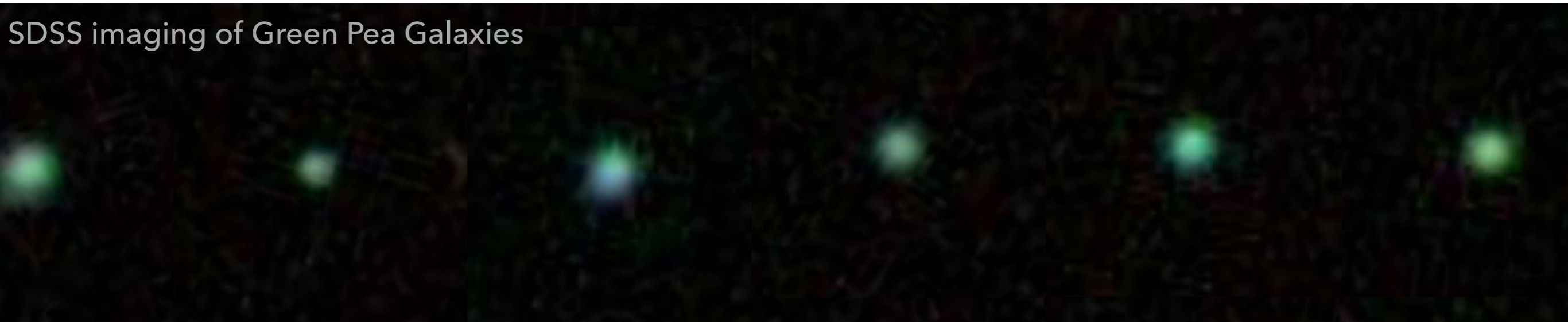


SDSS imaging of Green Pea Galaxies



Wednesday, 12 September 2018
Escape of Lyman Radiation from Galactic Labyrinths

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NEUTRAL GAS PROPERTIES AND LYA ESCAPE IN HIGHLY IONIZED GREEN PEAS

Collaborators

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Dr. James Lowenthal (Smith College)

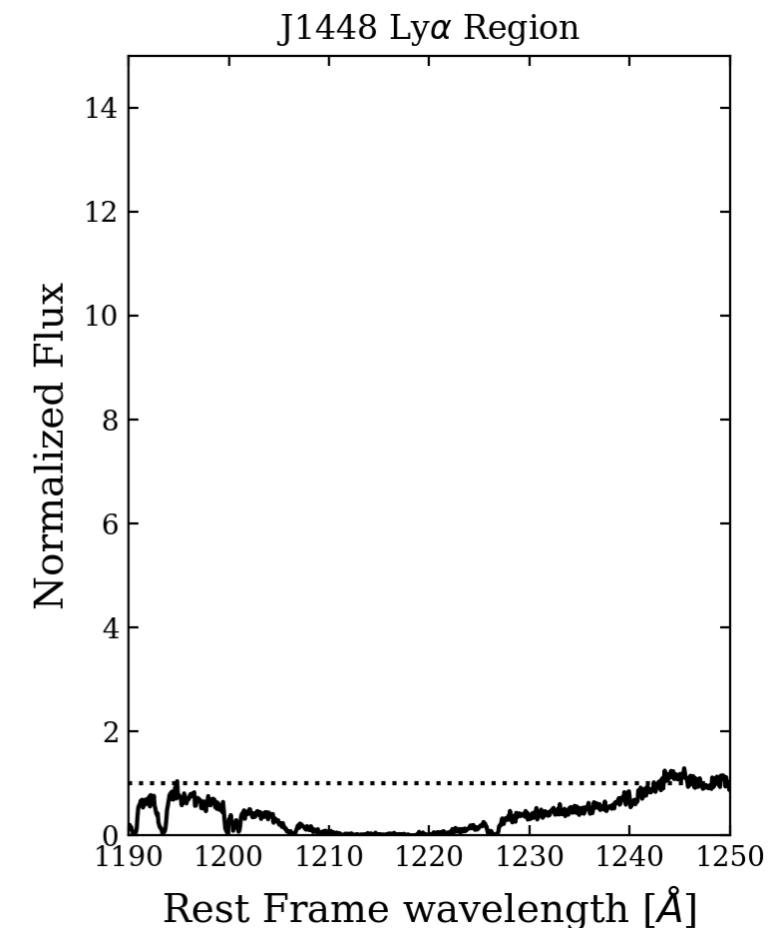
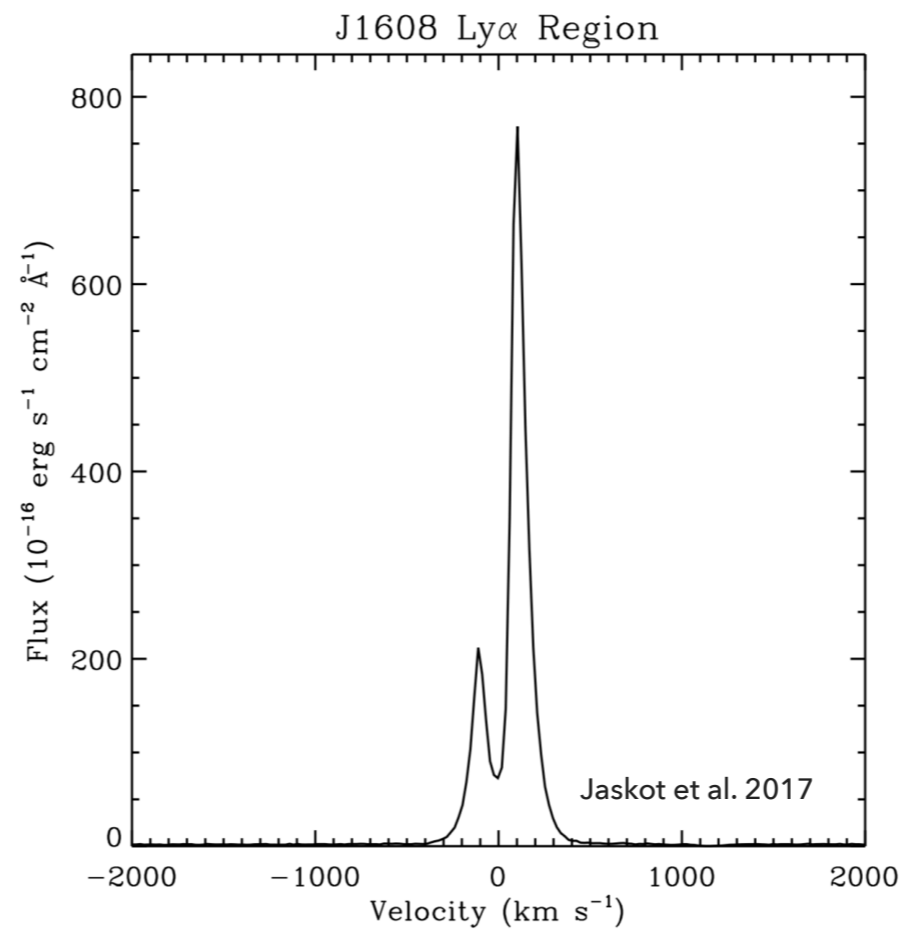
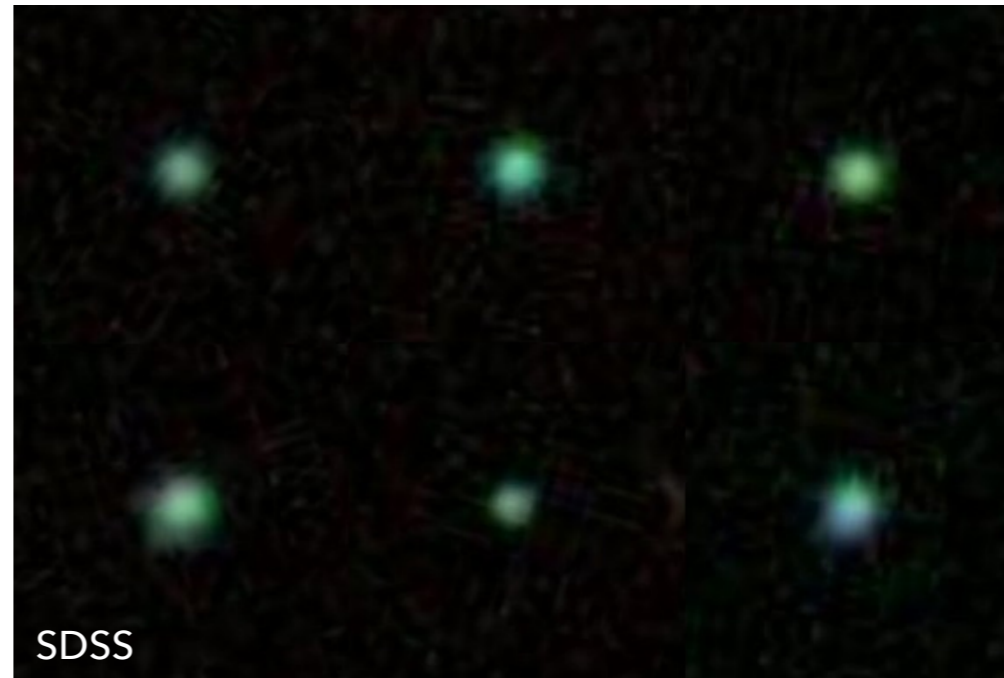


