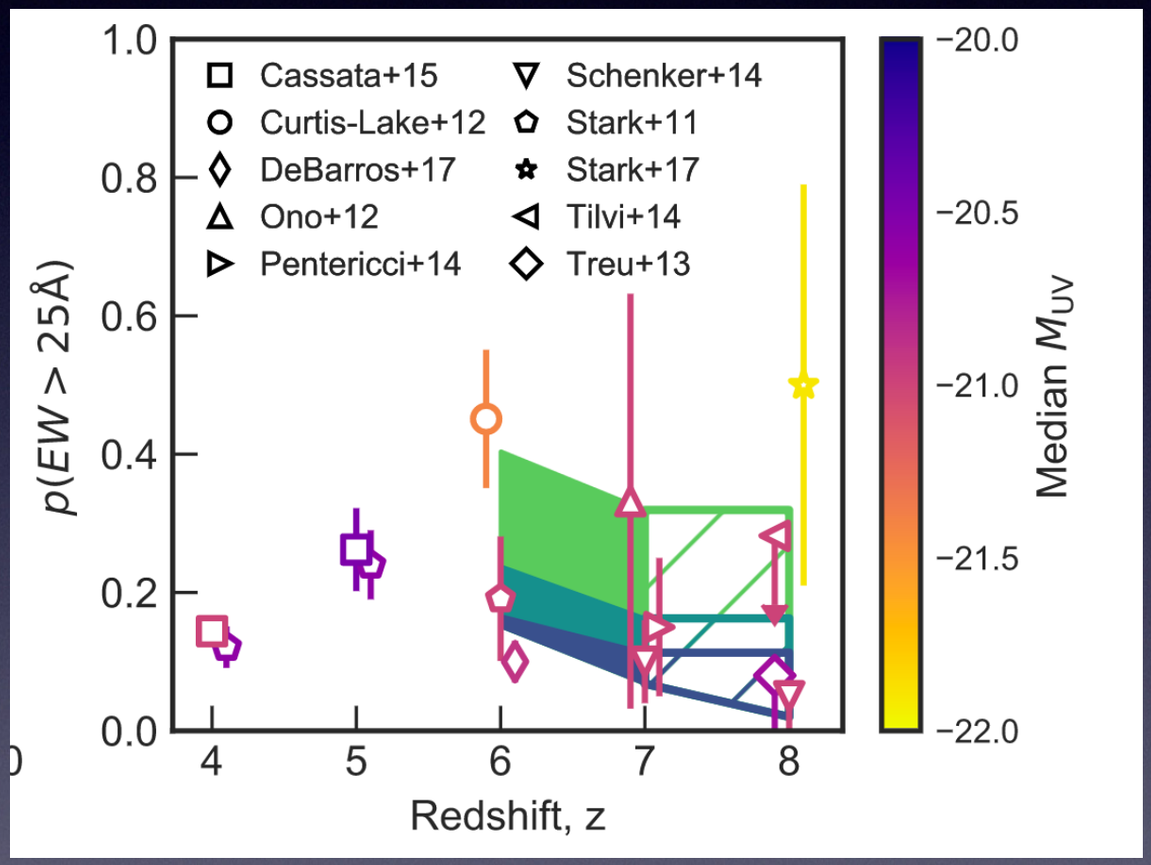
Does Mg II follow the same trend? Hard to say, need more dynamic range.

Is all of this just dust without resonant scattering?



Maybe sometimes. But, many of the escape fractions are clearly too low to be explained without resonant scattering.

