Subaru Users' Meeting, Jan. 22nd, 2014 @ NAOJ

Demographics of Lyman Alpha Emitter Structures

(Shibuya et al. 2014)

ICRR / Tsukuba

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Outline

✓**Introduction** - ***Lyα Emitting Mechanism***

✓**Sample** - $z=2.2$ ***LAEs***

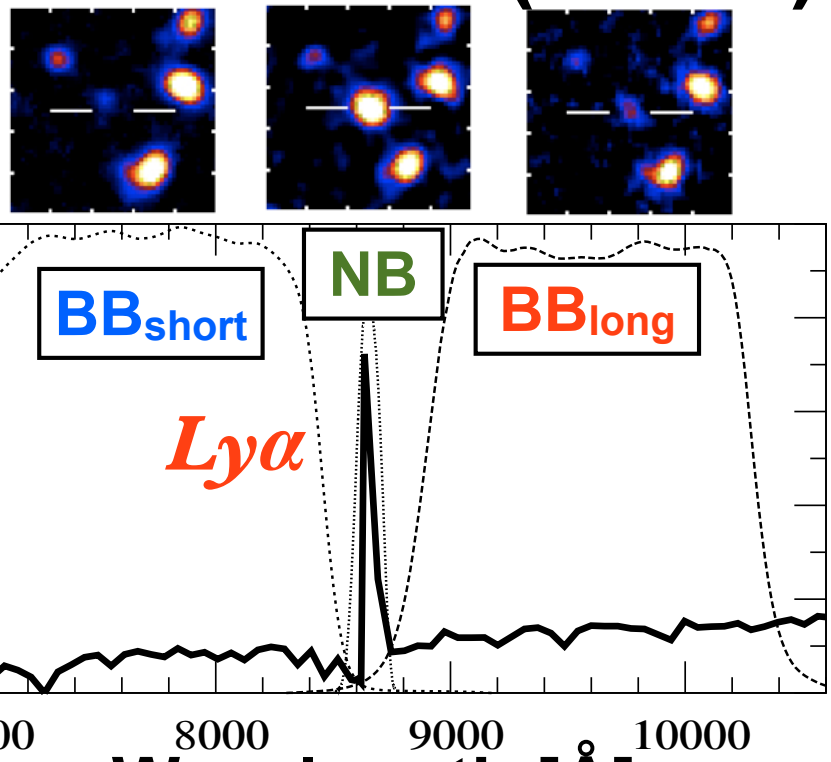
✓**Structure Analyses** - **Merger Fraction,**

Lyα Spatial Offset, Ellipticity

✓**Summary and Conclusion**

Lyα Emitting Mechanism

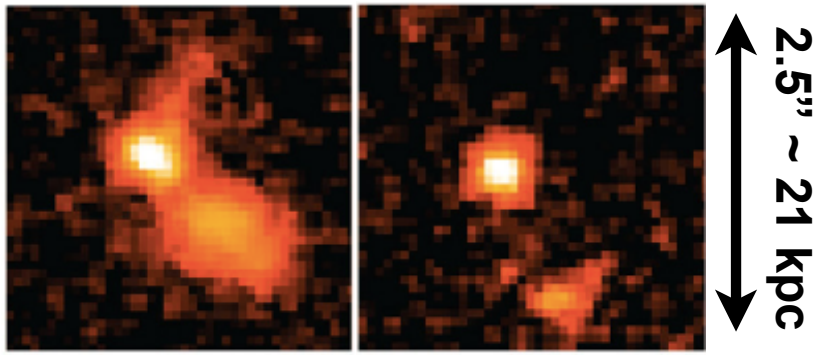
Lyα Emitters (LAEs)



✓Lyα emitting mechanism is not completely understood.

✓HI gas/dust distribution could be closely related.

HST / WFC-3 images (rest Opt.)



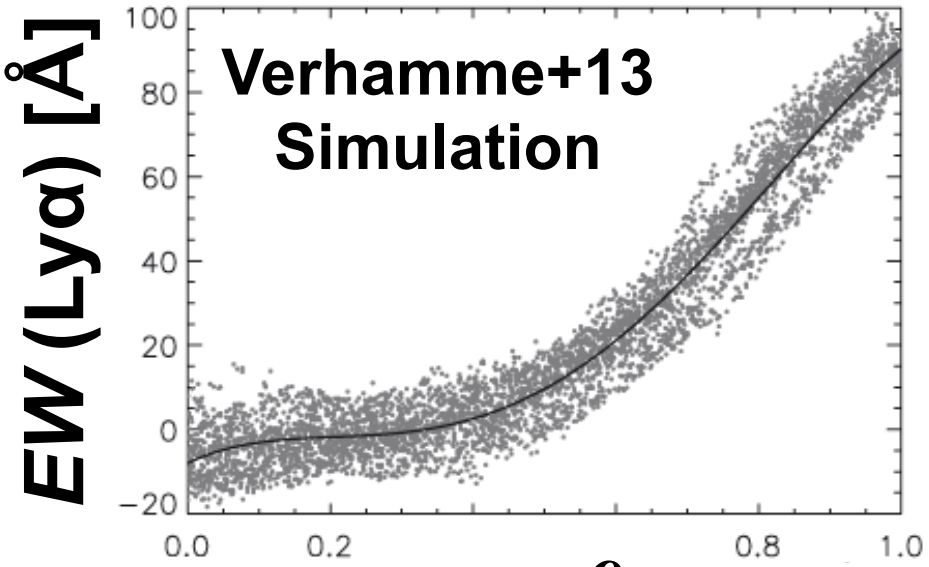
LAEs@z=2.4

Chonis+13

Trigger SF?