Green Peas - studying $\text{Ly}\alpha$ escape at low redshift

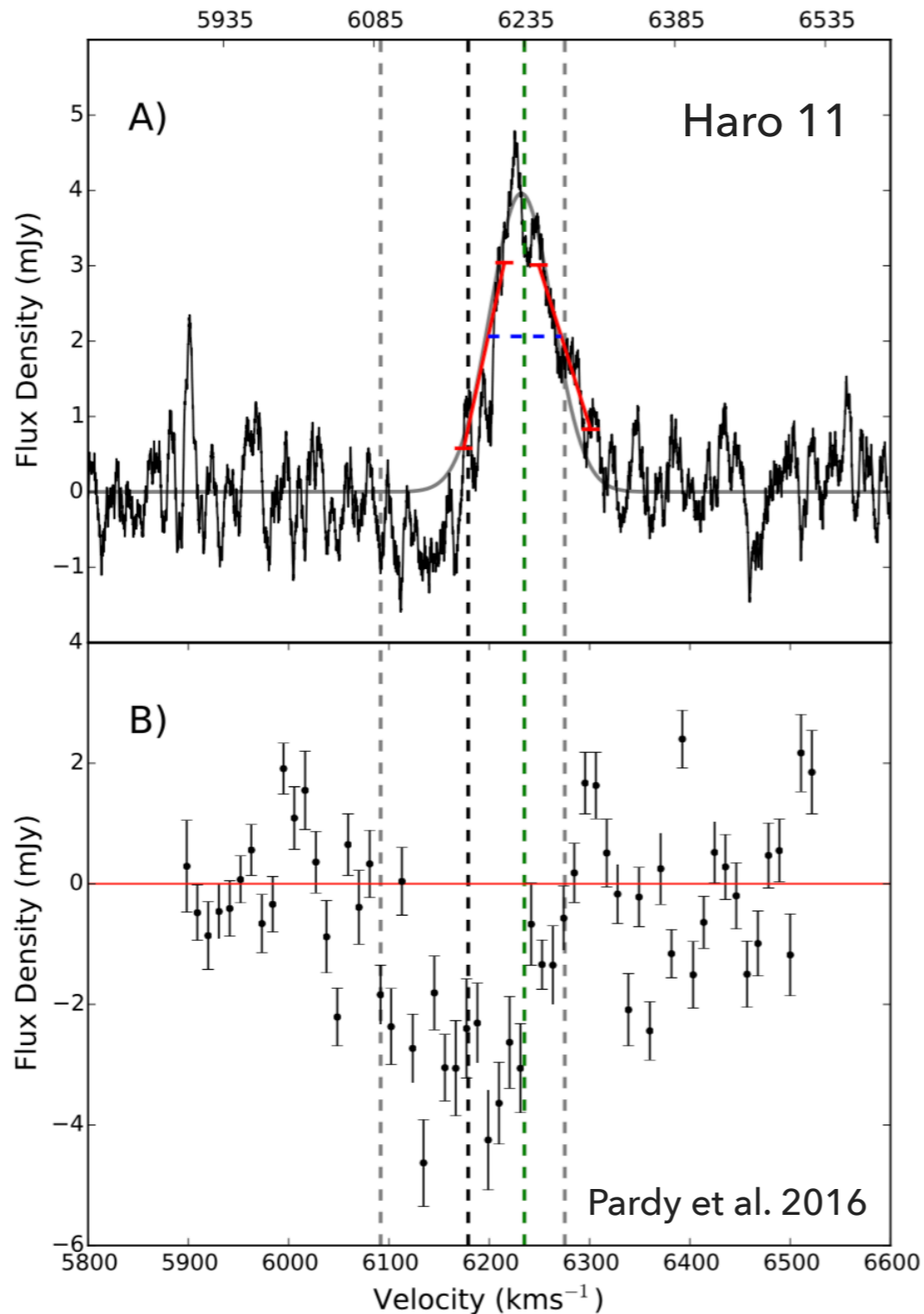
- ▶ $z < 0.2$
- ▶ Highly Ionized.

$$O_{32} = [\text{OIII}]\lambda 5007 / [\text{OII}]\lambda 3727 = 6 \sim 35$$

- ▶ Strong, narrow double-peaked $\text{Ly}\alpha$ emission (low optical depth?)
- ▶ What are the HI characteristics of the GPs?

