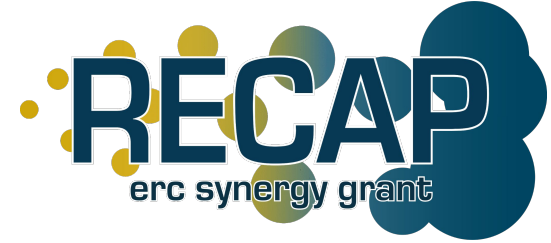


## 4th ReCAP online collaboration meeting 22nd May 2026

Next online meeting 11th of September 2026

Next In person meeting: 2-4 December  
starting morning Wednesday and ending midday Friday.  
Hosted by Chalmers (Göteborg)

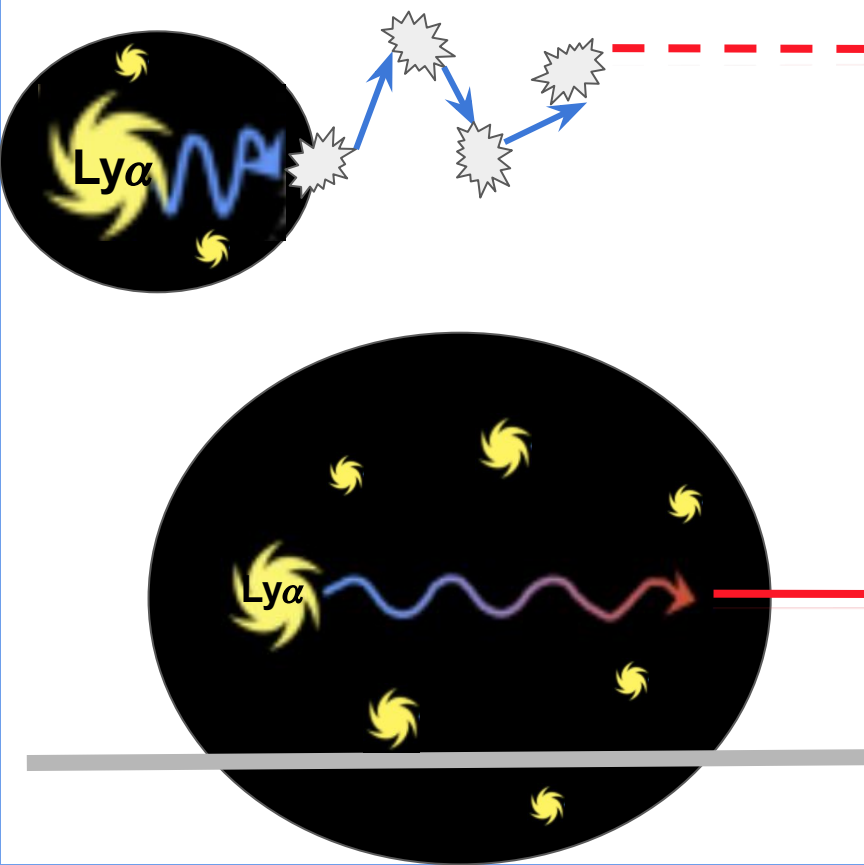
End of year Report (30th June): each person should provide a short report of the work done up to now, including a relevant figure (one page)  
Deadline 5th of June (two weeks)



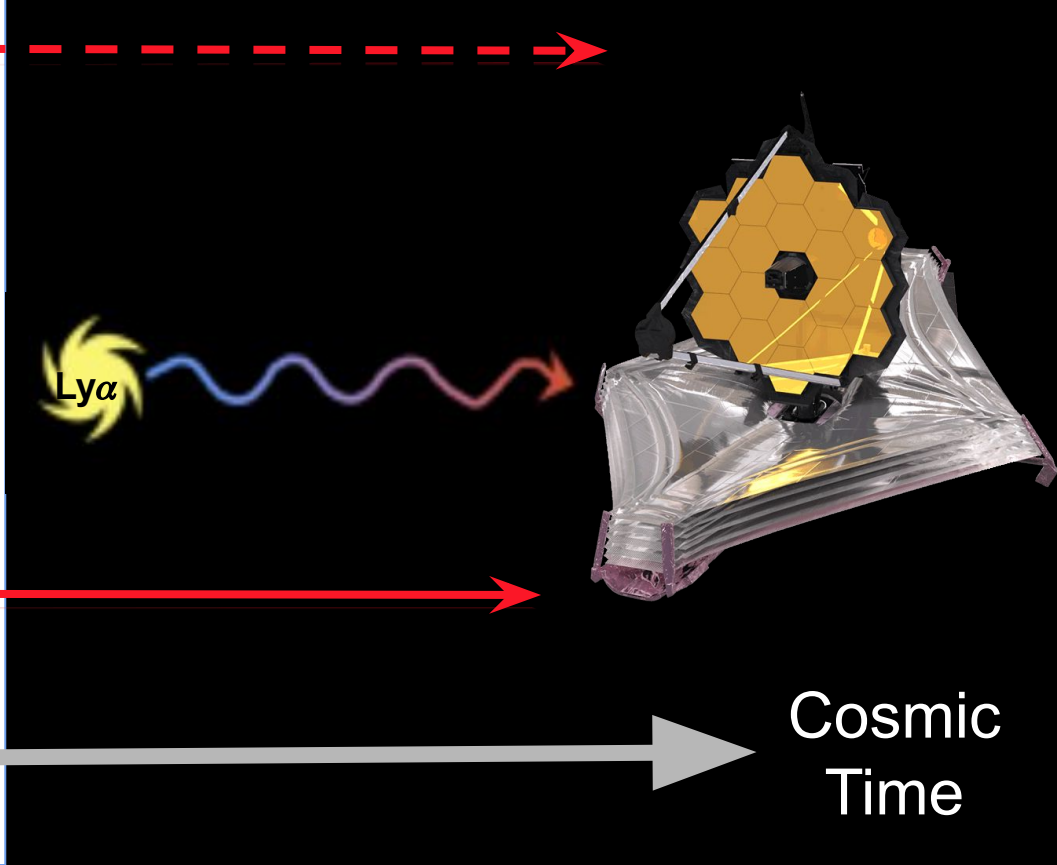
# Tracing inhomogeneous reionization with $\text{Ly}\alpha$ visibility

**Laura Pentericci, Lorenzo Napolitano , Roberta Tripodi  
Daniele Mannocchi**

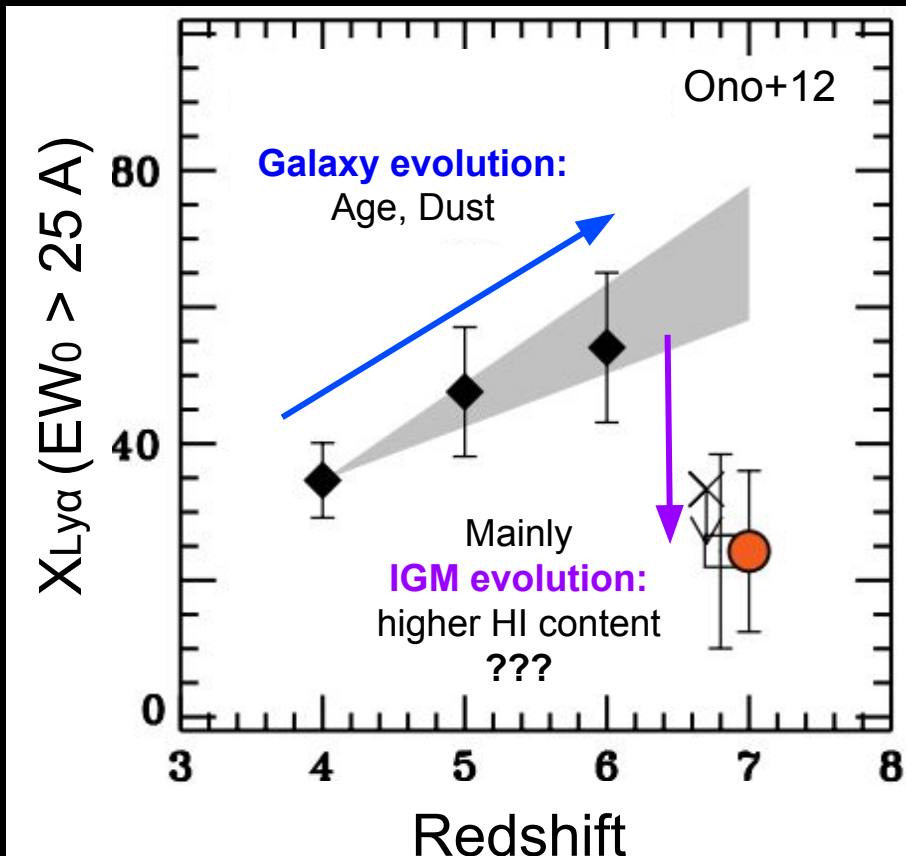
**Almost neutral  
Intergalactic medium  
(During reionization)**



