Evolution of Lya halos between low and high redshift

Possible sign of changes in the CGM

Axel Runnholm

Department of Astronomy

Stockholm University

Lya is a common tool
understanding it is critical - but hard

Lya is among the most common tools for finding high redshift galaxies

- Large FOV Integral field spectrographs (MUSE)

It is also a potential diagnostic of many things:

- Star formation
- Neutral gas around galaxies
- Reionization

We need low-z observations to get at the physics

What galaxies are emitting the Lya?

- how does it relate to the properties of galaxies

Optical emission lines are unobservable at high-z
but obligatory JWST reference

We need low-z observations to get at the physics

What galaxies are emitting the Lya?

- how does it relate to the properties of galaxies

Optical emission lines are unobservable at high-z
but obligatory JWST reference

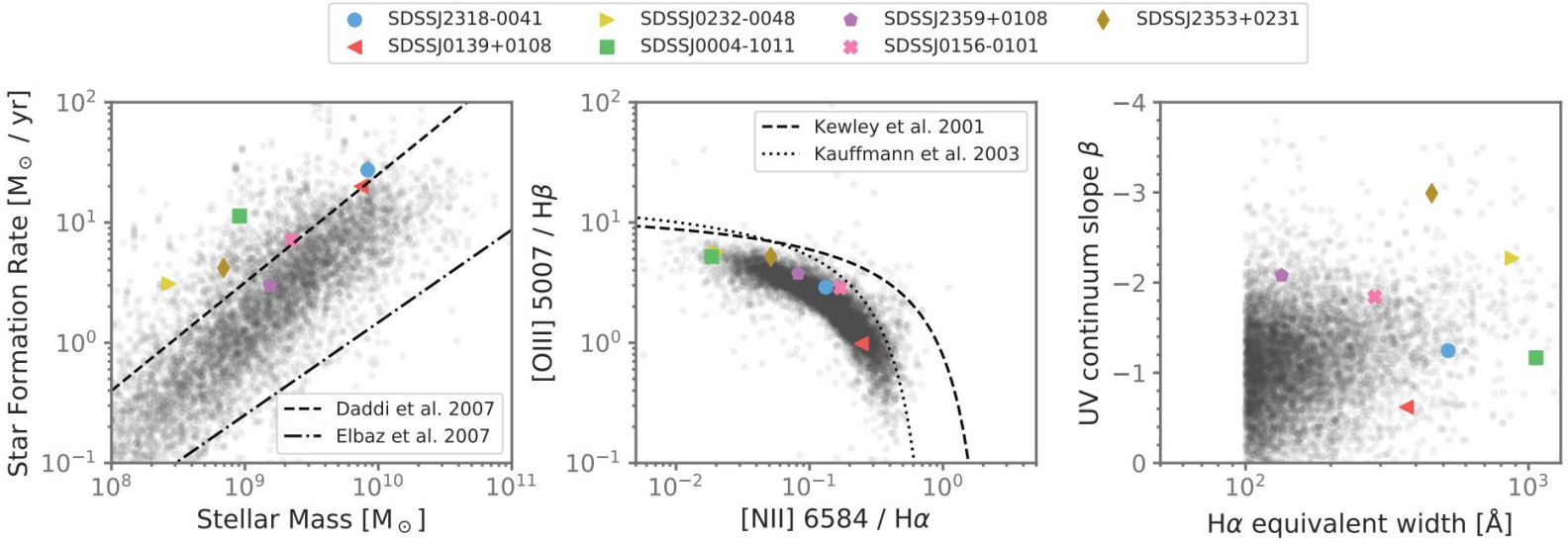
But low-z brings some unique challenges:

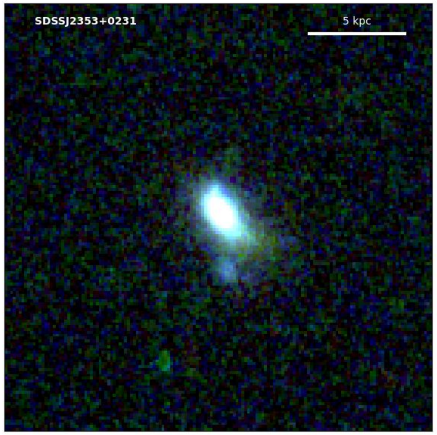
- λ = 1216 -> need UV observations -> HST
- Backgrounds: Geocoronal emission (Lya or [OI])
- Galaxy sizes
- Dark currents