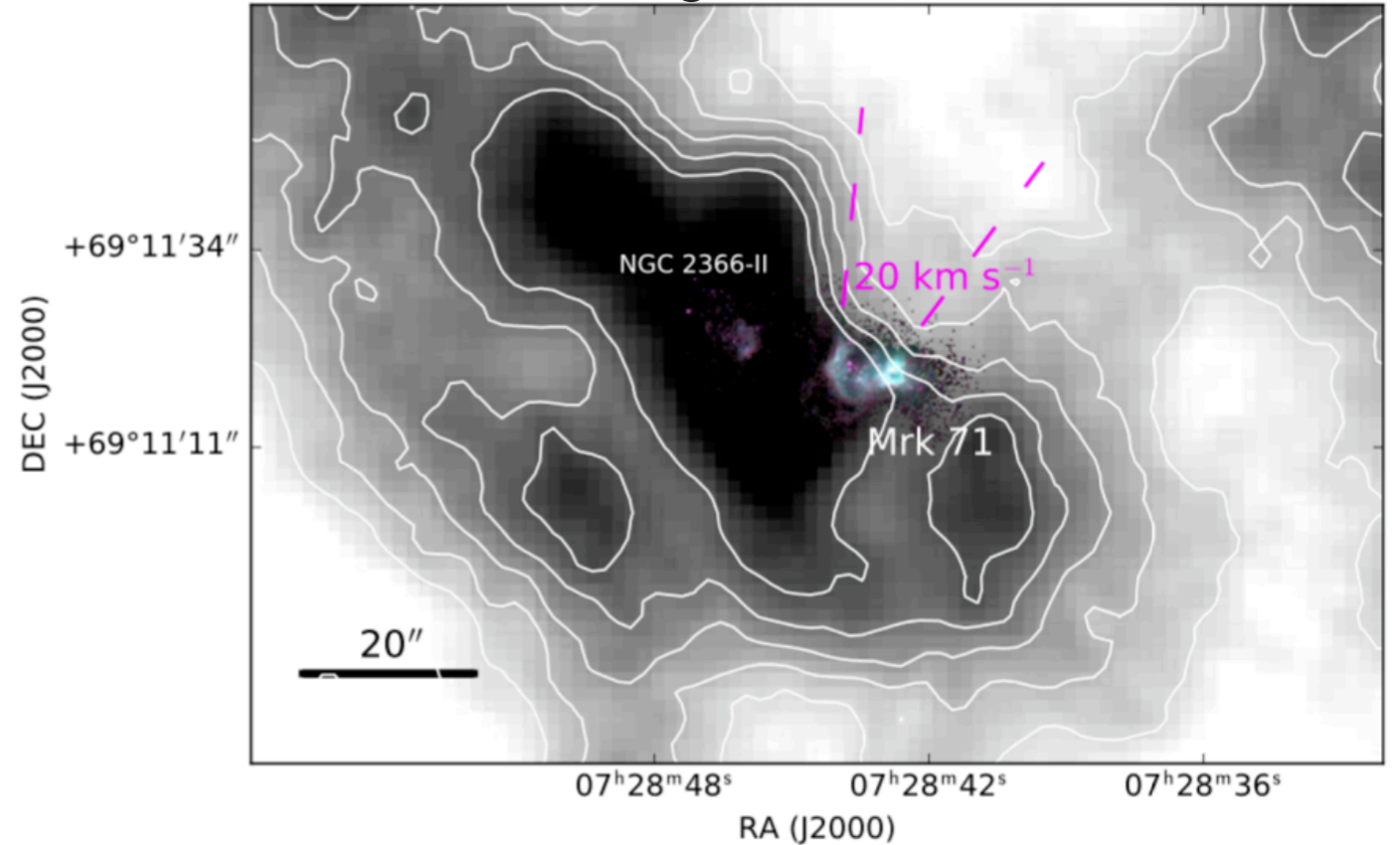


Probing the Neutral Gas in Green Peas (1) – Very Large Array



Mrk 71 (GP analog)