**Fully Ionized  
Intergalactic medium  
(After reionization)**



# The time evolution of Ly $\alpha$ emission (before JWST)



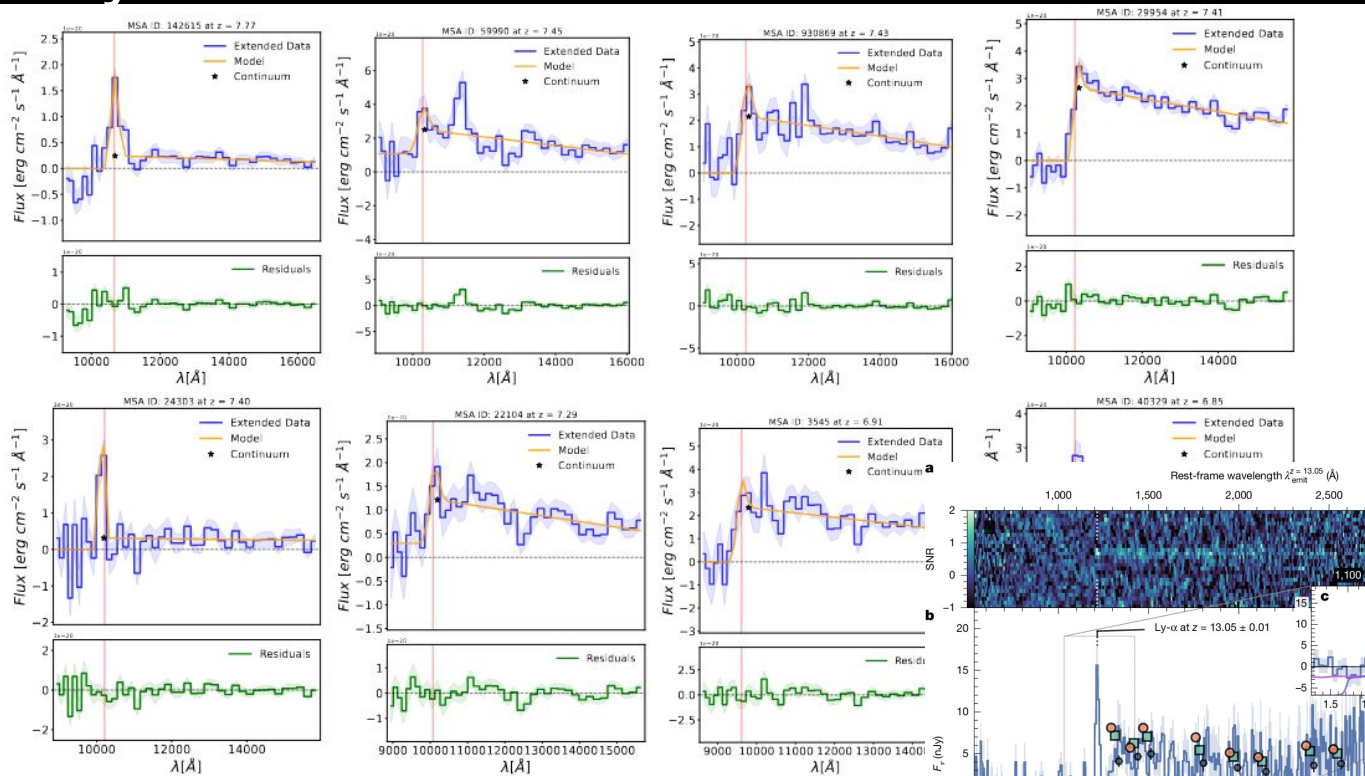
The fraction of Ly $\alpha$  emitters (LAEs) over the total number of star forming galaxies ( $X_{\text{Ly}\alpha} = N_{\text{LAEs}} / N_{\text{SFGs}}$ ) mostly depends on:

**Galaxy evolution at  $z < 6$**

**IGM evolution at  $z > 6$**

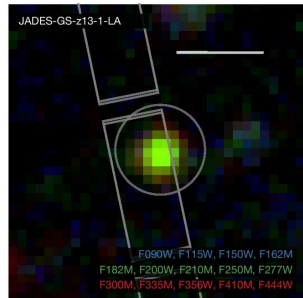
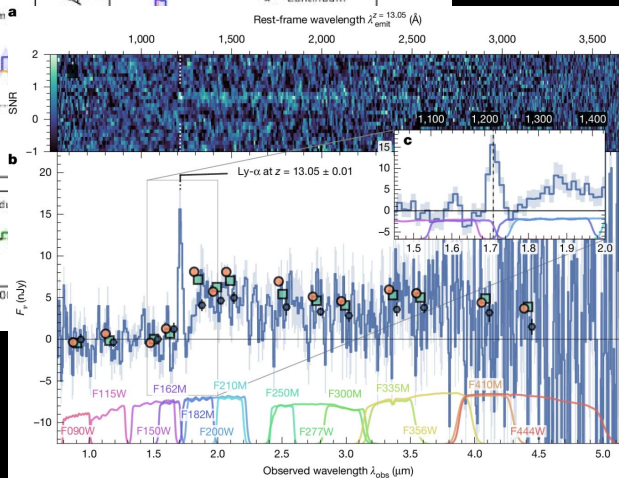
See also Stark+11, Tilvi+14, DeBarros+17, Pentericci+18, Mason+19

# Ly $\alpha$ emitters with JWST



Witstok+25

Napolitano+26a



- NIRSpec/PRISM spectrum
- ◆ Synthetic NIRSpec photometry
- NIRCcam photometry (ForcePho)
- NIRCcam photometry (CIRC2)