Make holes ?

LAEs are mergers?



Need to investigate statistically LAE structures

Structure Analyses

We investigate *3* structural properties,

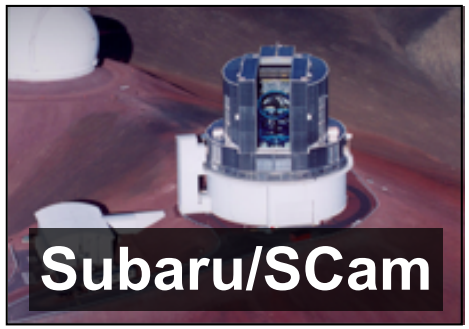
1. **Merger Fraction**
2. **Lyα Spatial Offset**
   between Lyα and stellar continuum emission
3. **Ellipticity**

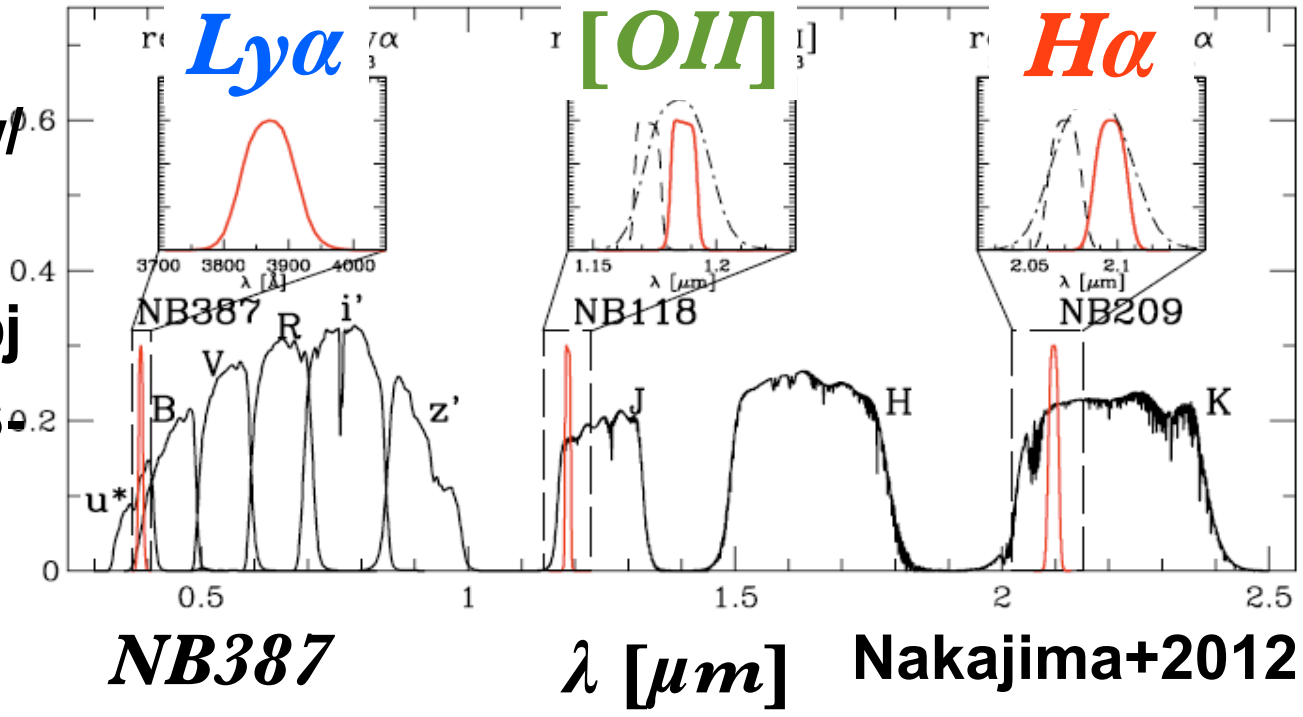
and Lyα EW dependences on these structural parameters.

LAE Sample & *HST* Data

LAE Sample

- ✓z=2.2 LAEs cnstrcted w/ Subaru/S-Cam
- ✓Phot sample: ~3400 obj
- ✓SXDS, COSMOS, GOODS-NS, HUDF, SSA22





NB387 *λ [μm]* Nakajima+2012

HST high res. data

- ✓ACS/I_{814}-band: rest-frame UV
- ✓WFC3/H_{160}-band: rest-frame optical
- ✓SXDS, COSMOS, GOODS-SN

