Insight into LyC Escape by stacking z~0.3 HST/COS spectra

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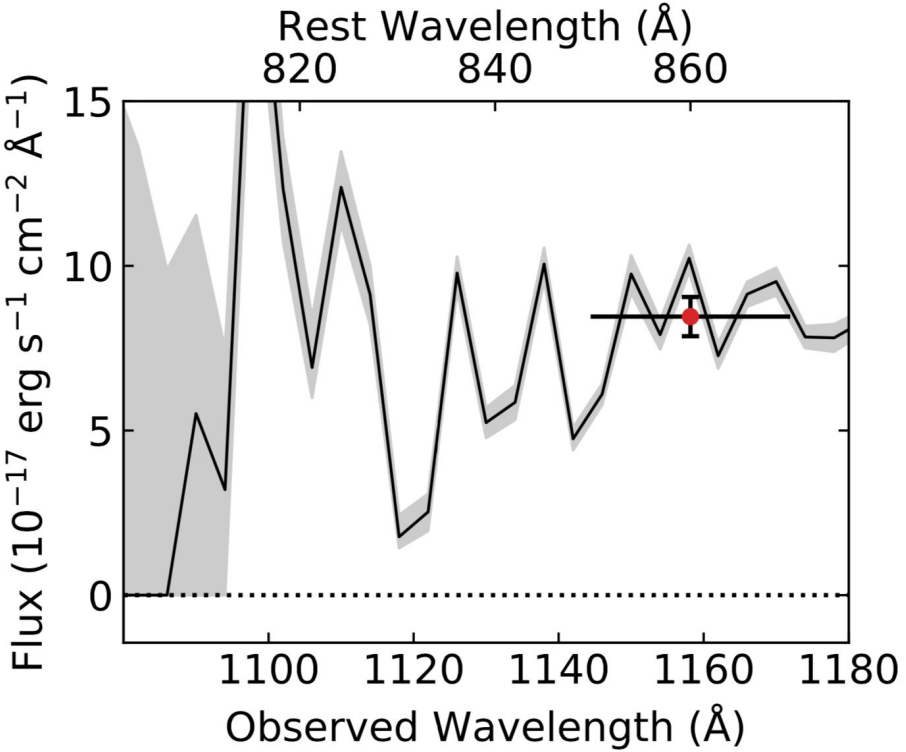
and the LzLCS collaboration

The LzLCS – Objectives and Successes

- Large HST program (134 orbits) observing 66 z~0.3 galaxies with COS G140L to measure Lyman continuum (LyC)
- combine with 23 LyC measurements from literature
- samples wide parameter space
- nearly triples local LyC detections
- found LyC emitters (LCEs) are heterogeneous
- diagnostics exhibit scatter