# Ly $\alpha$ EW<sub>0</sub> vs M<sub>UV</sub> from NIRSpec PRISM

Napolitano+26b in prep



+



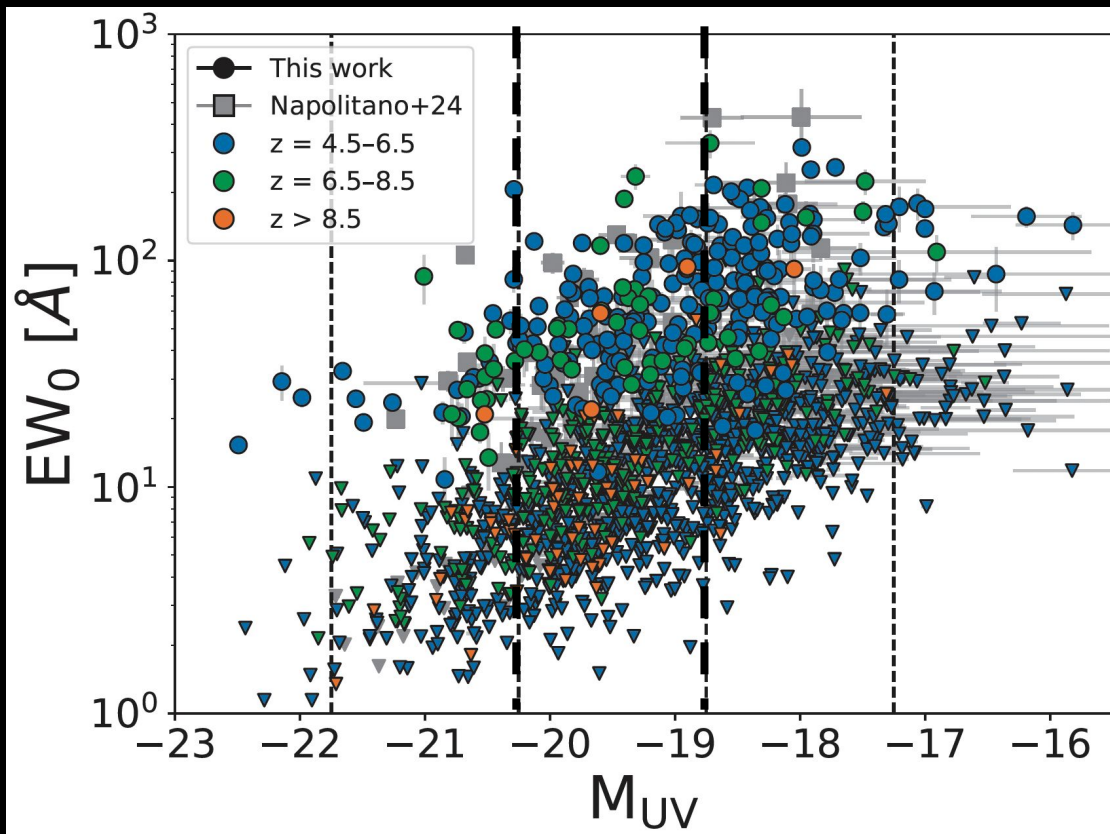
+



=

2200

NIRSpec/PRISM  
spectra

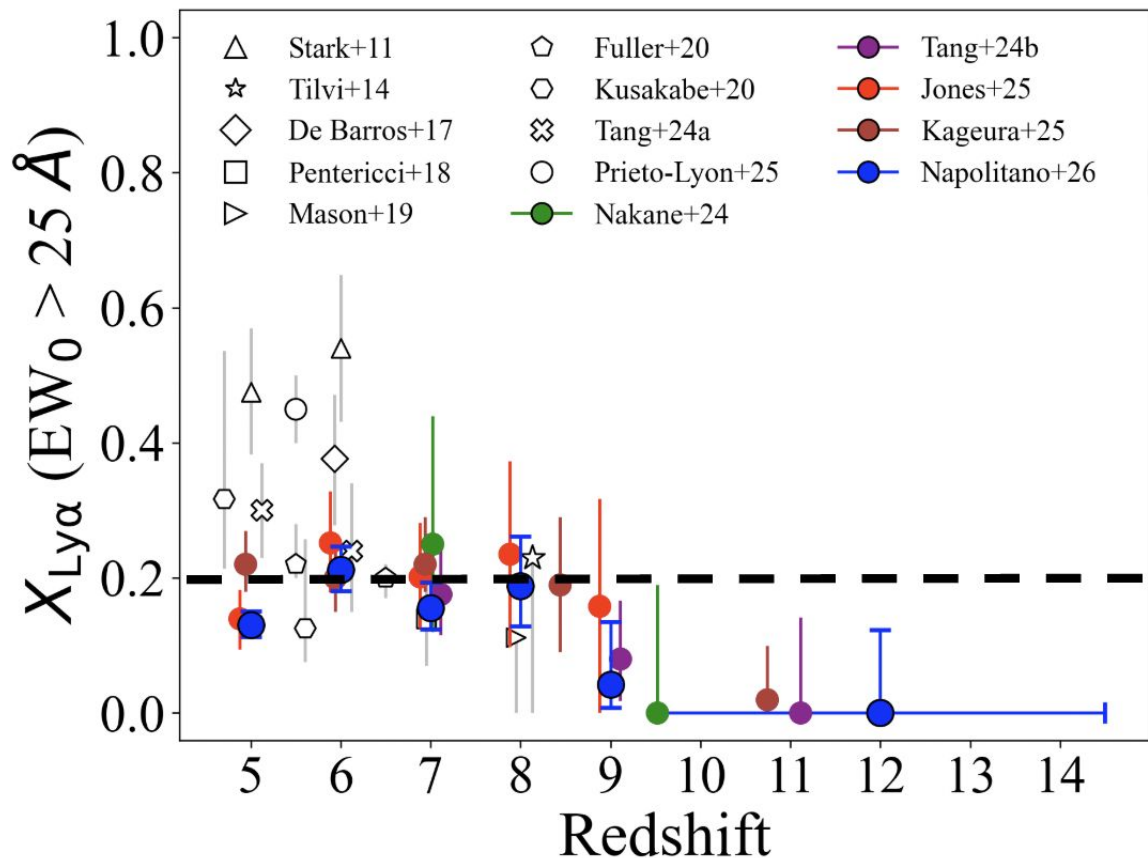


**Adopted cut:**  
 $-20.25 < M_{UV} < -18.75$   
AGN excluded  
 $EW_{0,lim} < 25 \text{ \AA}$

see also, e.g.  
Nakane+24, Jones+25,  
Prieto-Lyon+25



# Evolution of Ly $\alpha$ visibility across different lines of sight



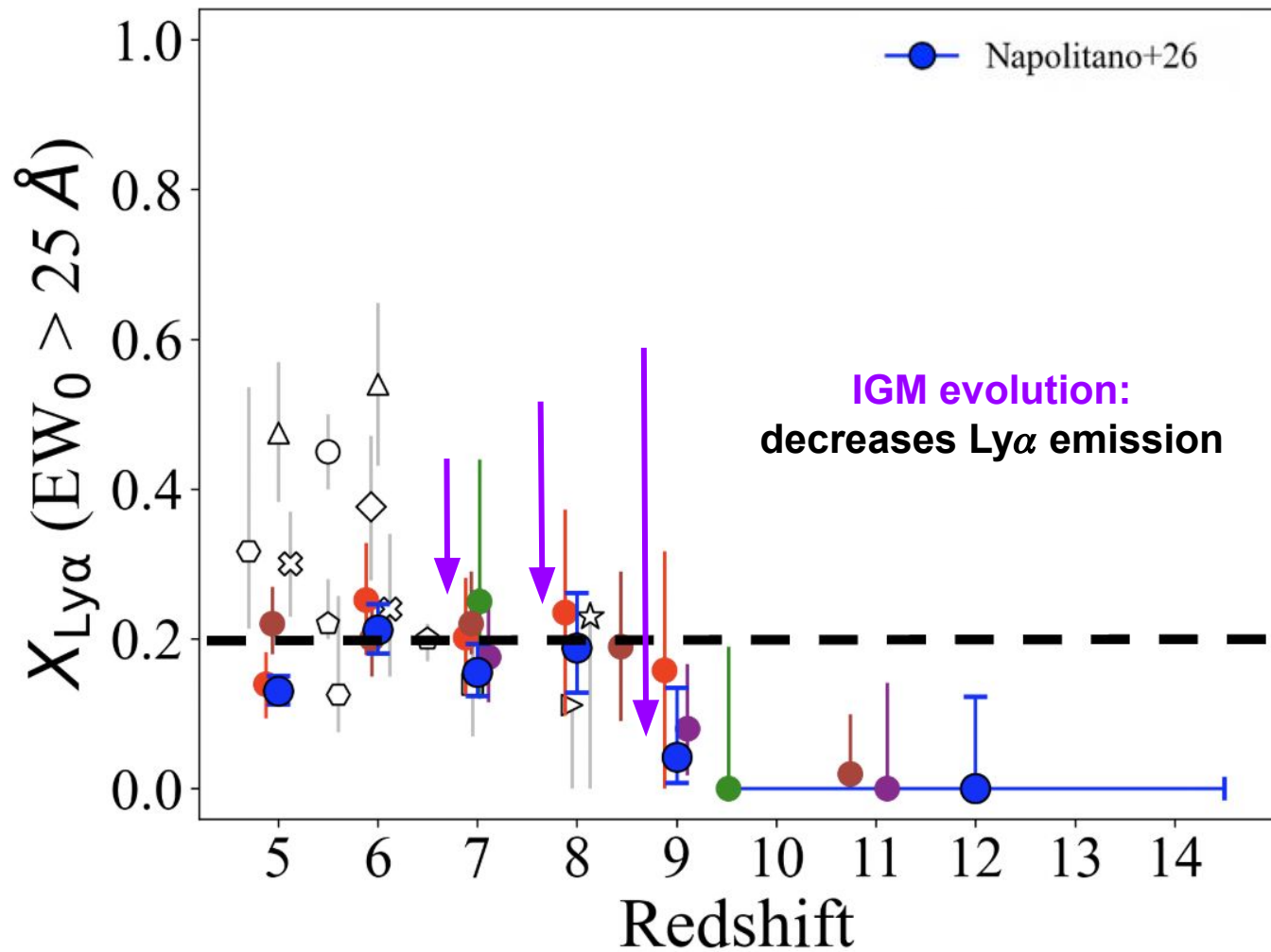
Napolitano+26b in prep

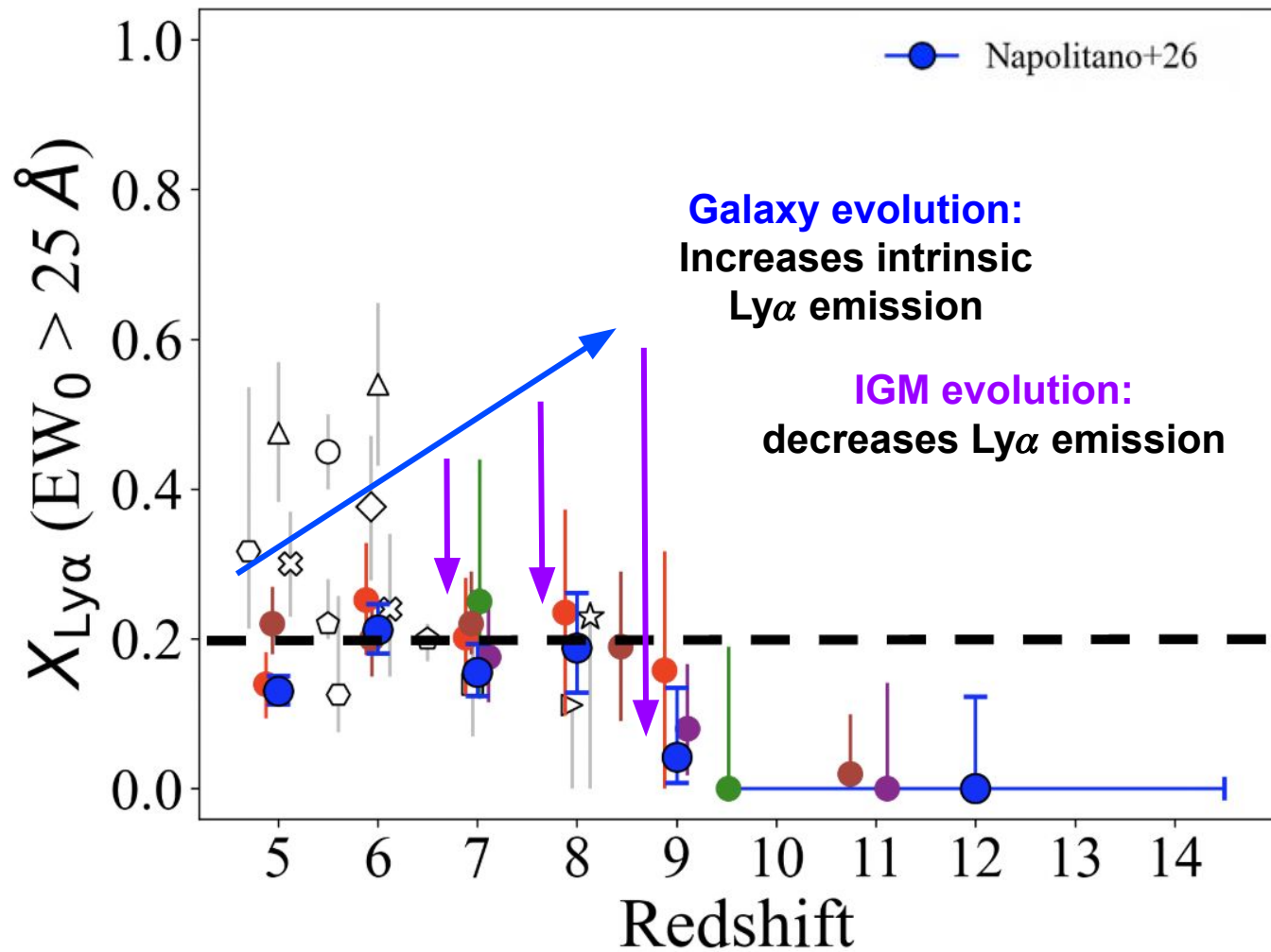
The fraction of Ly $\alpha$  emitters (LAEs) over the total number of star forming galaxies ( $X_{\text{Ly}\alpha} = N_{\text{LAEs}} / N_{\text{SFGs}}$ )