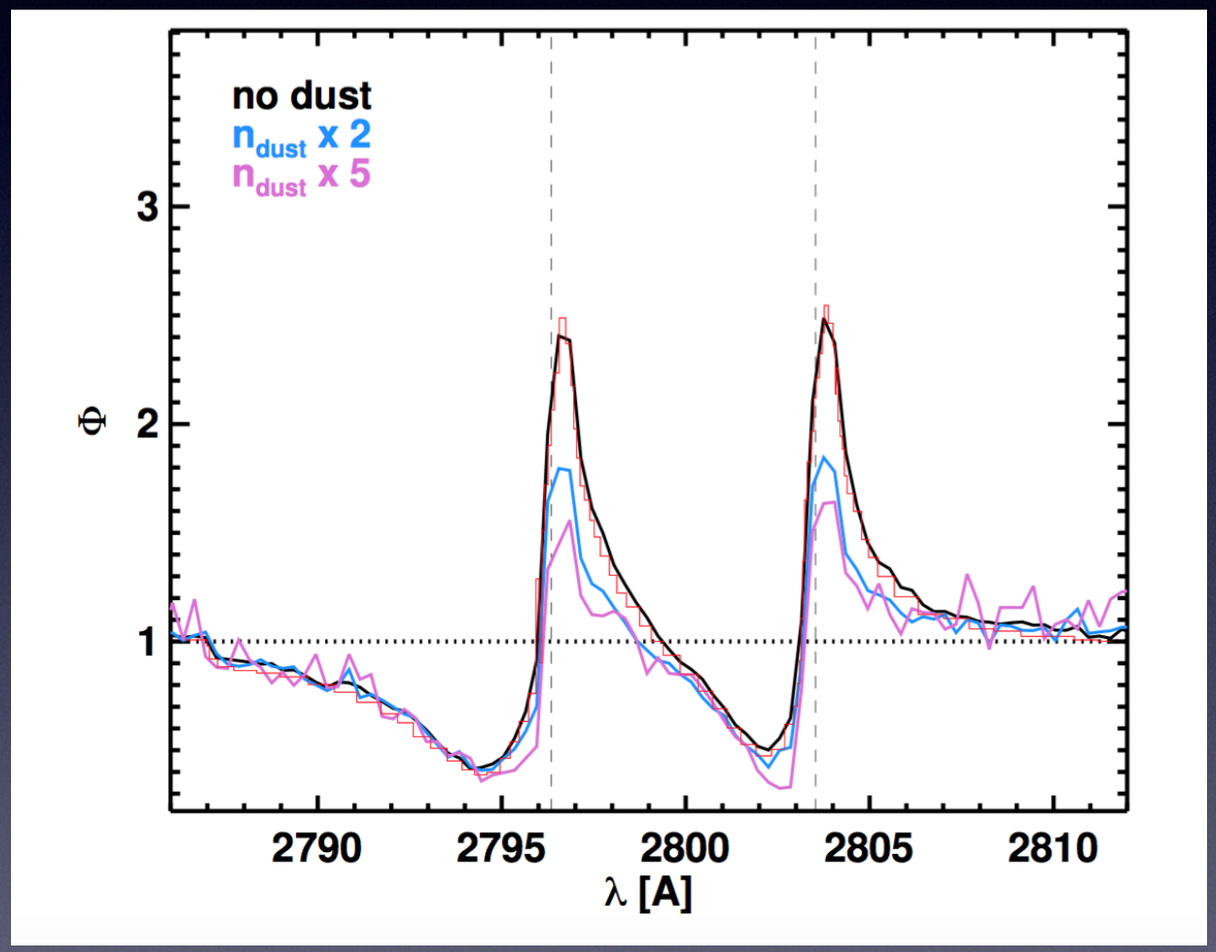
Conclusion I: If Mg II can predict Lyα, it will be very useful in the reionization epoch.



(Mason et al. 2018)

- Presently, inferences of IGM neutral fraction assume no evolution in the intrinsic Lyα properties. (Mg II is not impacted by neutral IGM due to low metallicity.)
- Lyα is one of our best predictors of LyC, but it is hard to observe in a neutral IGM.

Conclusion 2: Mg II may still teach us about outflows and the ISM/CGM…



(Garel, private communication)

- **But,** we must include scattering and nebular line photons in our models.
- The conditions that can produce consistent Lyα, LIS lines, and Mg II are an open question!
- (we should be careful about how we interpret resonant CIV emission)