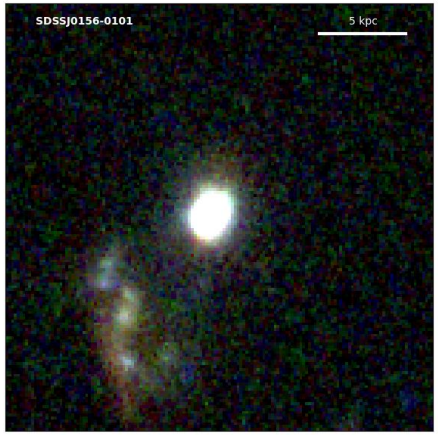
We have a new systematics controlled sample

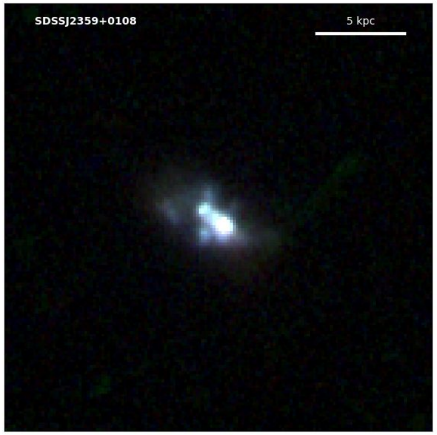
We can sacrifice some spatial resolution to control for systematics and backgrounds

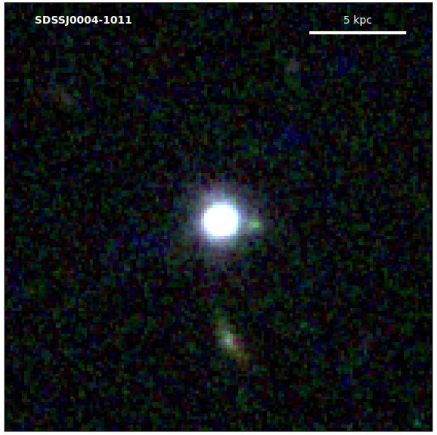
We also match the galaxies in properties to high-z samples