Fraction is constant up to  $z=8$   
different from previous views

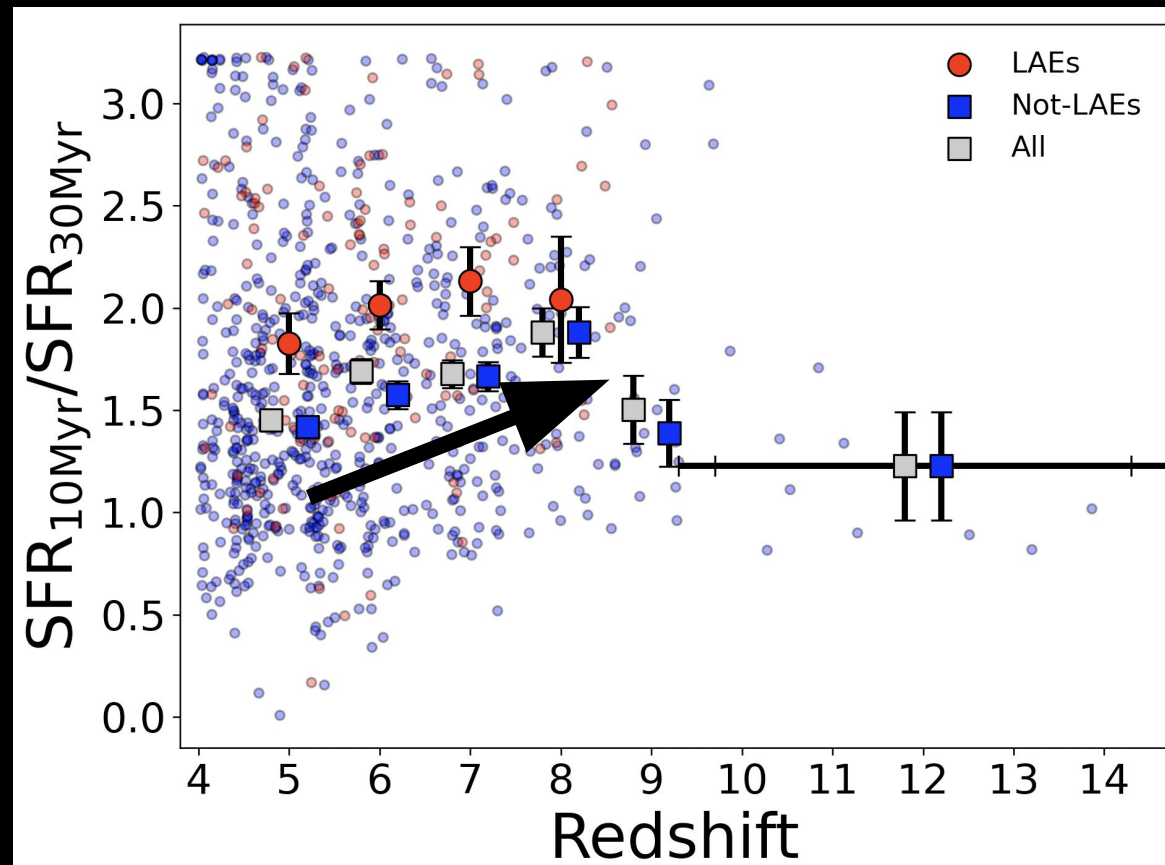
We are trying to interpret this unexpected trend and we came up with three possible explanations:

- the evolution of galaxy properties somehow enhance intrinsic Ly $\alpha$  production and this counterbalances the IGM effect
- galaxies in this  $M_{UV}$  range can always create large enough ionized bubbles in an otherwise largely neutral IGM, and therefore Ly $\alpha$  is visible
- galaxies shapes evolve (in Ly $\alpha$  extent) and we capture more or less the same Ly $\alpha$  in the small MSA apertures