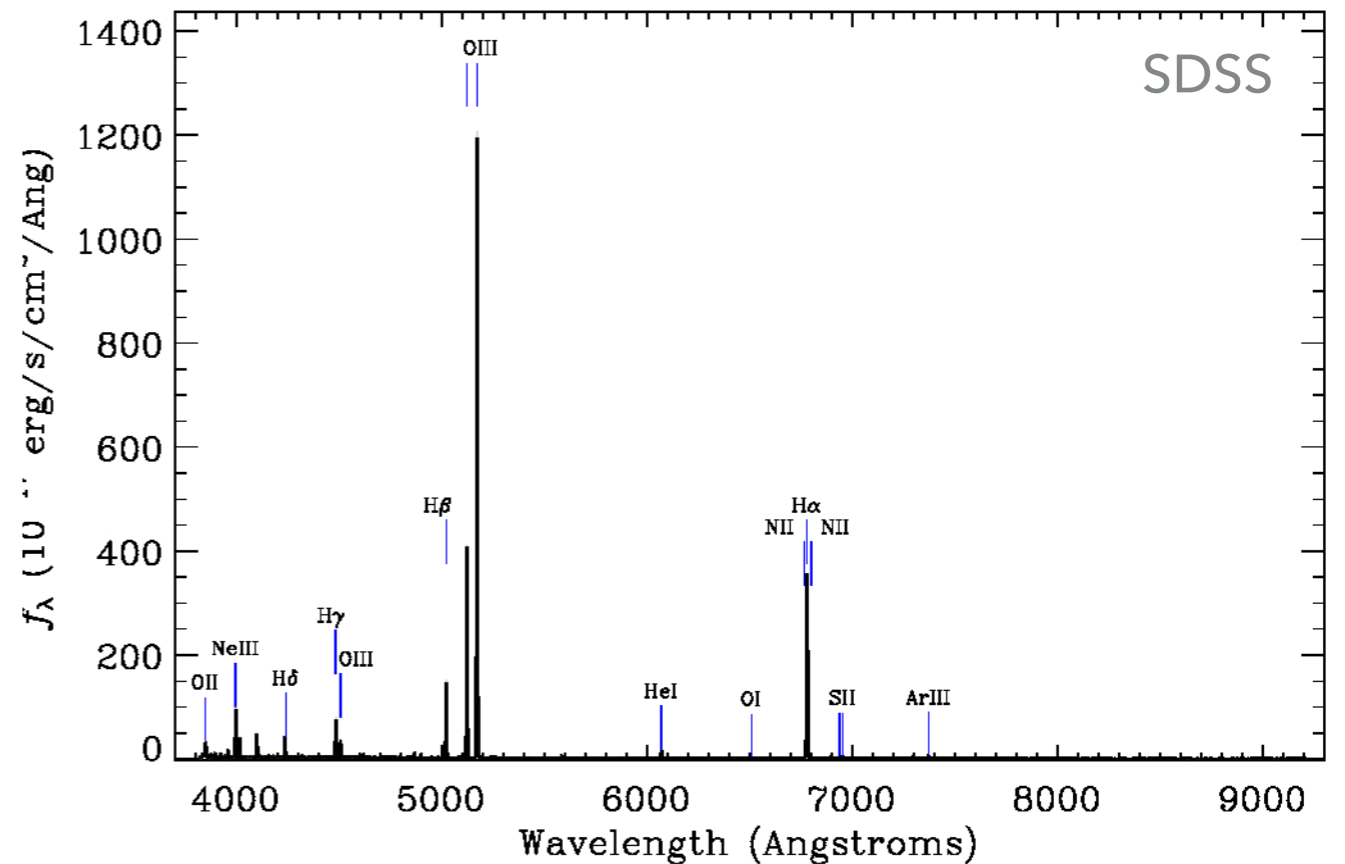
Micheva et al. 2017



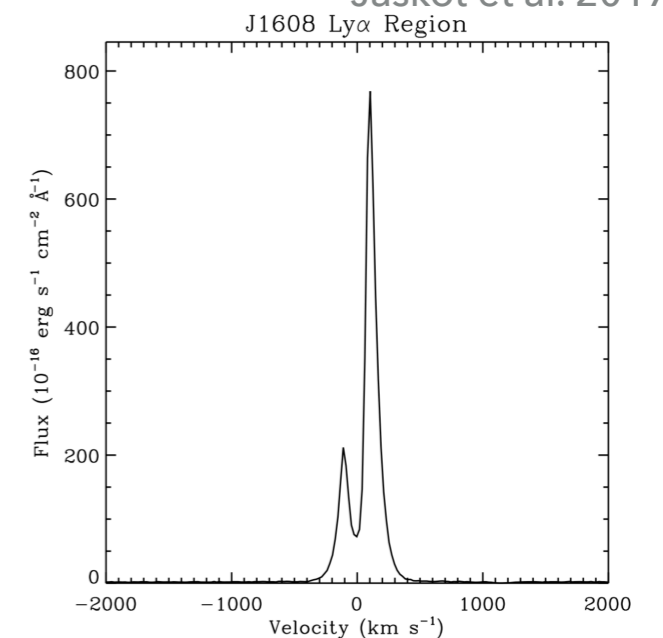
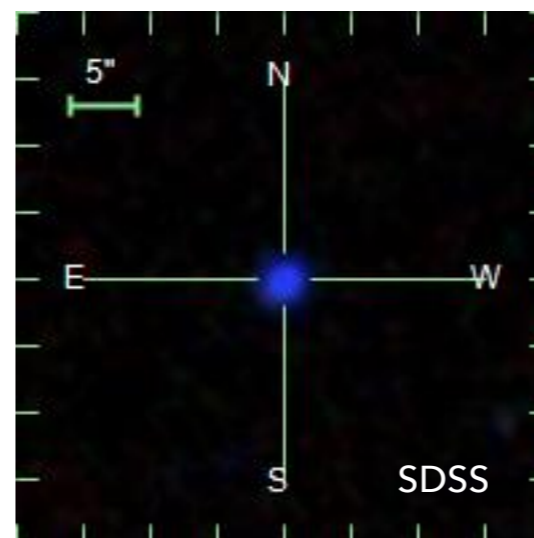
J1608+3528 - The most highly ionized SFG in SDSS

- ▶ $O_{32} \approx 35$
- ▶ Low Ly α peak separation of 214 km/s
- ▶ $f_{esc}^{Ly\alpha} = 16\%$
- ▶ High specific-SFR
- ▶ SFR and UV+optical colors predict a high HI gas mass fraction of