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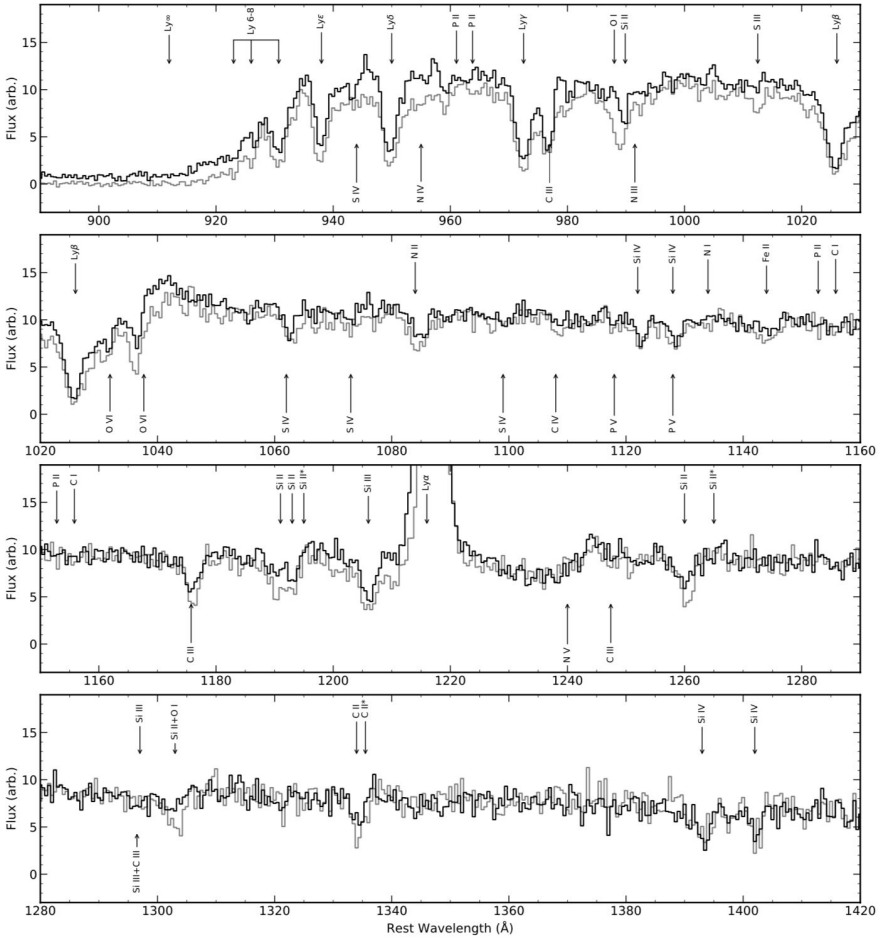
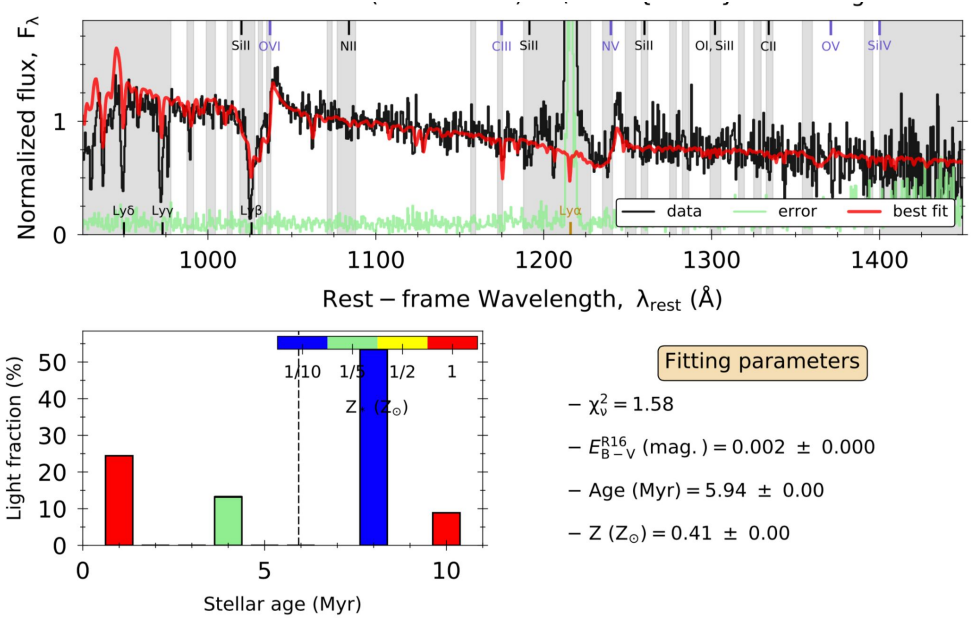
Open Questions

- Are the stellar populations and star formation history of LCEs unique?
- What is the geometry of gas in LCEs vs non-LCEs?
- Are there different types of LCEs?
- Need higher S/N – turn to stacking for answers
- Stack on different properties: O_{32}, fesc, Sigma_SFR, etc



Stellar Populations

- Fit stacks using FICUS*
- SB99 templates with custom CLOUDY nebular components
- Light-weighted properties
- Light and mass fractions as diagnostics