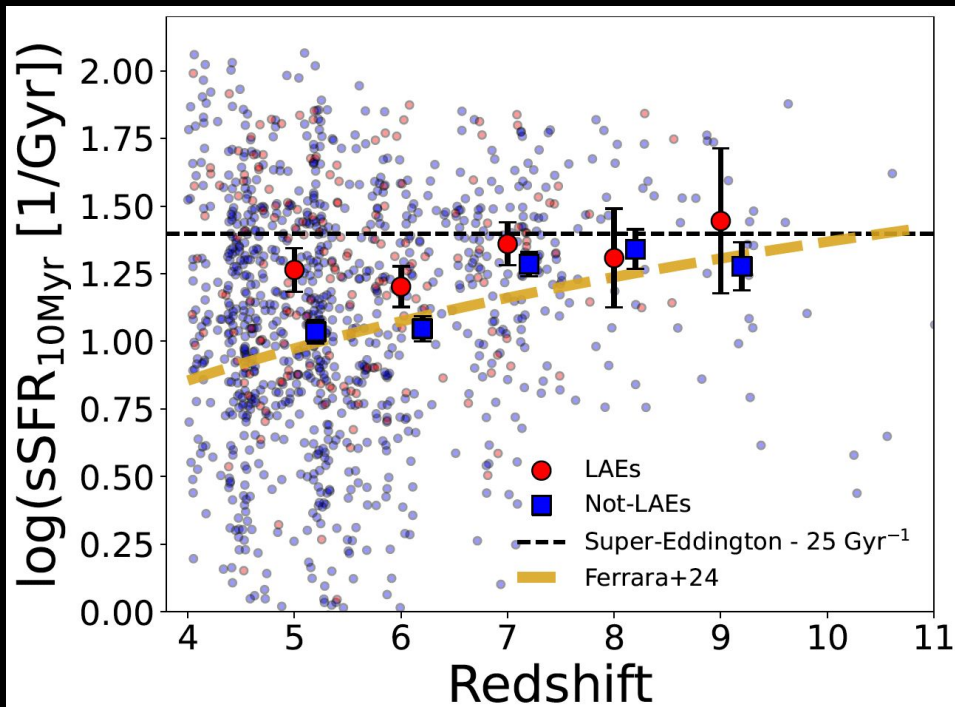
# Evidence for increased star-formation “burstiness”



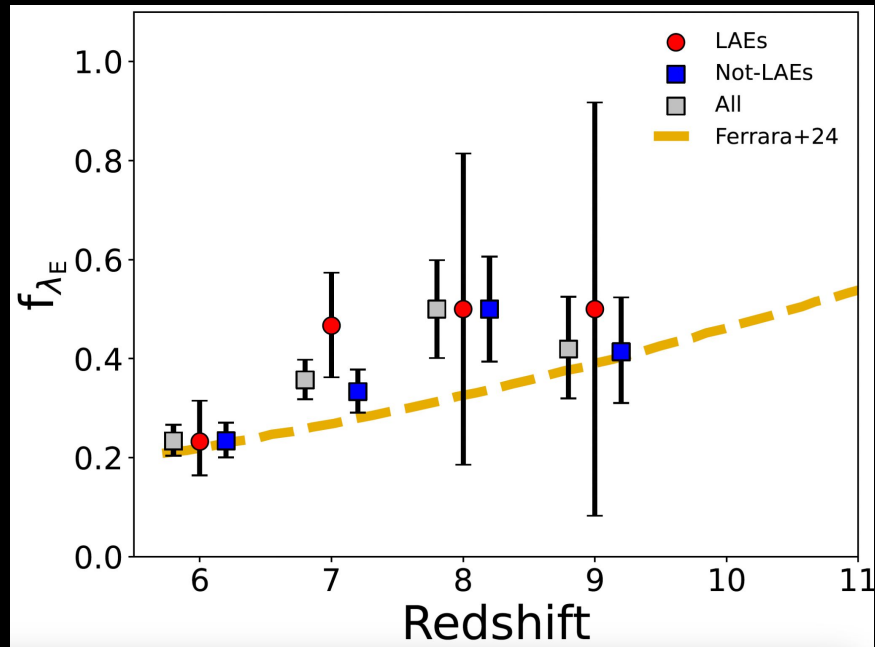
Galaxy evolution may counterbalance the effect of a neutral IGM on Ly $\alpha$  visibility at least up to redshift 8

working on a model with Andrea Ferrara

increased sSFR (higher for LAEs)

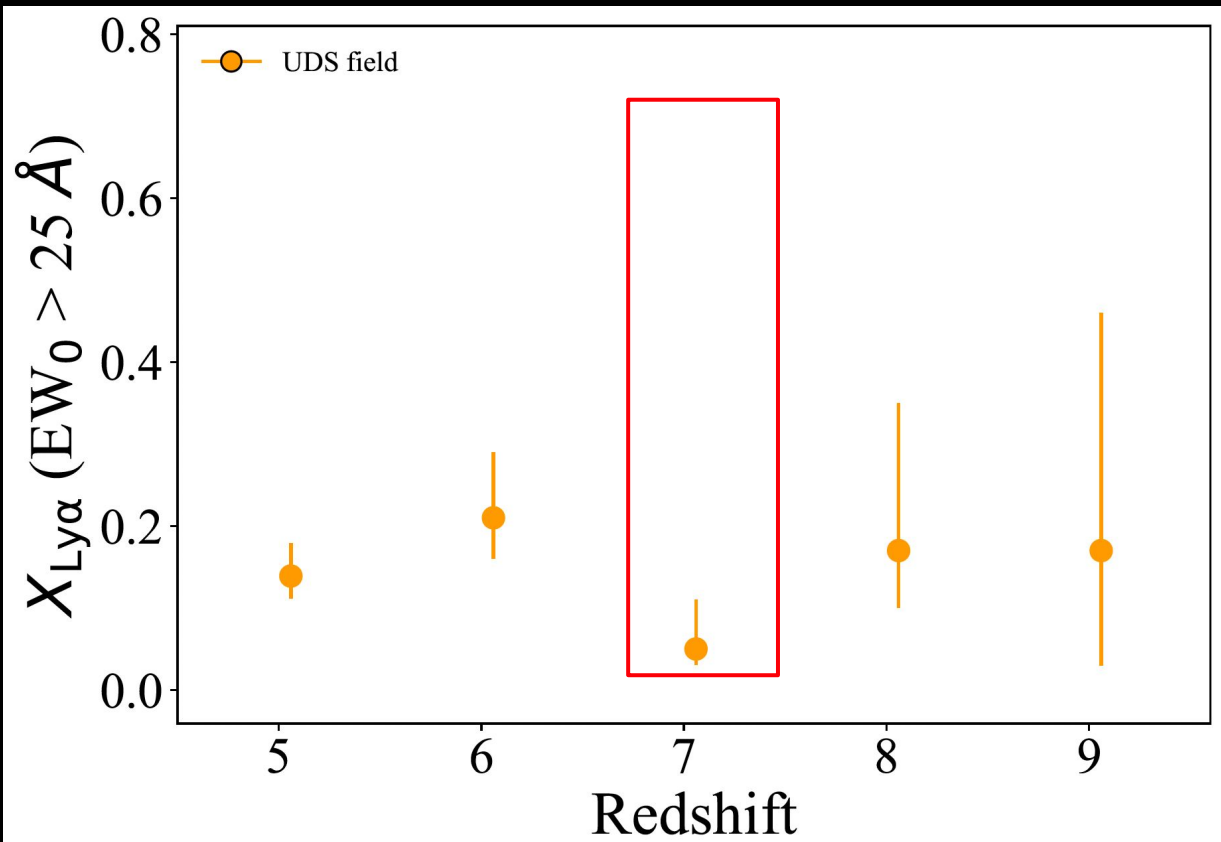


Super-Eddington fractions



Napolitano+26b in prep

# Field-to-field variation at the mid-point of reionization



At  $z = 7$ ,  $X_{\text{Ly}\alpha}$  is:

**UDS**: 2 LAEs / 40 SFGs

**EGS**: 9 LAEs / 16 SFGs

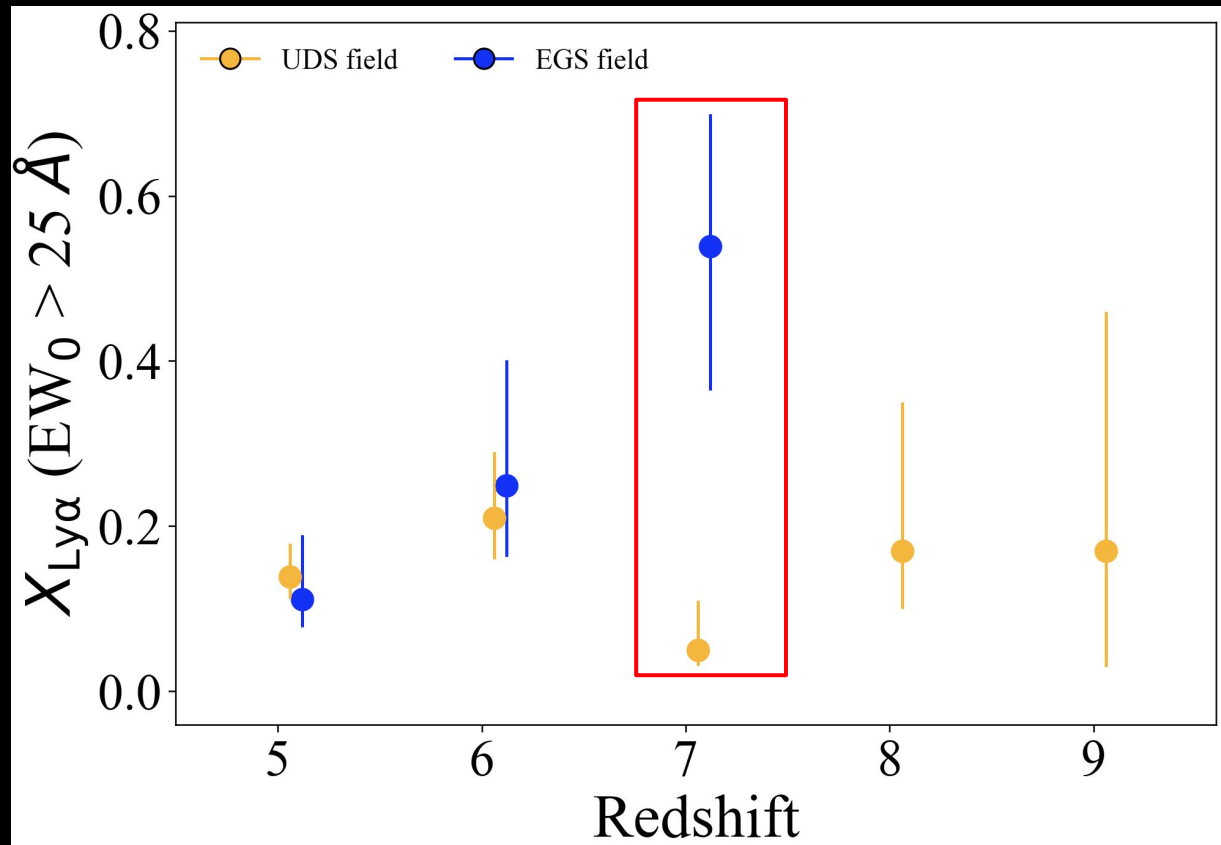
**GOODS-S**: 3 LAEs / 29 SFGs

**COSMOS**: 5 LAEs / 14 SFGs

**GOODS-N**: 4 LAEs / 39 SFGs

**2.7 $\sigma$**  tension between the EGS and UDS results at  $z = 7$

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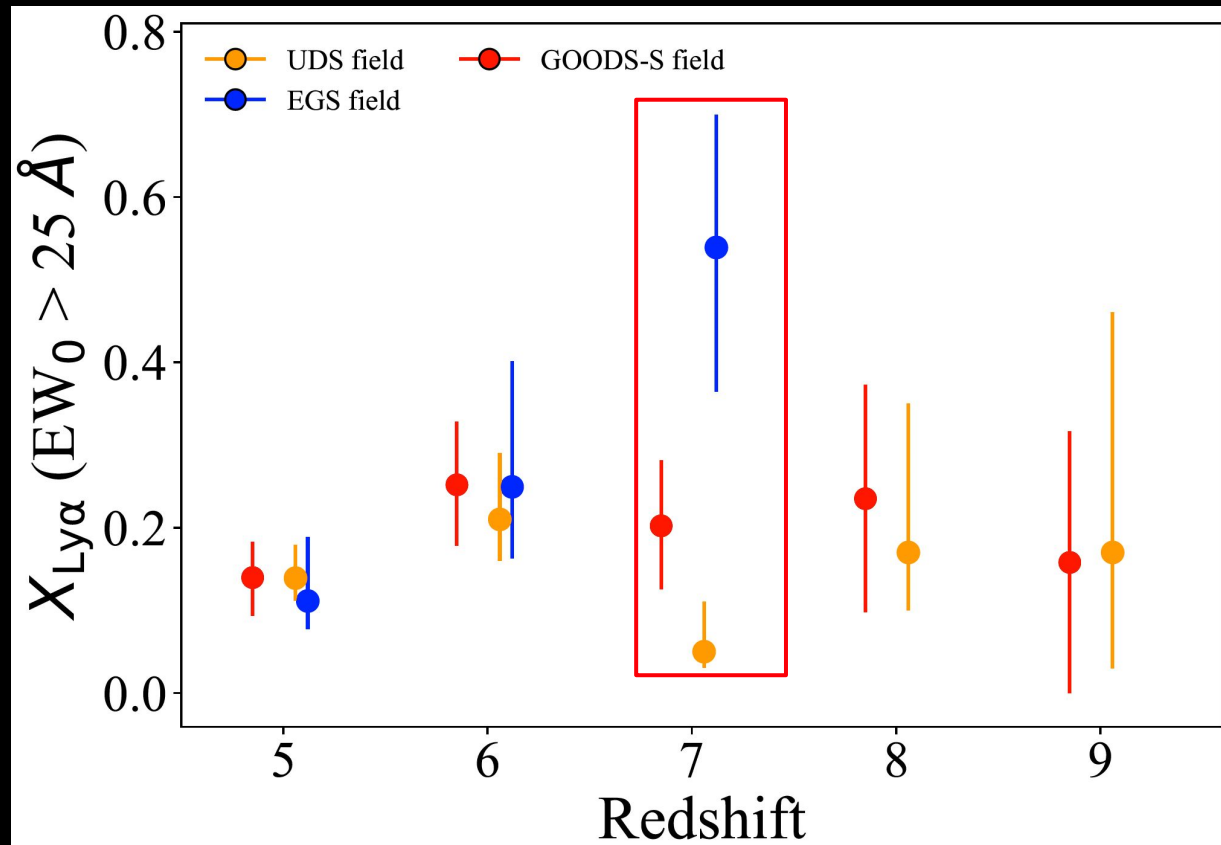
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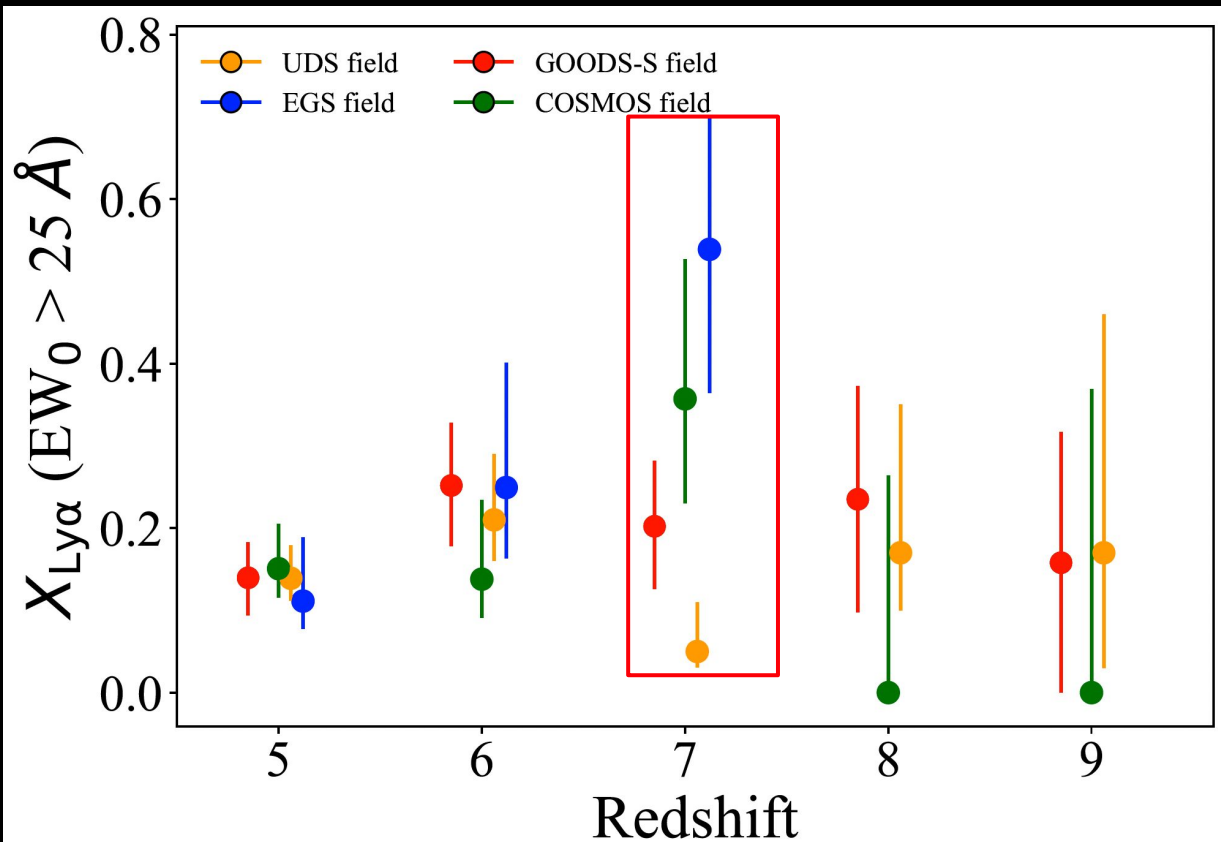
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Napolitano+26b in prep