$$\frac{M_{HI}}{M_*} \equiv f_{HI} \sim 20 - 400$$

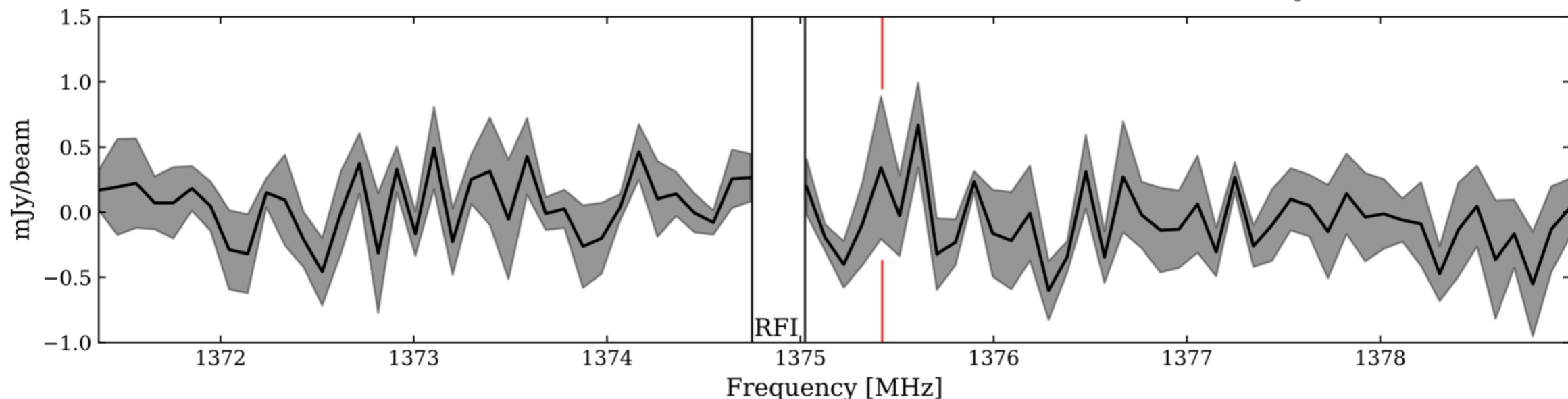
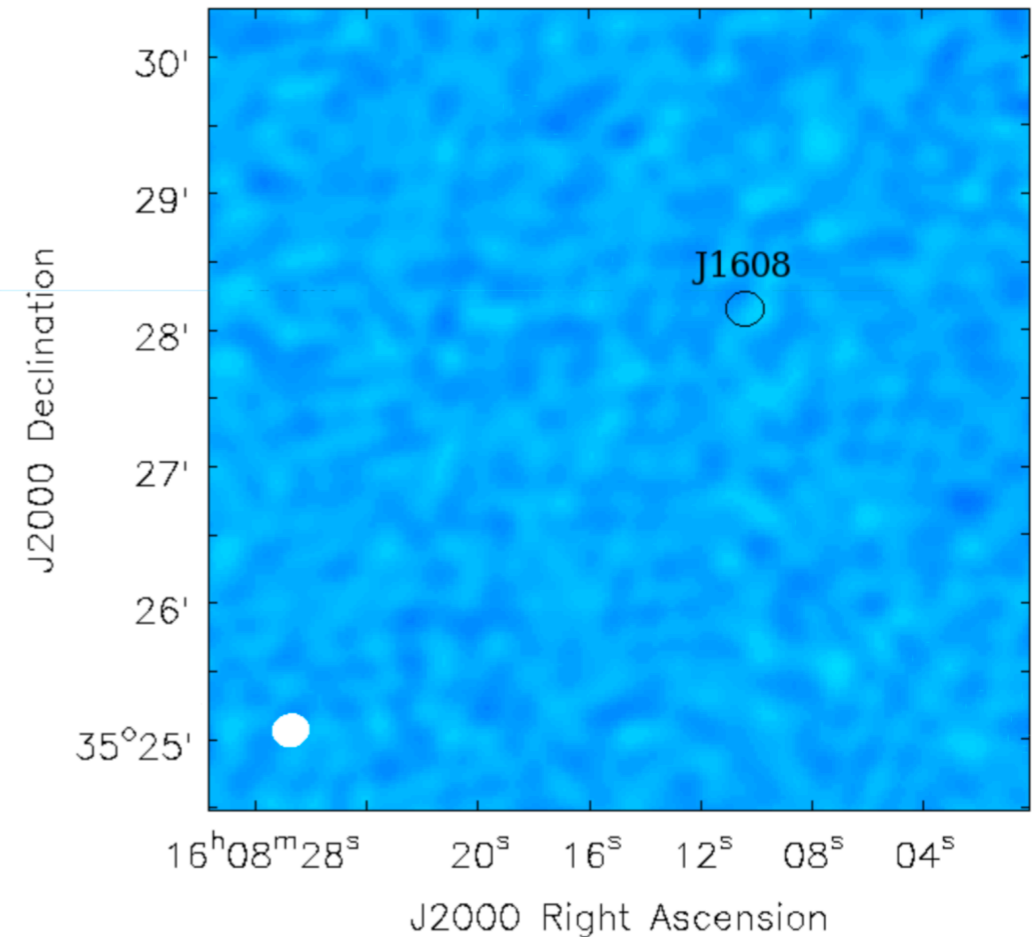