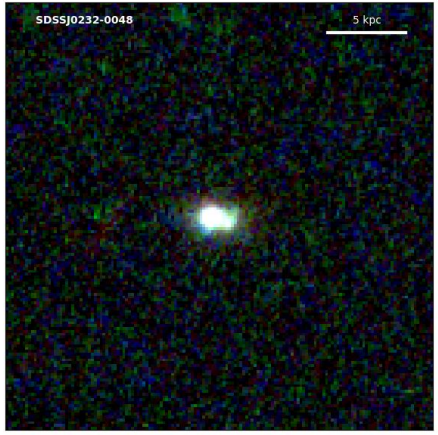


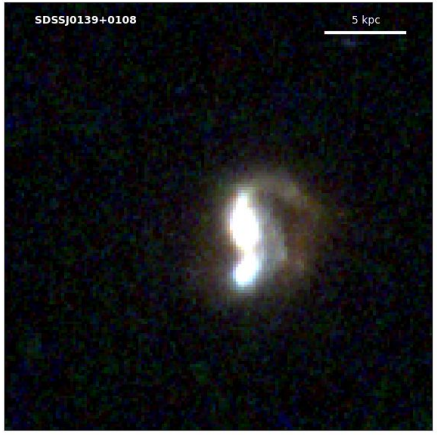

SDSSJ2353+0231
5 kpc

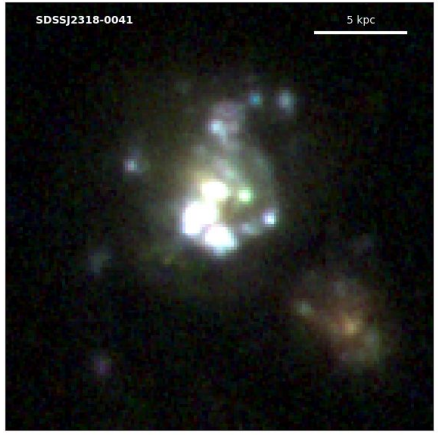

SDSSJ0156-0101
5 kpc


SDSSJ2359+0108
5 kpc

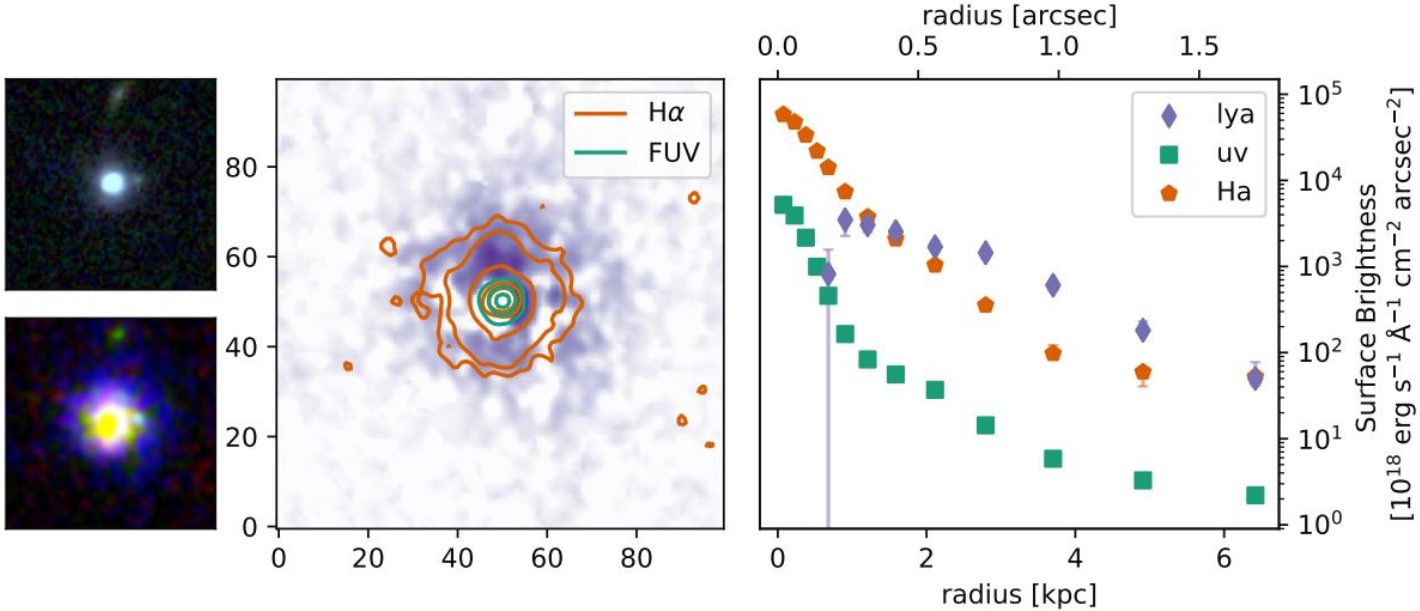

SDSSJ0004-1011
5 kpc


SDSSJ0232-0048
5 kpc

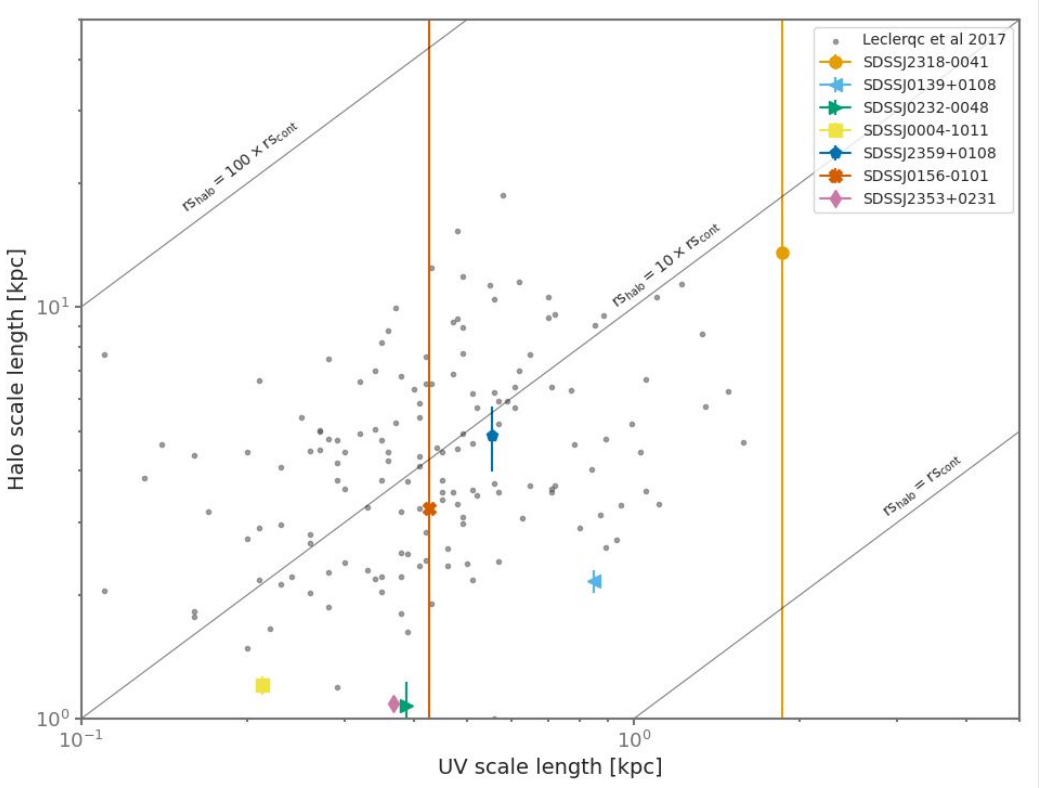

SDSSJ0139+0108
5 kpc


SDSSJ2318-0041
5 kpc

We want to characterize the extended Lya emission

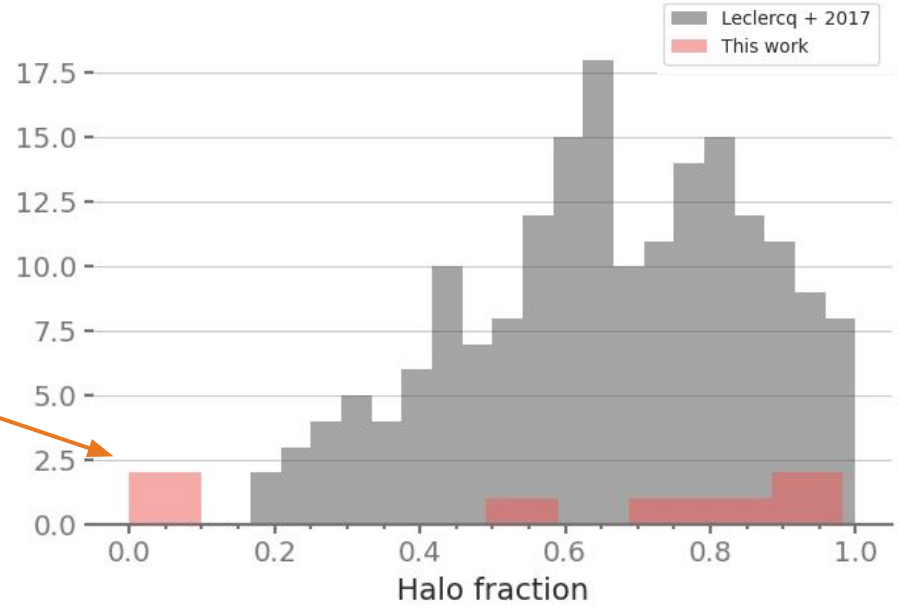


Despite being selected to be similar populates only the smaller halo space



And some galaxies see smaller fraction of halo emission than any MUSE galaxy

2 out of 7 galaxies consistent with only central lya emission



Difficult to say why this should be

Bias in emission line selection at high redshifts?

- Not likely: The most centrally concentrated emitters are also the brightest

No scattering gas?

- Surveys of neutral gas around galaxies show that there is plenty of that

We need to examine the correlations with other galaxy properties more in detail

In conclusion: Tentative hints that low-z lya emission differs from high-z

Trying to determine whether the effect is real or not is crucial.

Then we can see if there is actually some properties of the galaxies themselves that change

We can use JWST for that!