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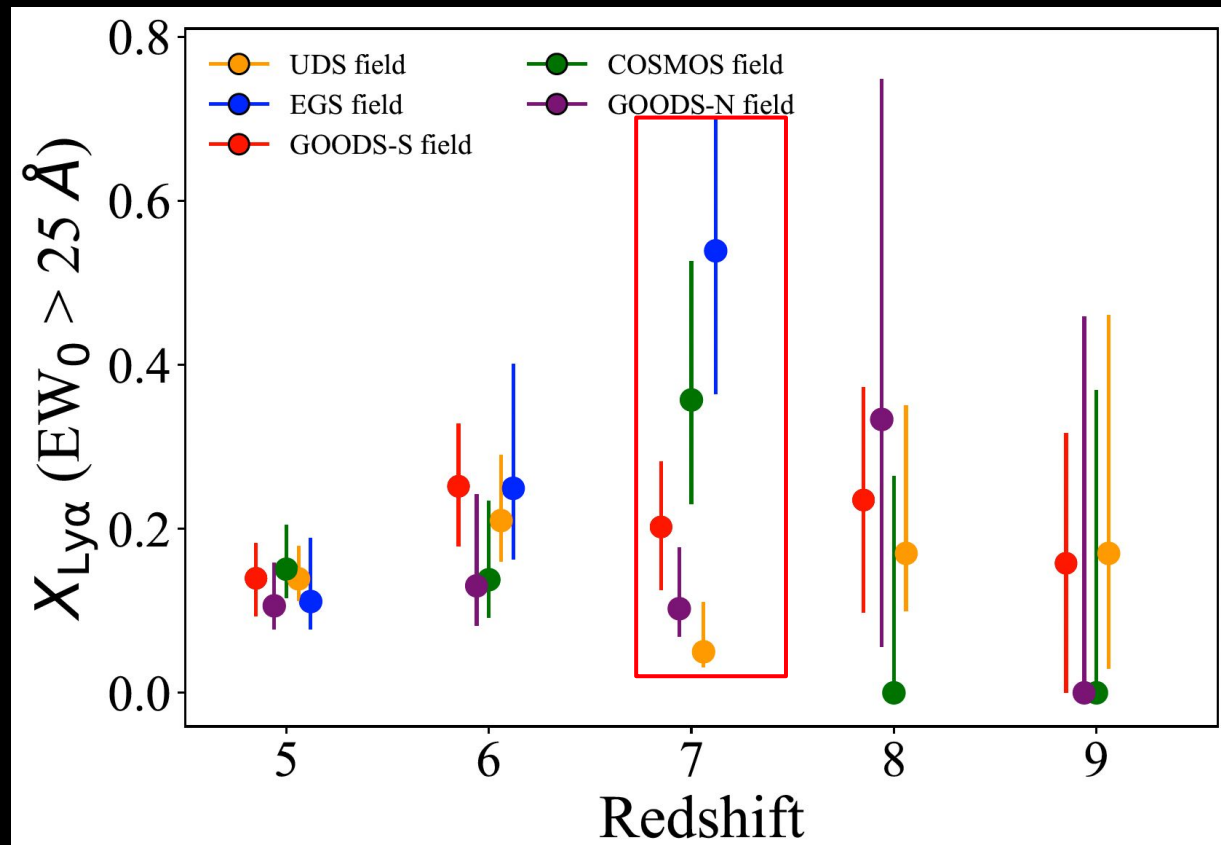
**EGS**: 9 LAEs / 16 SFGs