Jaskot et al. 2017

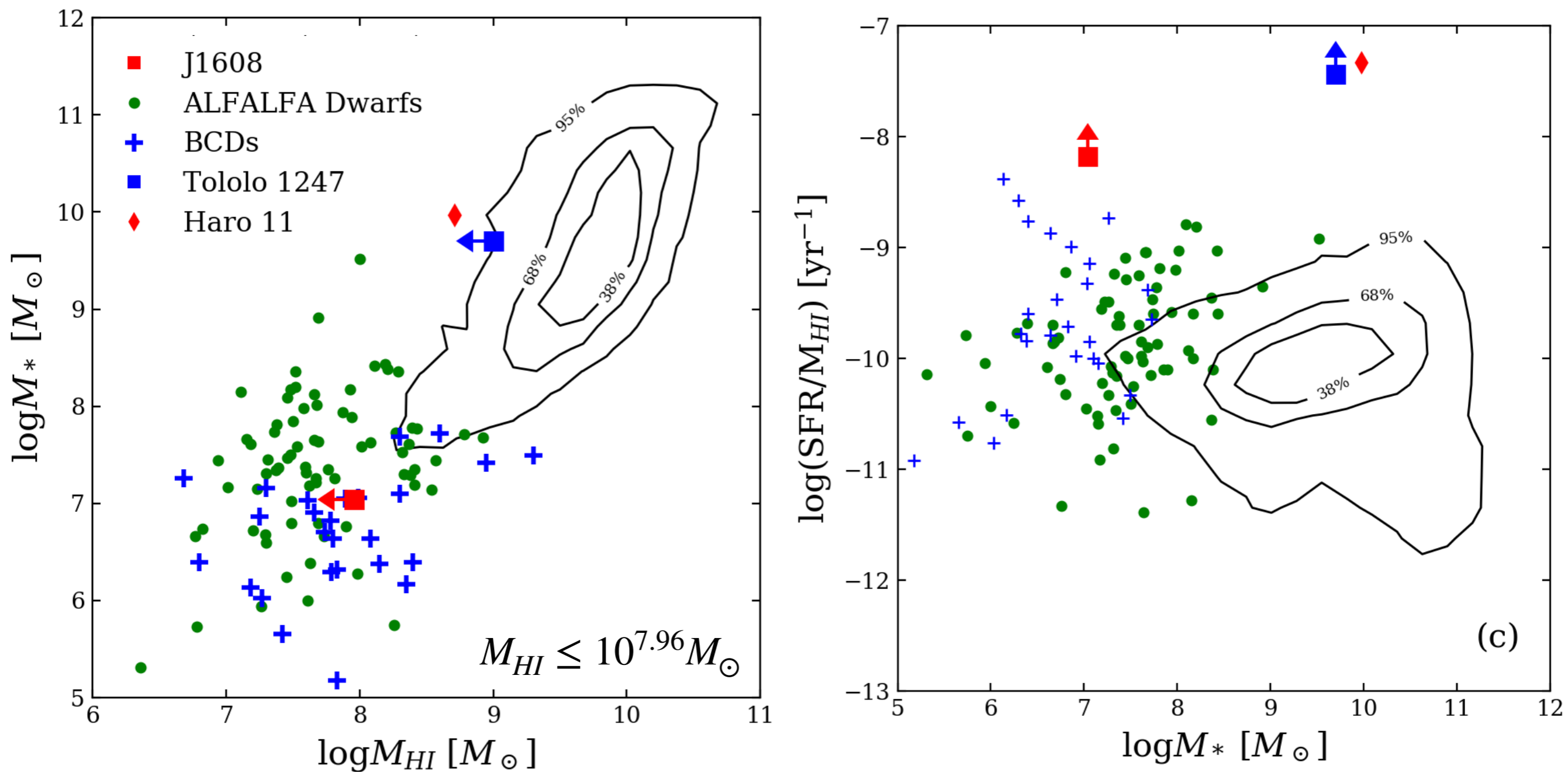


J1608 - Very Large Array (VLA) observations

- ▶ L-band (1-2 GHz) imaging
- ▶ $RMS = 0.13$ mJy/beam
- ▶ $M_{HI} \leq 10^{7.96} M_{\odot}$
- ▶ $f_{HI} \leq 8.41$
- ▶ **Measured HI limit is less than all predictions.**



J1608 - Comparison with Other Galaxies

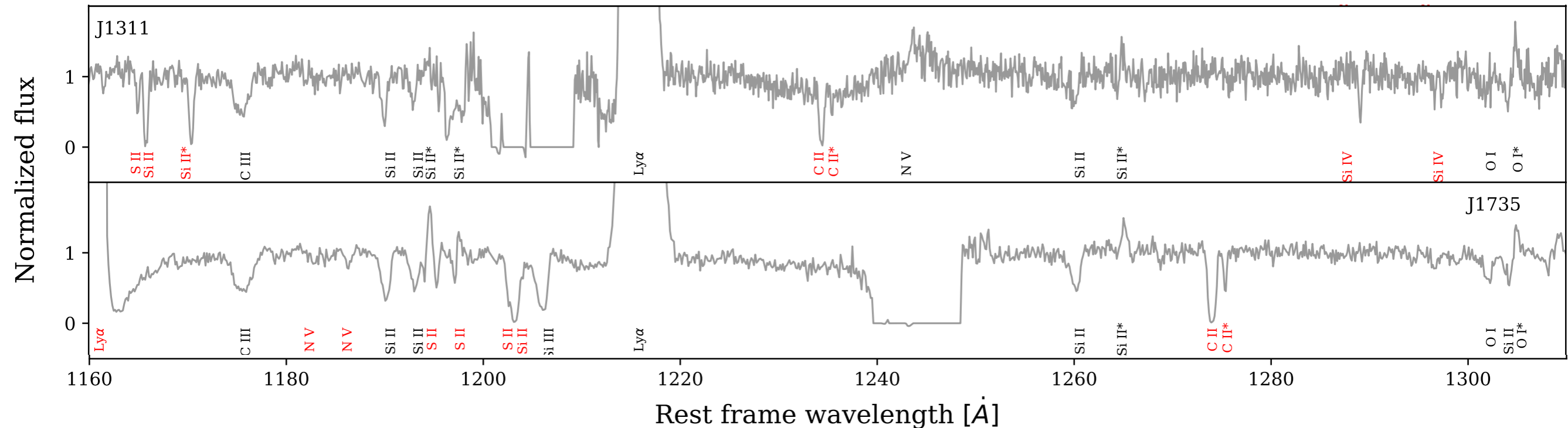


J1608 may be typical in terms of HI and stellar mass, but has a highly unusual SFR, similar to confirmed LCEs.