*https://github.com/asalda/FiCUS

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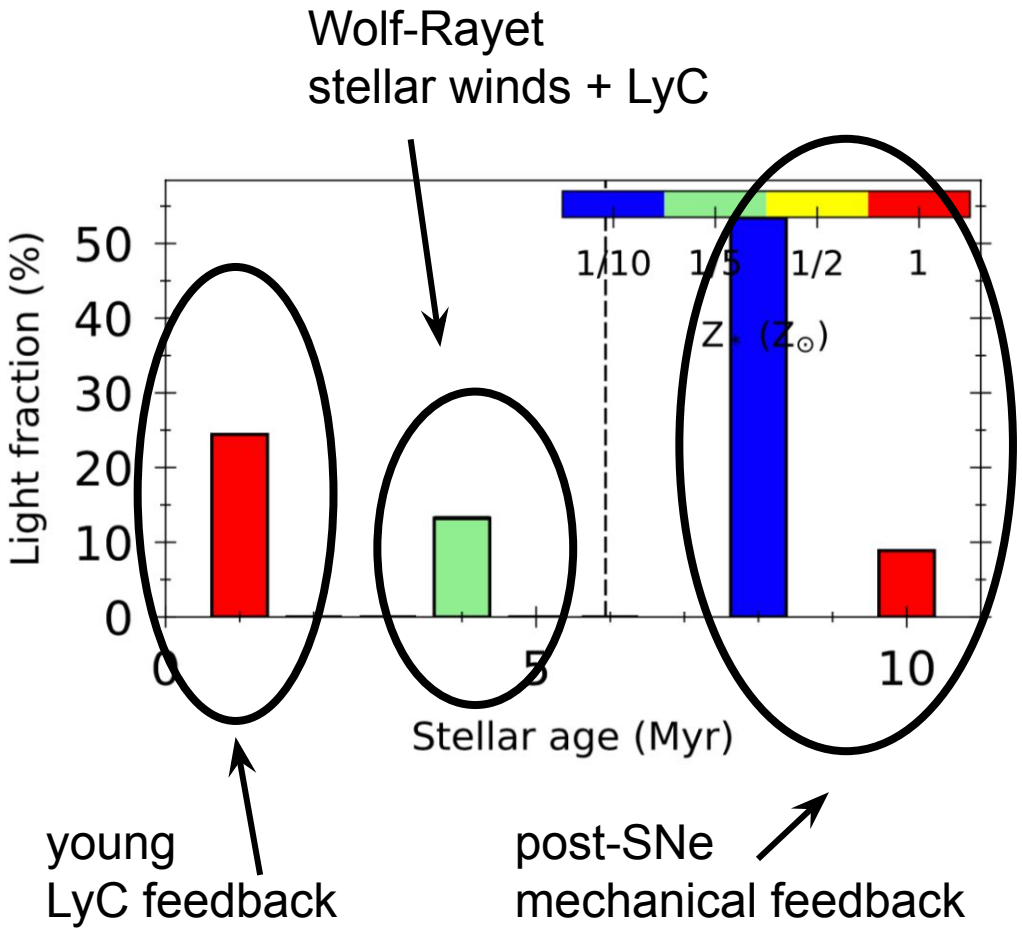

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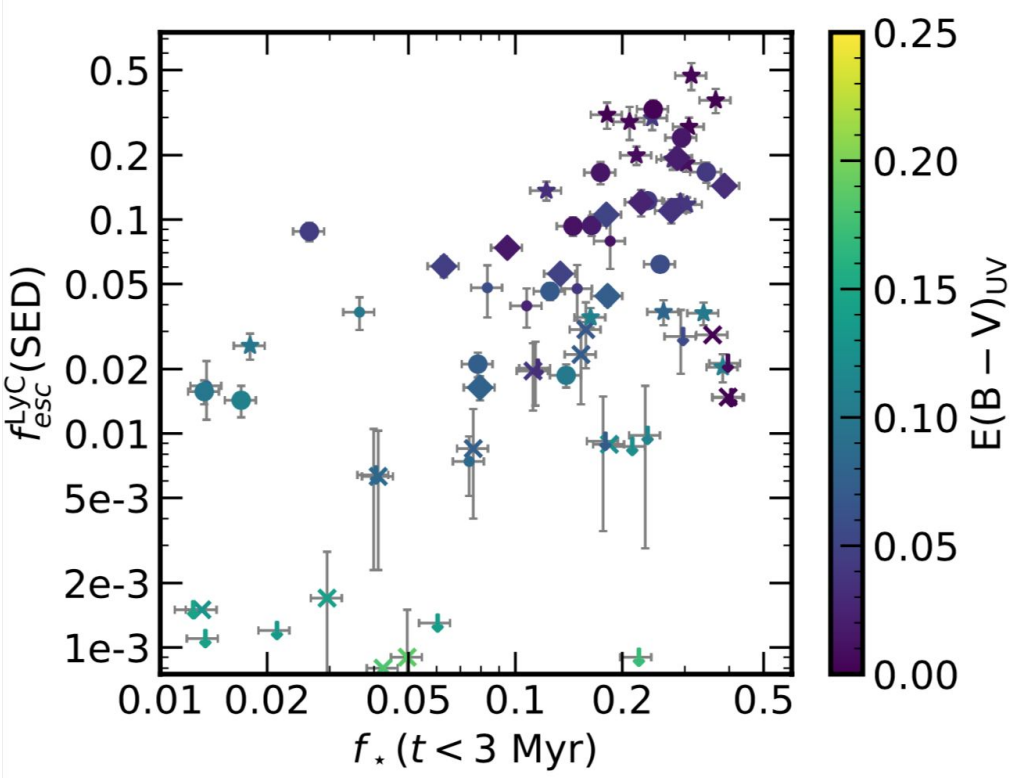
Stellar Populations