CANDELS
Cosmic Assembly Near-infrared Deep Extragalactic Legacy Survey

Find LAE Counterparts

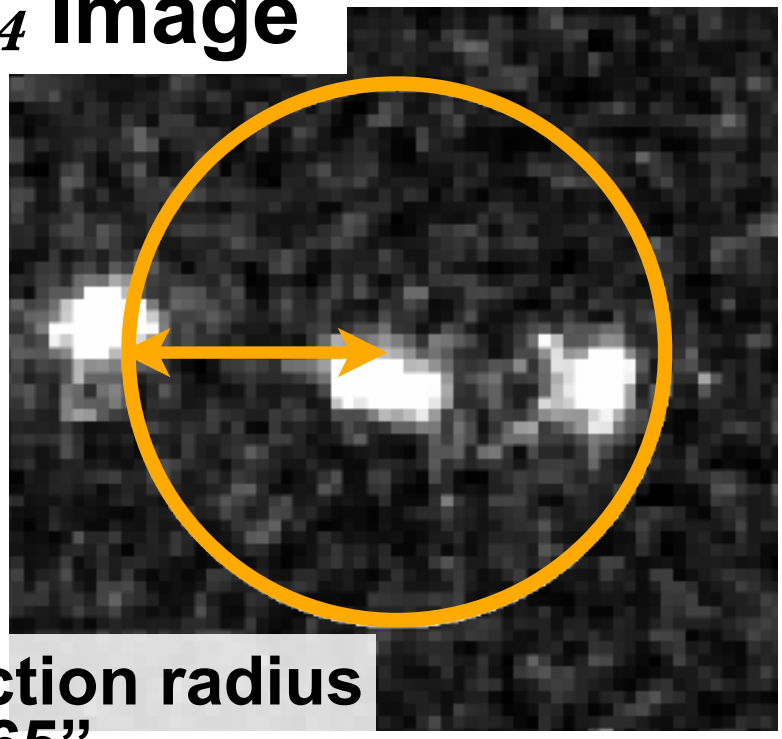
✓Investigate structure of our large sample of LAEs@z=2.2

✓Search for LAE counterparts w/ *HST* I_{814}, H_{160}<26.5

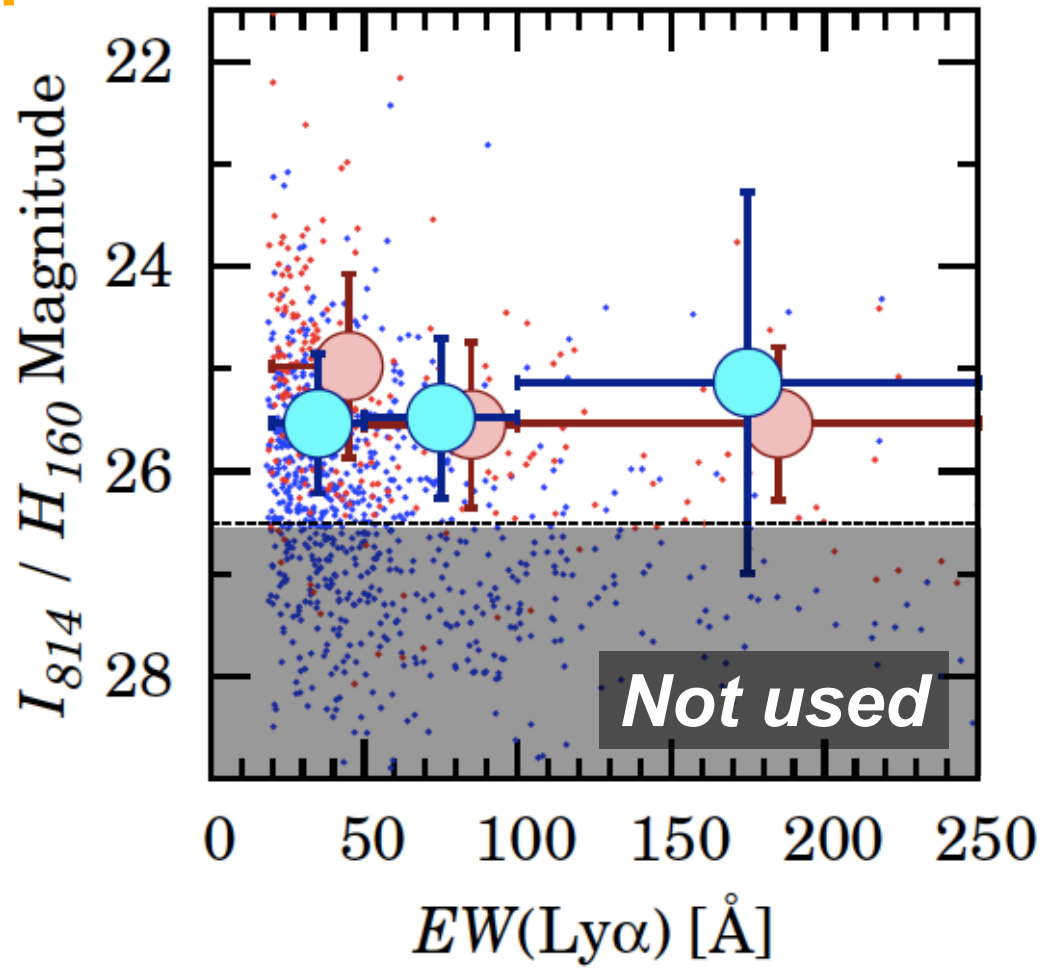
✓→ 426 obj. Largest structural study for LAEs