Probing the Neutral Gas in Green Peas (2) - HST COS



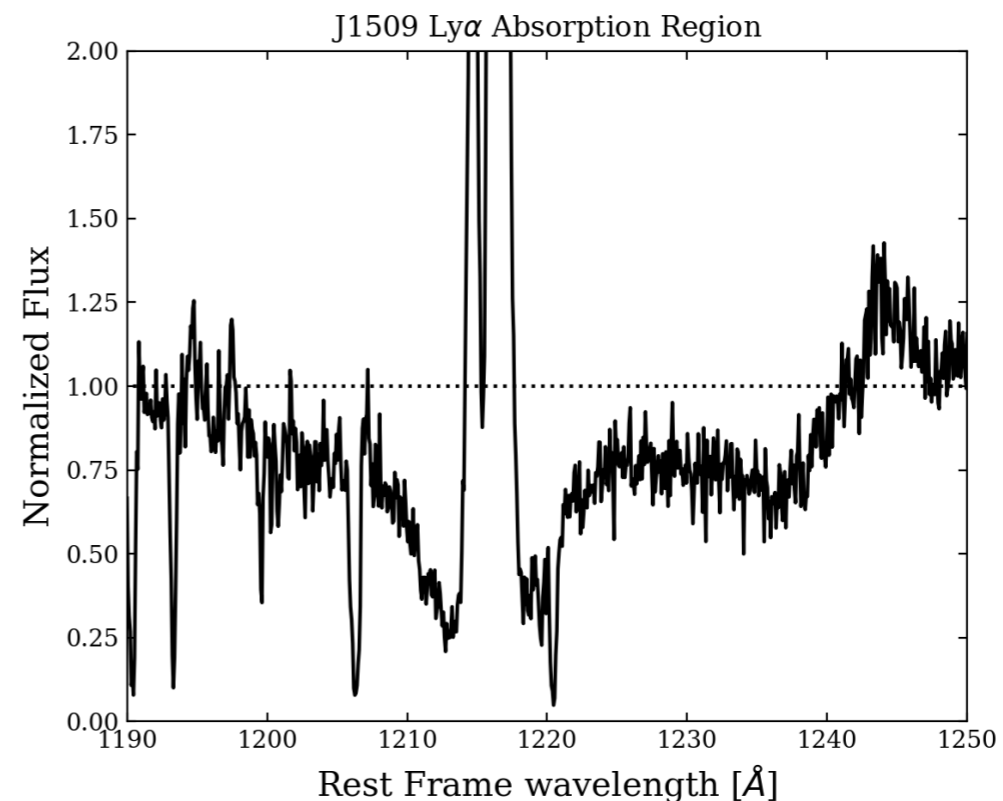
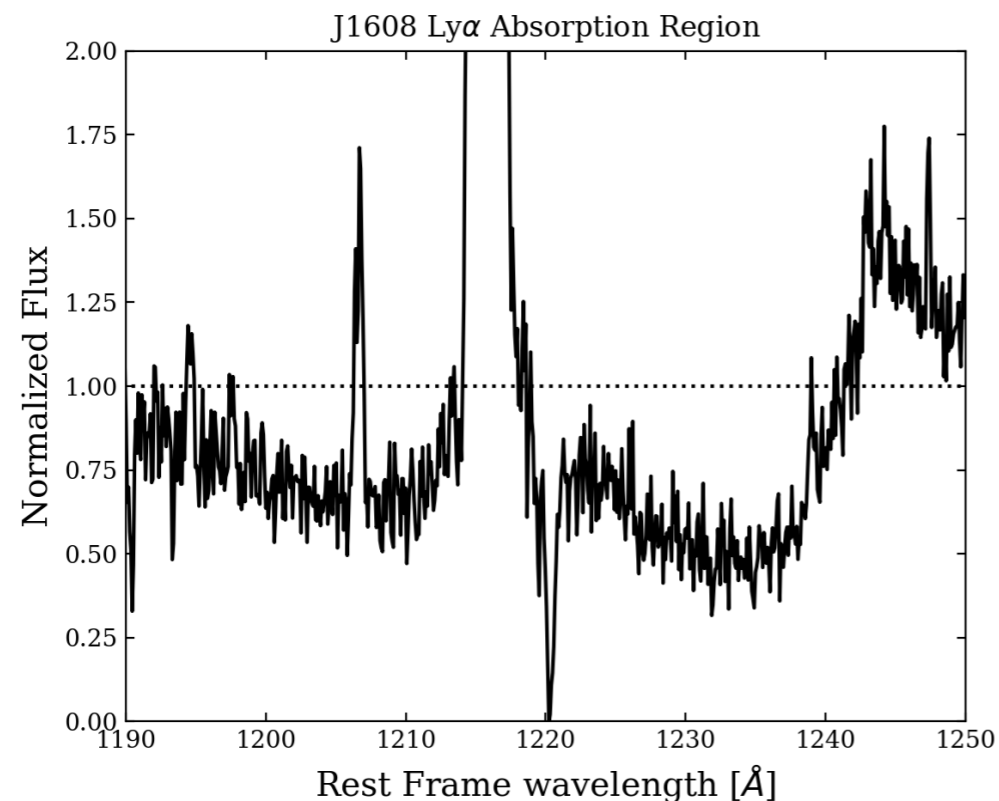
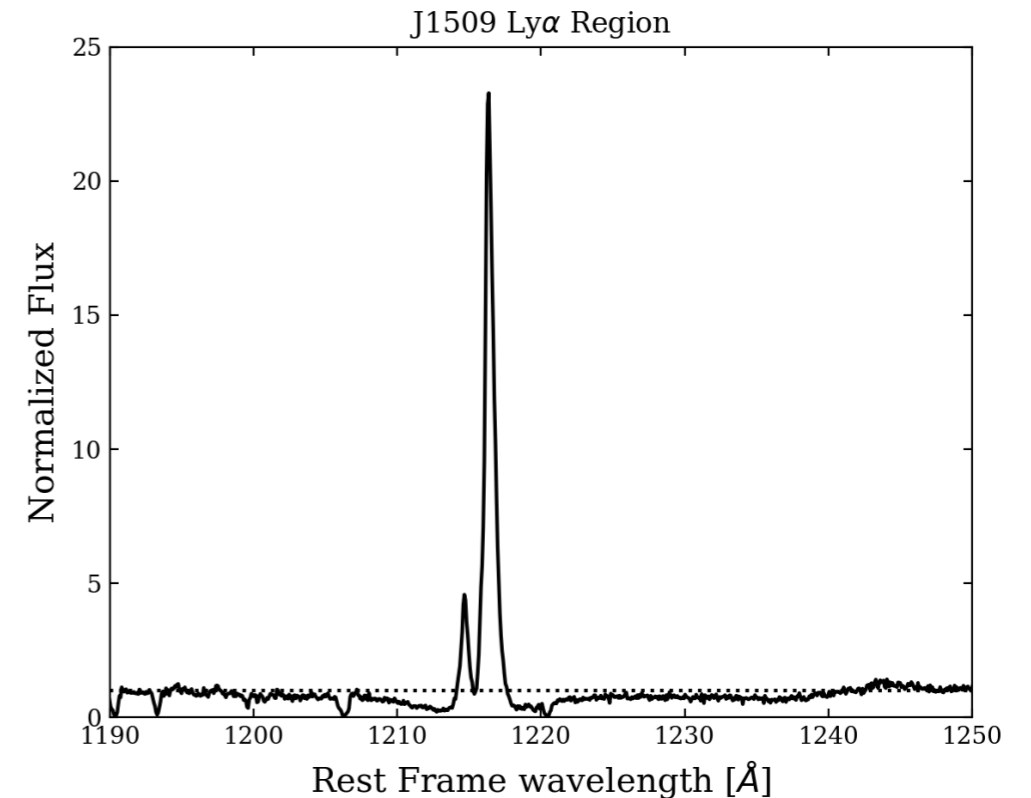
- ▶ UV spectra of 17 highly ionized Green Peas.