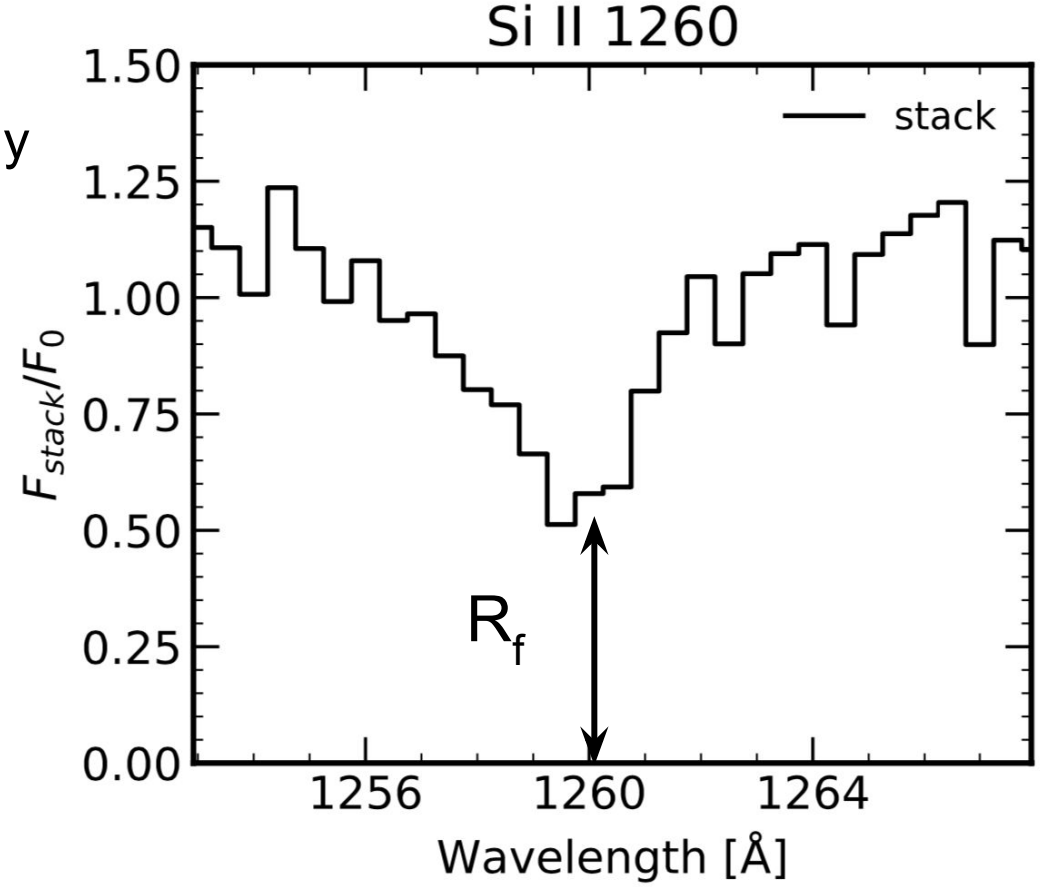
- Dust attenuation at least as important as 1-2 Myr pops