✓Mean I_{814}, H_{160}-mag is comparable b/w EW bins→No bias

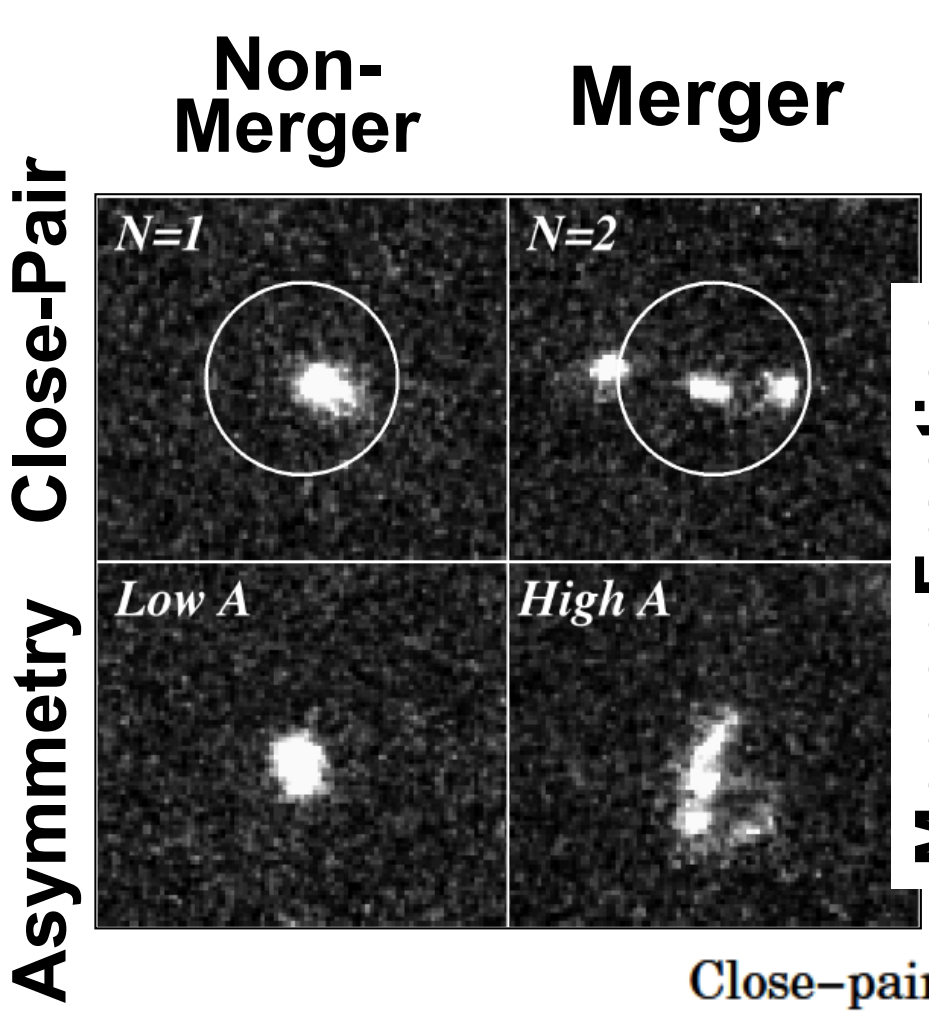
I_{814} Image

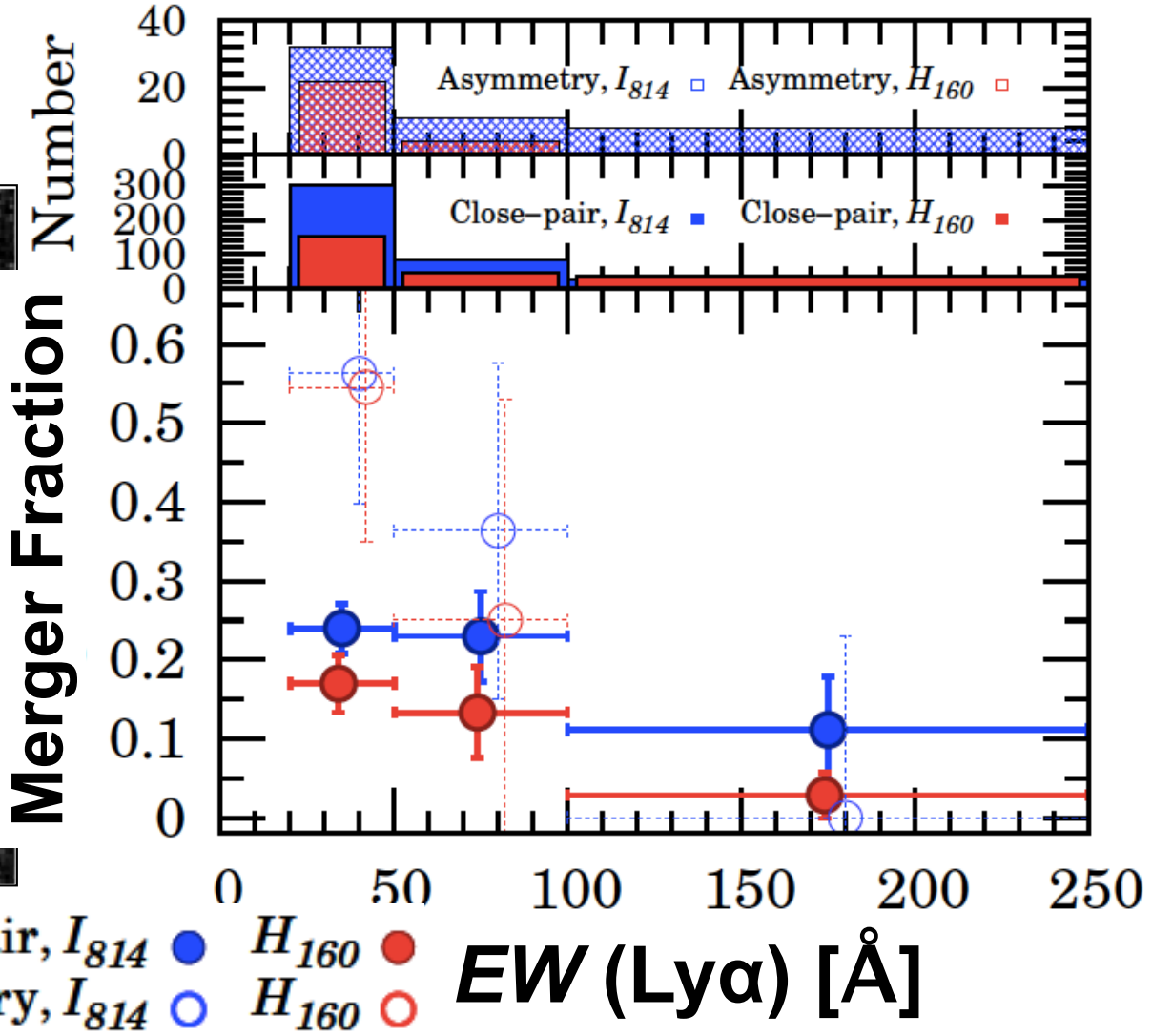


Selection radius
0.65”~5.4 kpc
(Bond+2012)