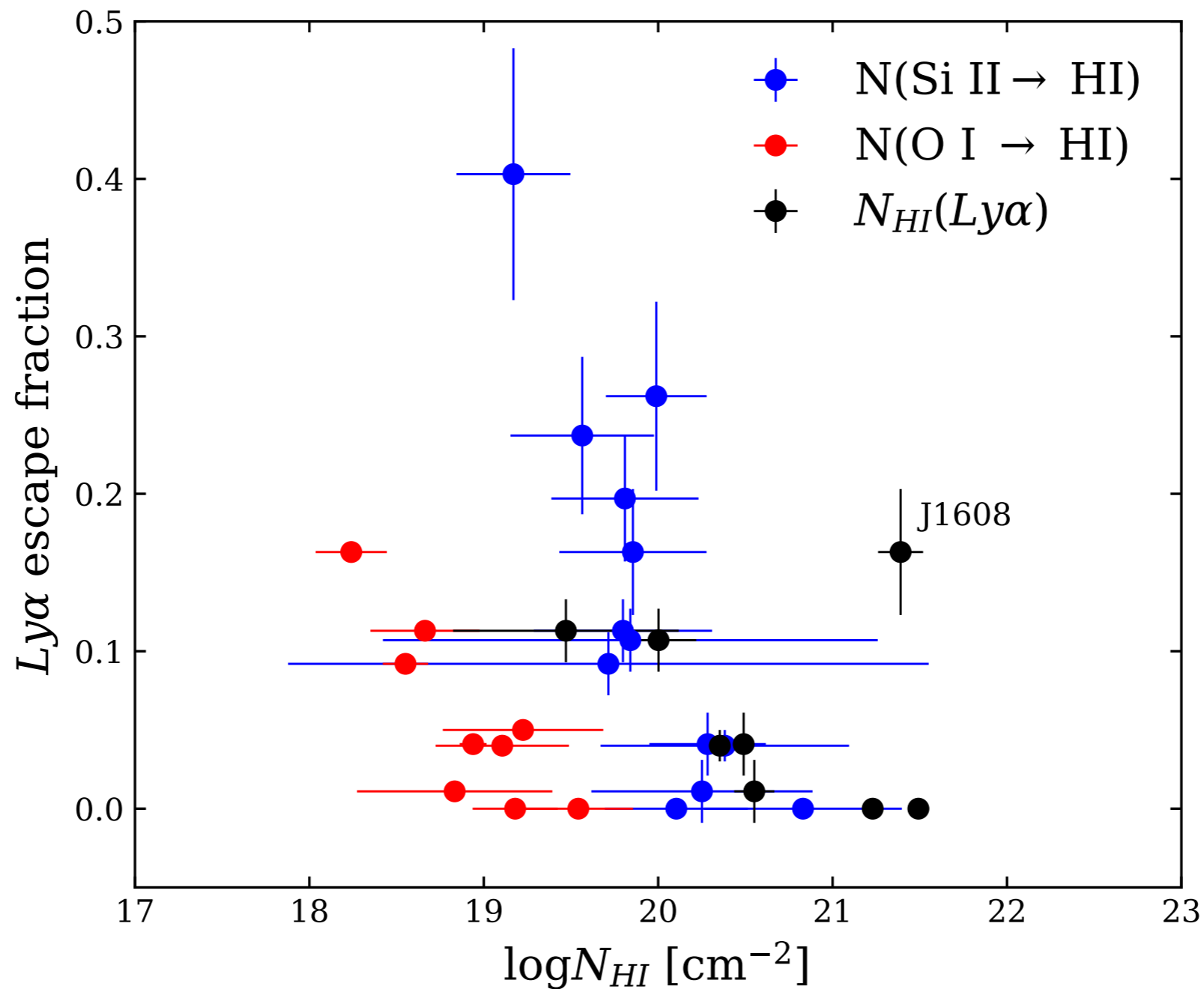
- ▶ A wealth of low-ionization UV absorption lines, and Ly α absorption.

Ly α escape in Green Peas - what do we see?

- ▶ Strong Ly α emission + deep Ly α absorption
- ▶ How do we reconcile deep Ly α absorption with other signatures of low optical depth?

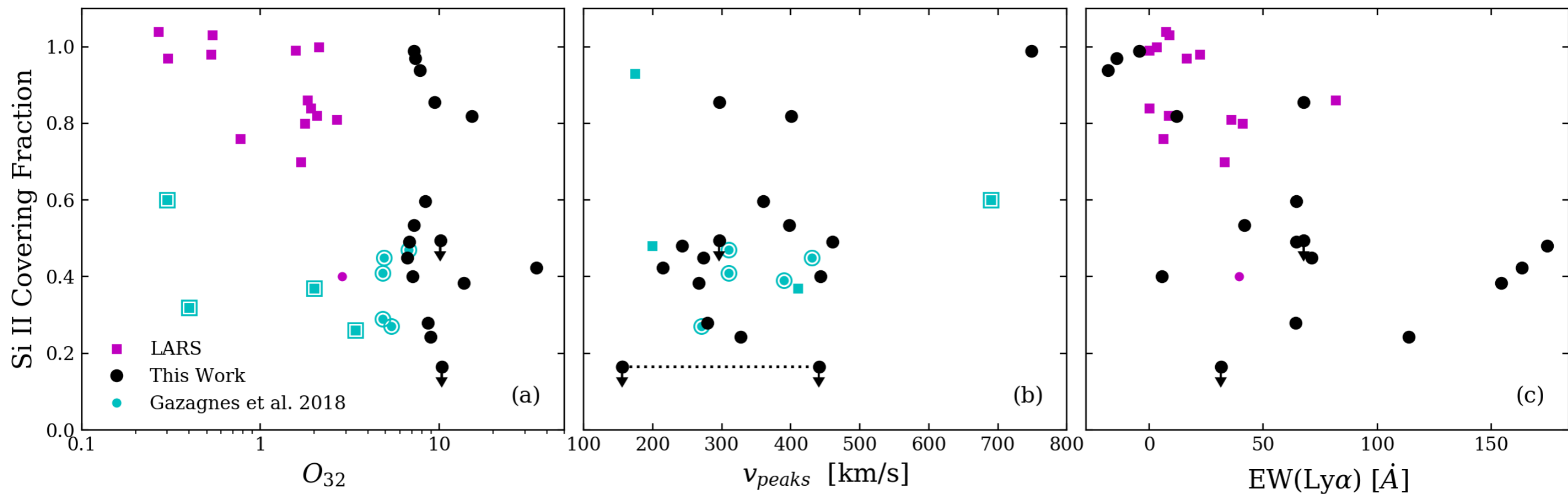


HI Column Densities in Green Peas



HI column densities are optically thick to Ly α and LyC in all cases.

Do tracers of LyC escape scale with covering fraction?



- ▶ O_{32} may increase probability of observing low covering fraction, but not guaranteed.
- ▶ Low covering may reduce number of scattering events, lowering v_{peaks} .
- ▶ Expect a trend between $EW(Ly\alpha)$ from covering fraction - $f_{esc}^{Ly\alpha}$ relation.

Conclusions

- ▶ 1. J1608 has an HI mass of $M_{HI} \leq 10^{7.96} M_{\odot}$, and high ratio of SFR to HI like local LCEs.
- ▶ 2. Observe Ly α absorption + Ly α emission. Ly α and low-ionization metal absorption consistent with high HI column density and inhomogeneous covering.
- ▶ 3. $f_{esc}^{Ly\alpha}$ is greater at lower covering fraction. GPs at low and high covering fraction are similar in all but $f_{esc}^{Ly\alpha}$.
- ▶ 4. No clear correlation between tracers of LyC escape and covering fraction.

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