		f_{esc}^{LyC}	
↓	non-LCE	×	< 1%
○	LCE	∘	1-5%
◇	total	✡	> 5%



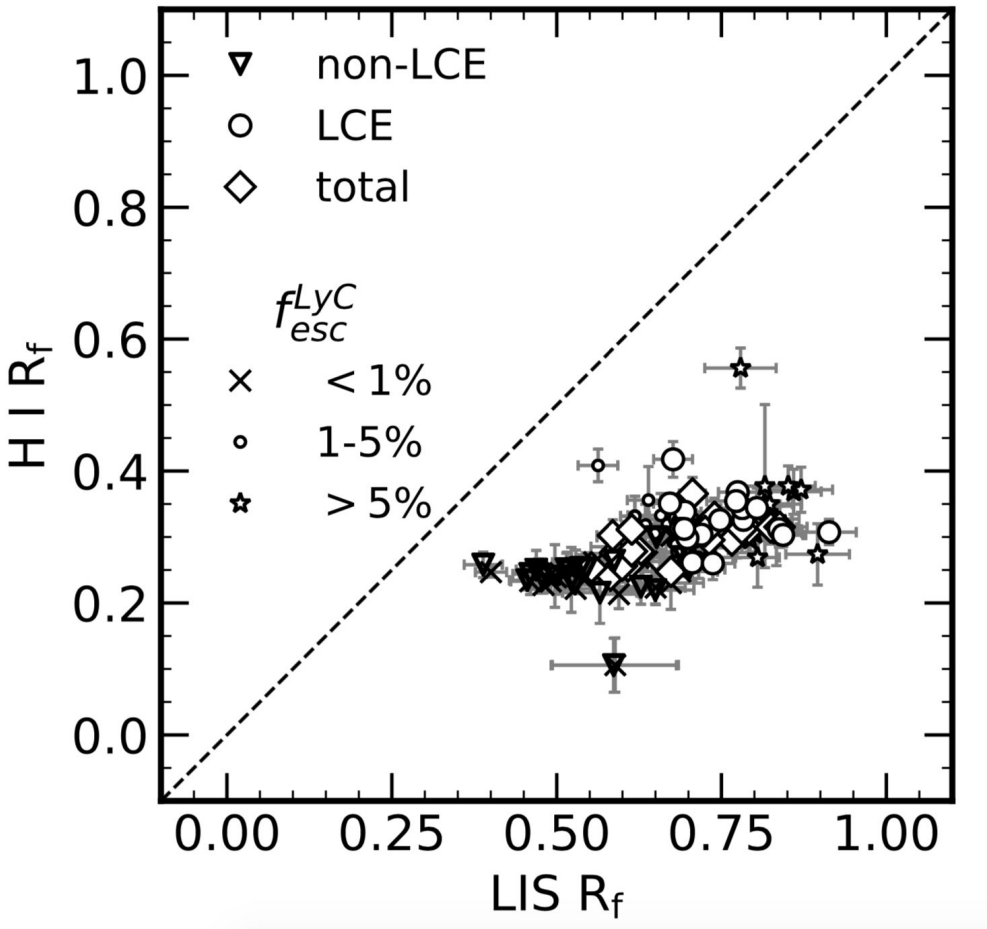
ISM Geometry

- calculate W_λ and R_f for many lines of various ion species
- weighted average of ion species classes to lower uncertainty



ISM Geometry

- calculate W_λ and R_f for many lines of various ion species
- weighted average of ion species classes to lower uncertainty
- marked differences in R_f
- correlation with metallicity is weak (corr = -0.094)