1. EW - Merger Fraction



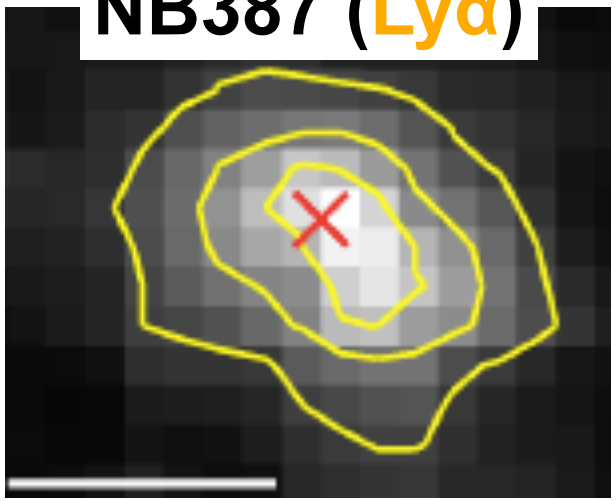


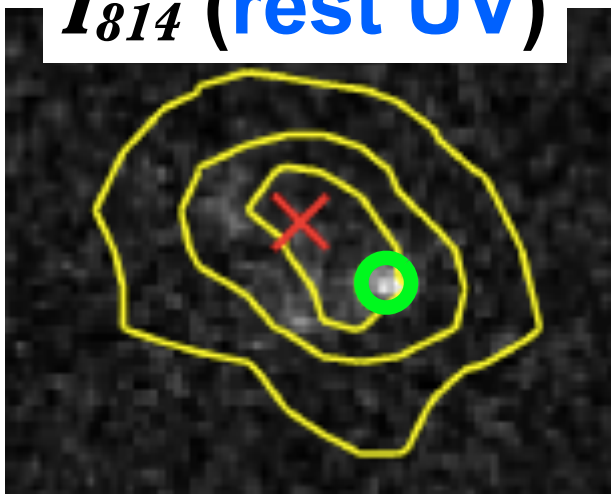
✓**Merger Fraction F_{merg} = 0.2-0.3**

✓**→ Consistent w/ LBGs (e.g. Law+2012)**

✓**But, F_{merg} does NOT increase w/ Lyα EW**

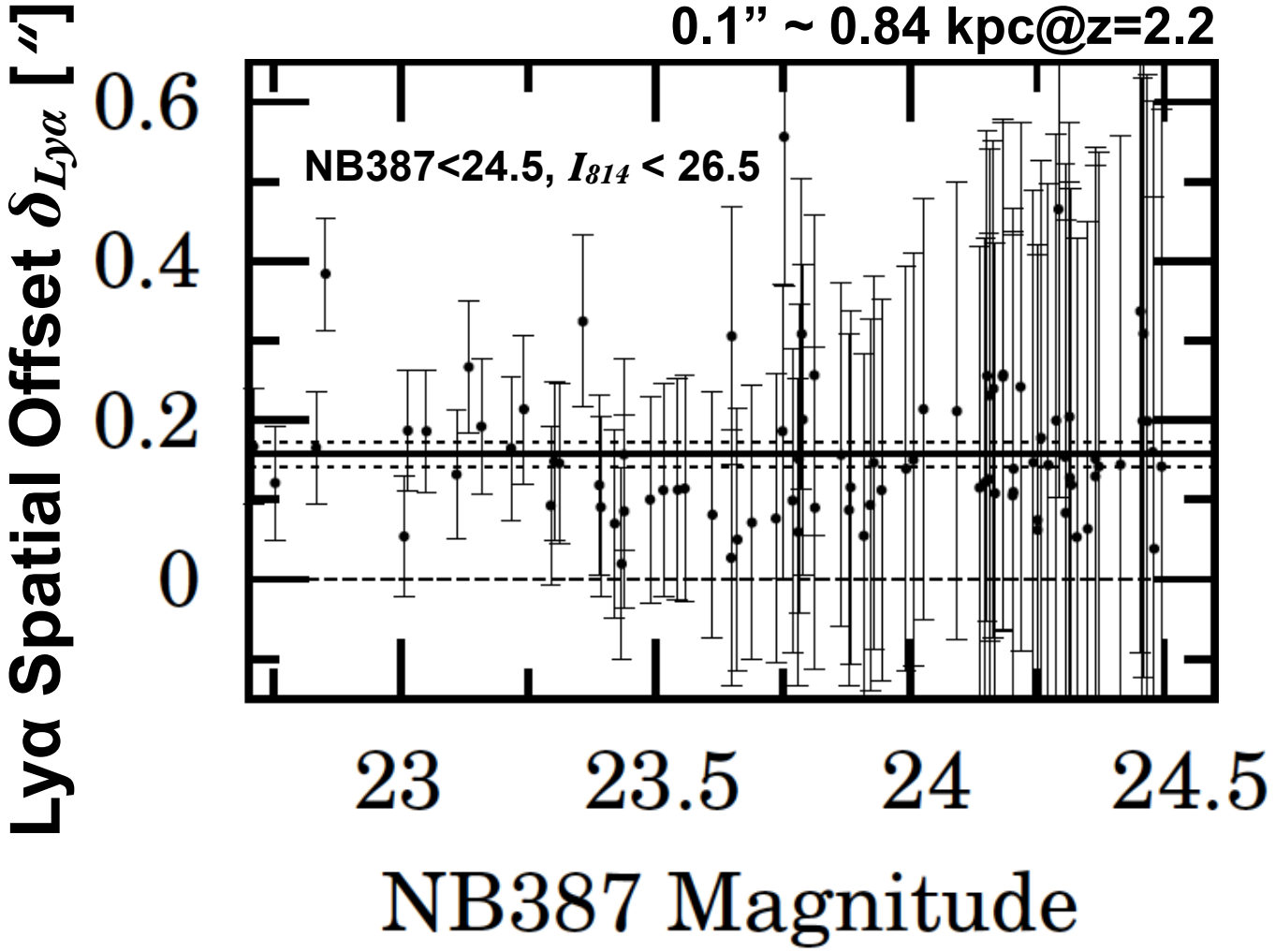
2. Lyα Spatial Offset (Lyα - Cont.)