**GOODS-S**: 3 LAEs / 29 SFGs

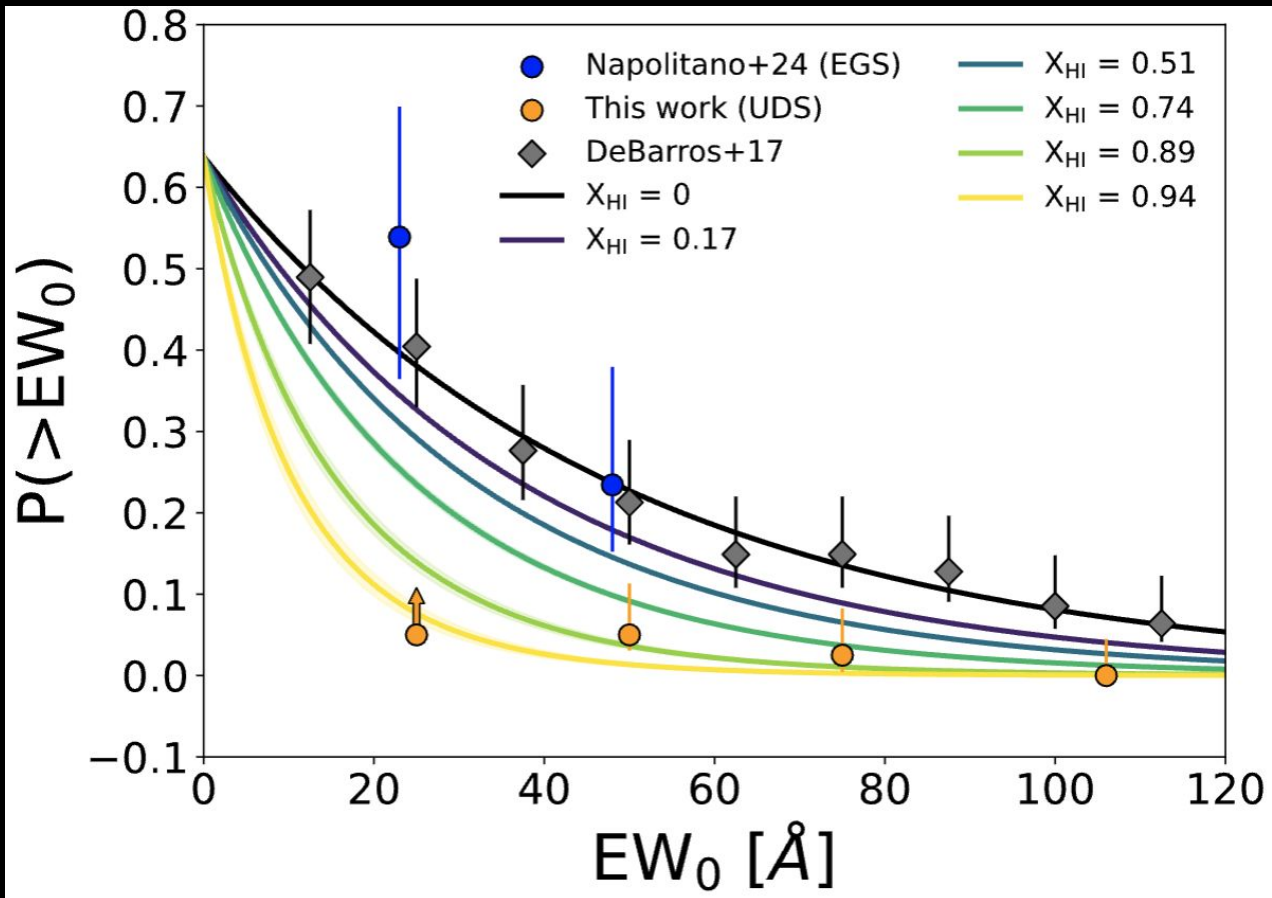
**COSMOS**: 5 LAEs / 14 SFGs

**GOODS-N**: 4 LAEs / 39 SFGs

2.7 $\sigma$  tension between the EGS and UDS results at  $z = 7$



# The neutral hydrogen fraction at $z = 7$



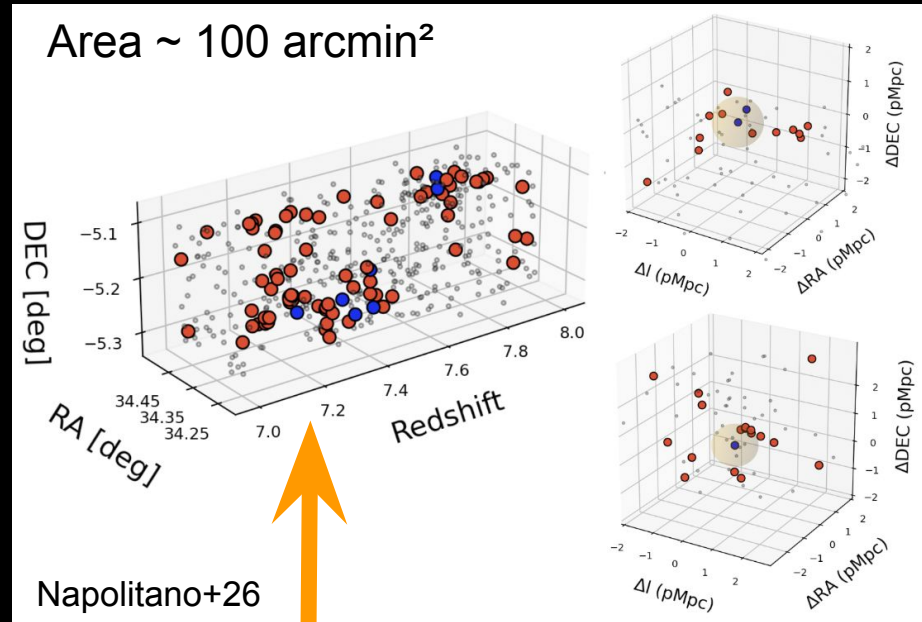
At  $z = 7$  there is huge field-to-field variation:

This a proof of a spatially inhomogeneous Cosmic Reionization

Models: Dijkstra+11

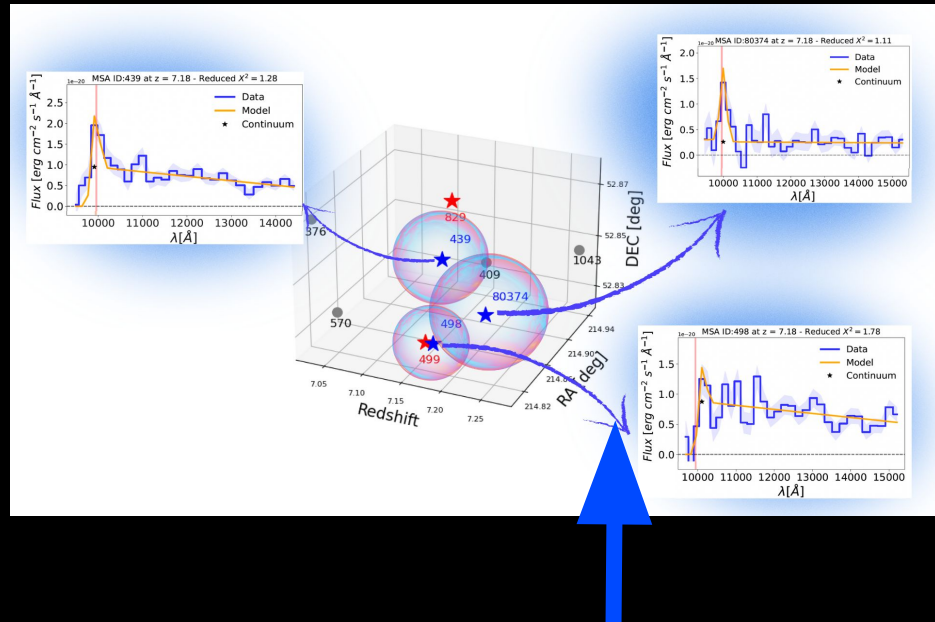
# Similar results come from studying ionized bubble properties

Area  $\sim 100$  arcmin<sup>2</sup>



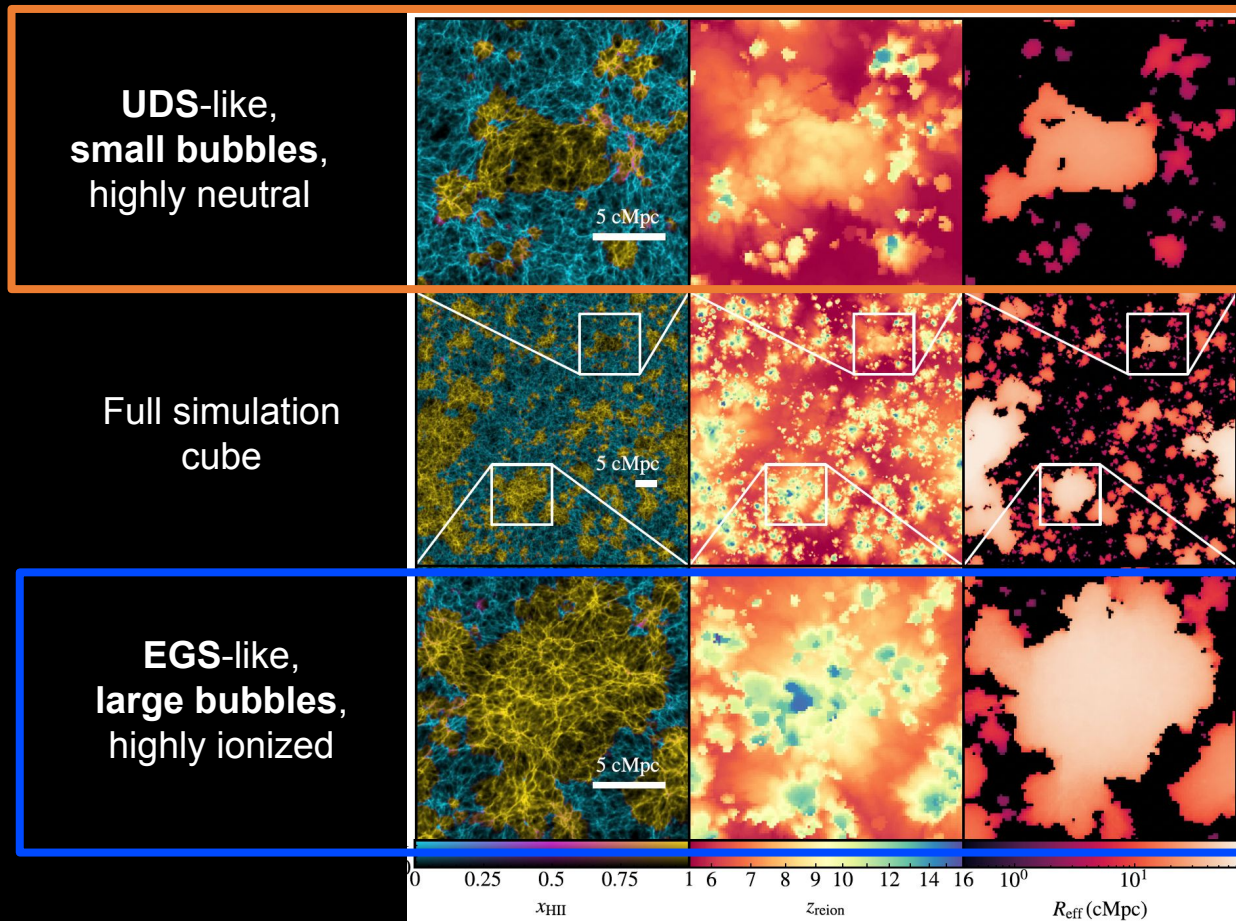
UDS field -small bubbles  
 $z_{\text{spec}} \sim 7.29$  and  $7.77$   
 3 Ly $\alpha$  emitting galaxies  
 0.5 - 0.6 pMpc

...see also Chen+24,+25, Tilvi+20,  
 Leonova+22, Larson+22, Jung+22



EGS field -large bubbles  
 $z_{\text{spec}} \sim 7.18$  and  $7.48$   
 3 Ly $\alpha$  emitting galaxies  
 within 1.2 - 2.5 pMpc

# Ionized bubble statistics: a direct comparison to simulations



Neyer+24,25