The R_f Discrepancy

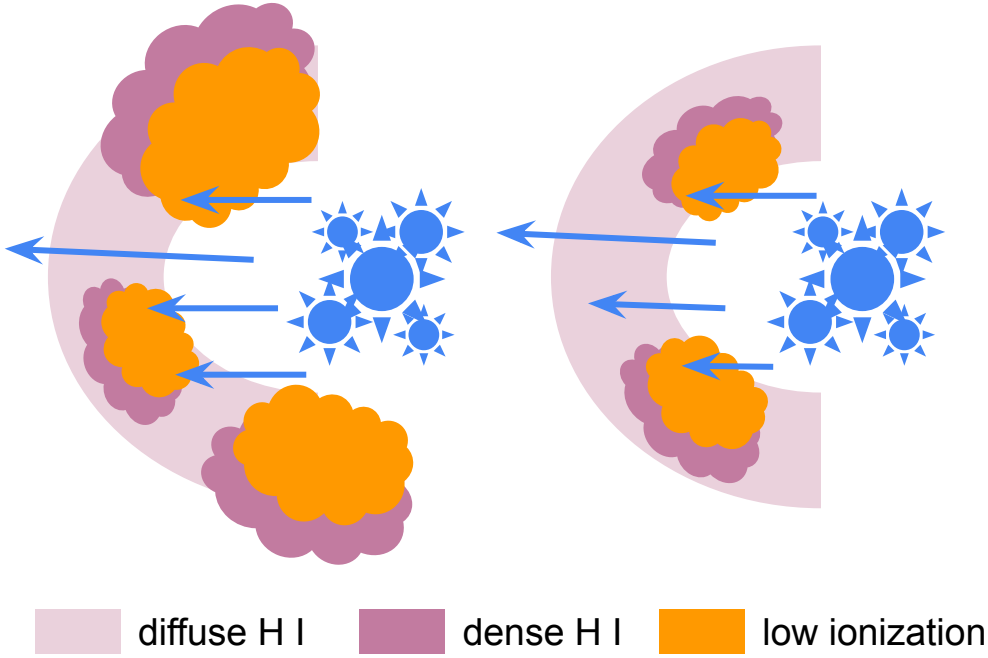
- discrepancy as optical depth τ

$$\tau = -\ln\left[1 - \frac{1 - R_f(\text{LIS})}{1 - R_f(\text{H I})}\right]$$

  - low τ = less LIS relative to H I
  - high τ = more LIS relative to H I
- brute force ionization?