× Lyα peak

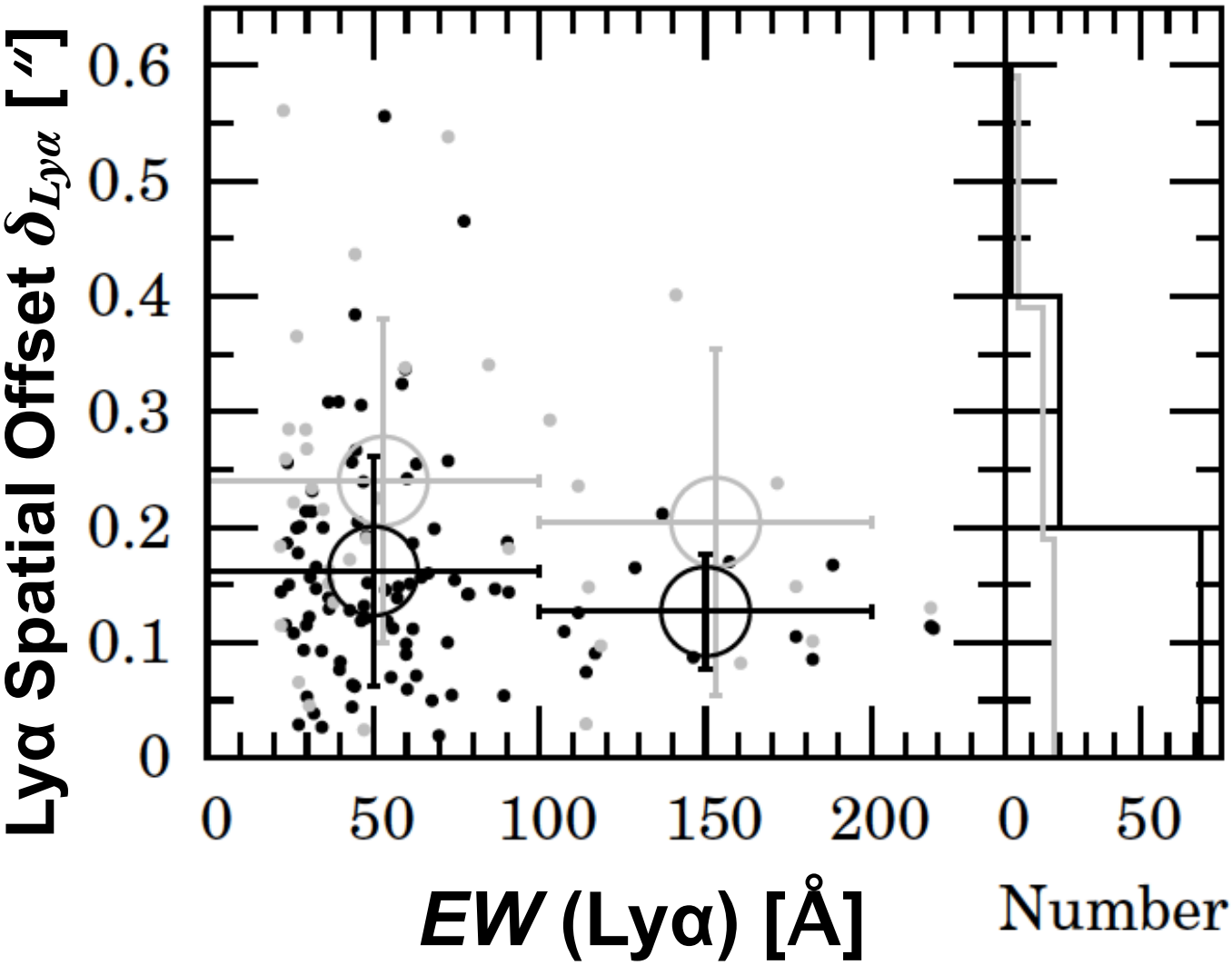
○ Counterparts in *HST* img



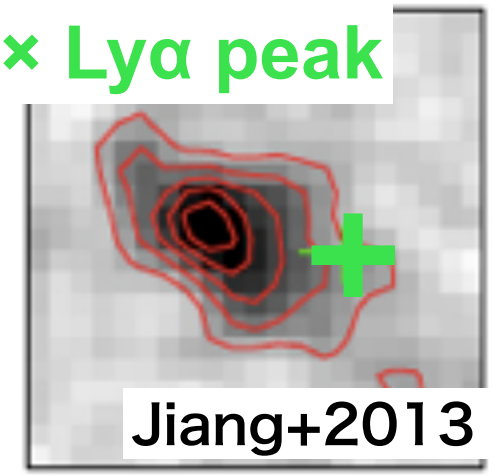
✓Several LAEs have a large $\delta_{Ly\alpha}$ beyond statistical error