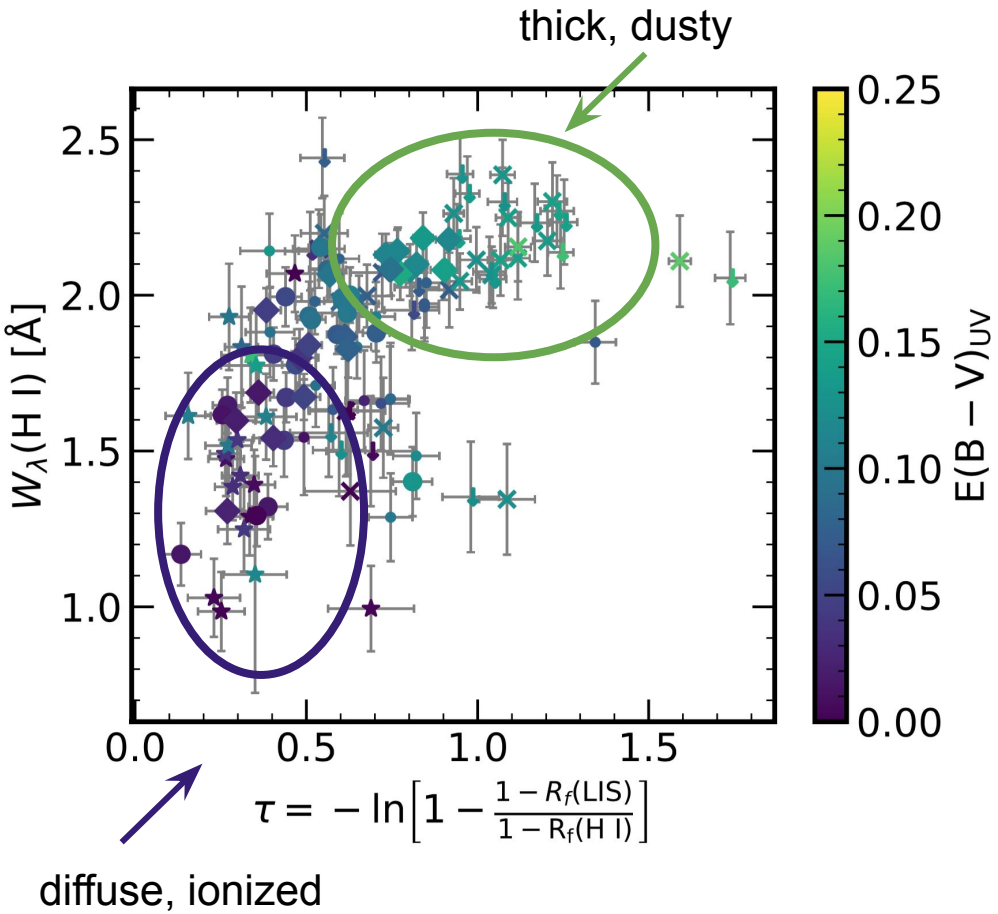
high τ:
thick, dense

low τ:
thin, diffuse



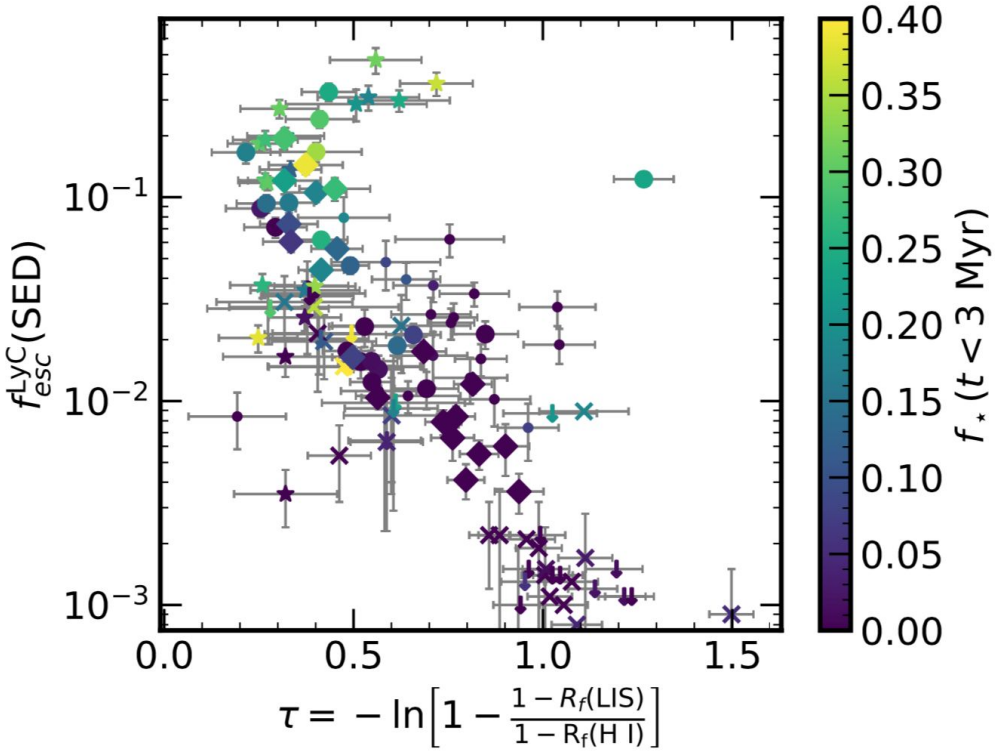
The R_f Discrepancy

- H I R_f systematically lower than LIS
- correlation with metallicity is weak
- discrepancy as optical depth
- varies with Lyα W_λ, H I W_λ, E(B-V)
- suggests a depth/geometry effect with less H I at lower τ



ISM Geometry and Stellar Populations

- depth/geometry correlates with prevalence of young (<3 Myr) stellar populations
- young pops + less LIS-H I agreement + less H I + less dust all correspond to LyC escape



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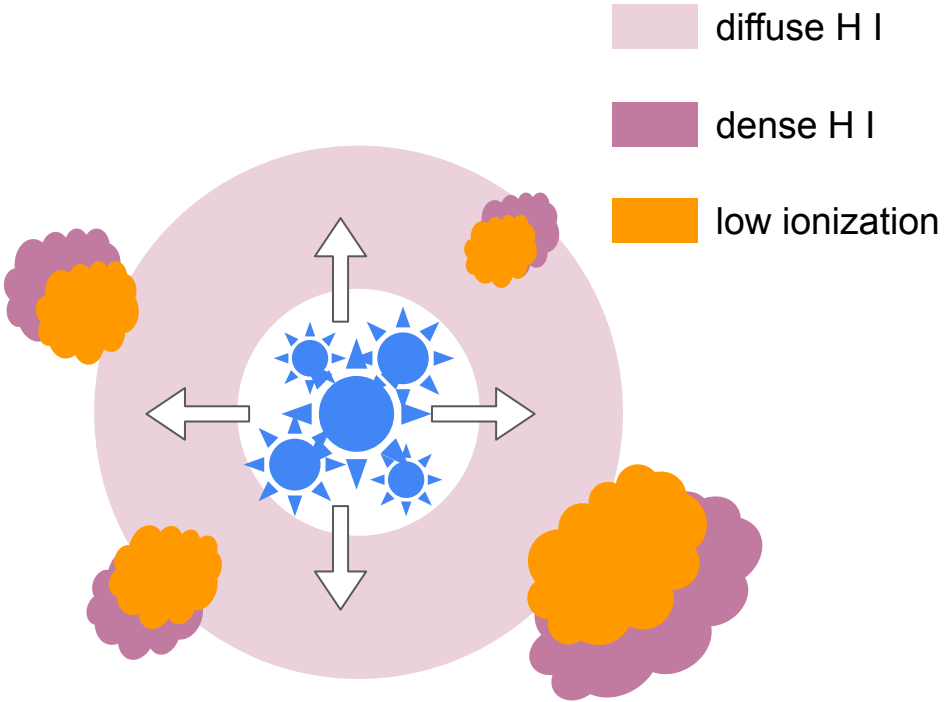
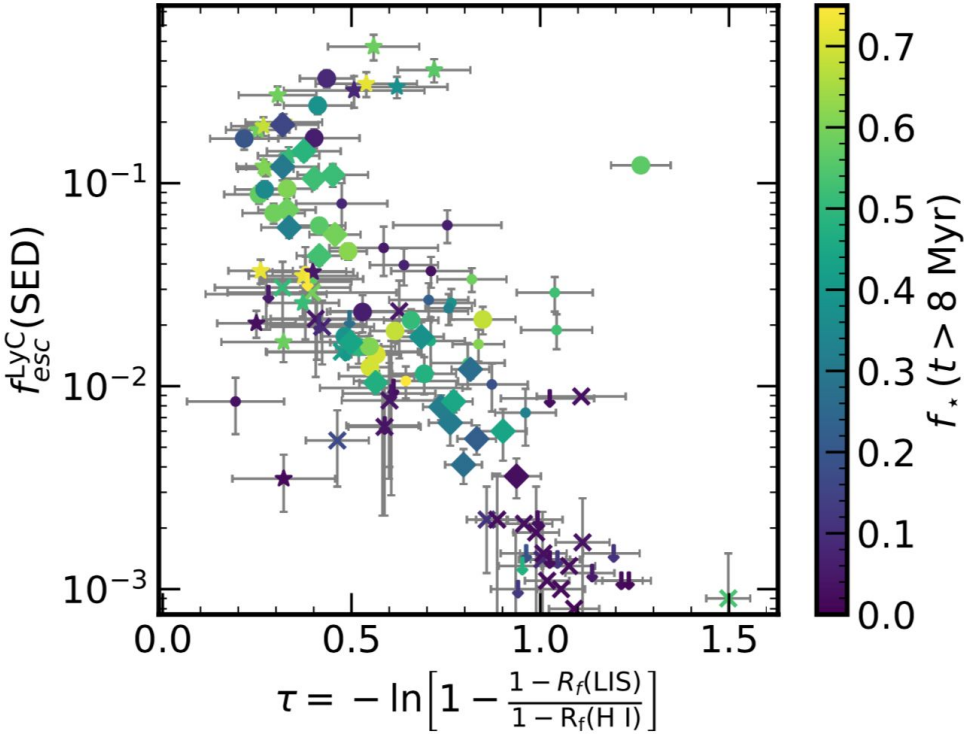


ISM Geometry and Stellar Populations

- depth/geometry correlates with prevalence of young (<3 Myr) stellar populations
- young pops + less LIS-H I agreement + less H I + less dust all correspond to LyC escape
- SNe feedback/burstiness common but not required



Summary

- stacking of FUV spectra of z~0.3 galaxies with LyC measurements to investigate
  – stellar populations + dust
  – neutral/low-ionization gas
- gas geometry correlates with dust, young (<3 Myr) stellar populations
- SNe feedback role unclear
- young pops, less LIS/H I, less H I, less dust facilitate LyC escape
- pending tests with CLOUDY