✓Even for NB-bright LAEs

2. EW - Spatial Offset



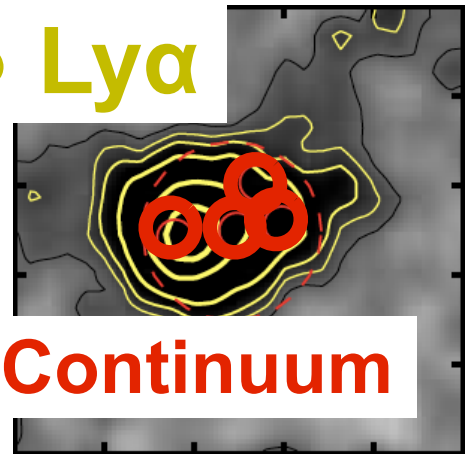
× Lyα peak



Jiang+2013

○ Lyα

○ Continuum

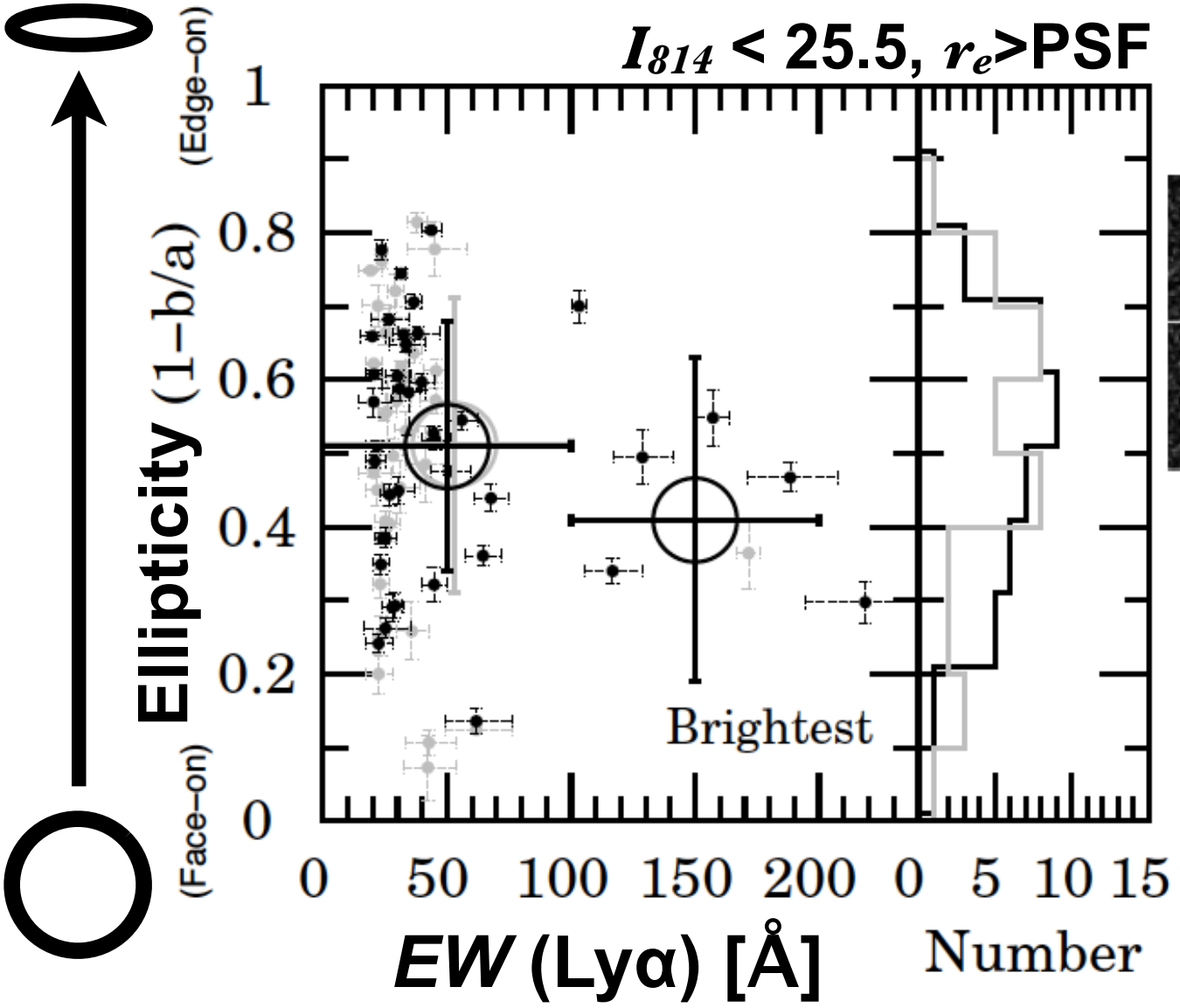


Himiko, Ouchi+2013

✓No LAEs w/ a large $\delta_{Ly\alpha}$ & a high Lyα EW

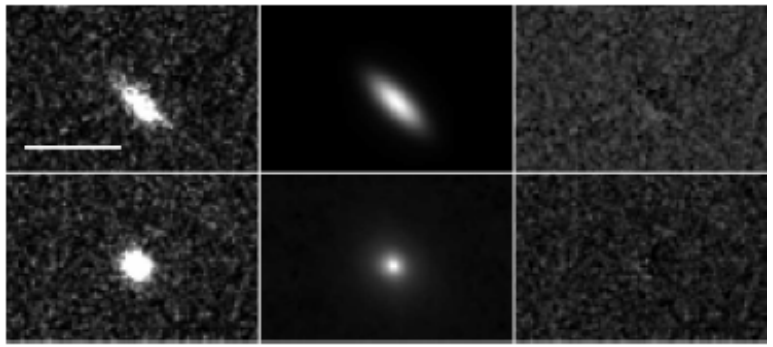
✓First systematic study on Lya spatial offset

3. EW - Ellipticity



GALFIT Fitting

Image Model Residual



Large *EW(Lyα)*

small $\Delta v_{Ly\alpha}$

small *EW(Lyα)*

Large $\Delta v_{Ly\alpha}$

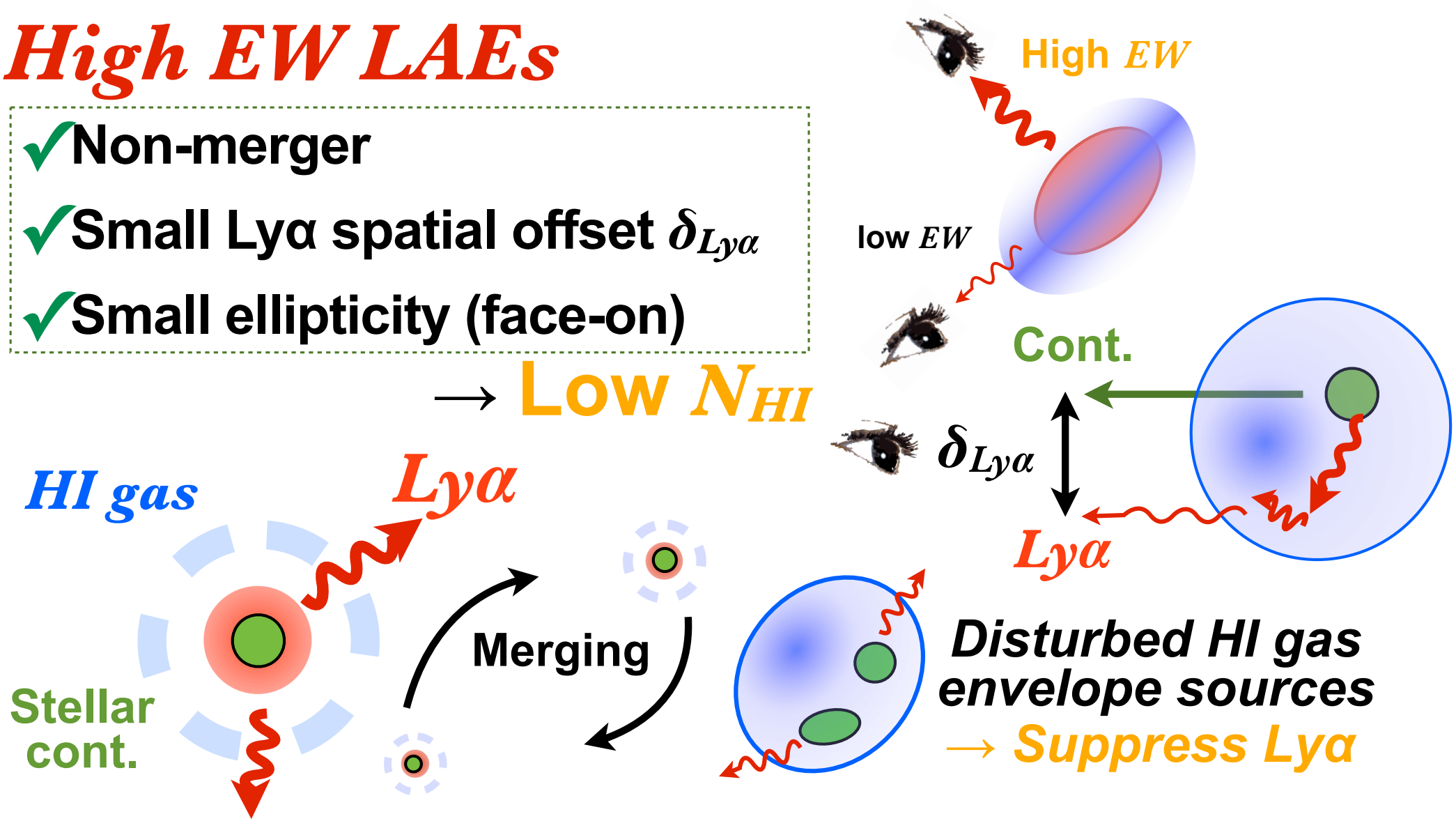
No elongated LAEs w/ a high Lyα

Origin of Strong Lyα Emission

High EW LAEs

- ✓Non-merger
- ✓Small Lyα spatial offset $\delta_{Ly\alpha}$
- ✓Small ellipticity (face-on)

→ Low N_{HI}



HI column density could be a key parameter determining EW(Lyα)

Summary

- ✓Analyze structures of 426 LAEs
- ✓LAEs with a high Lyα EW tend ...
- ✓To be a **Non-merger**
- ✓To have a **small Lyα Spatial Offset**
- ✓To have a small Ellipticity (**Face-on**)

N_{HI} is a key parameter determining Lyα EW

Subaru/HSC NB Survey will find rare high EW(Lyα) LAEs enabling us to study the nature of these intriguing objects.