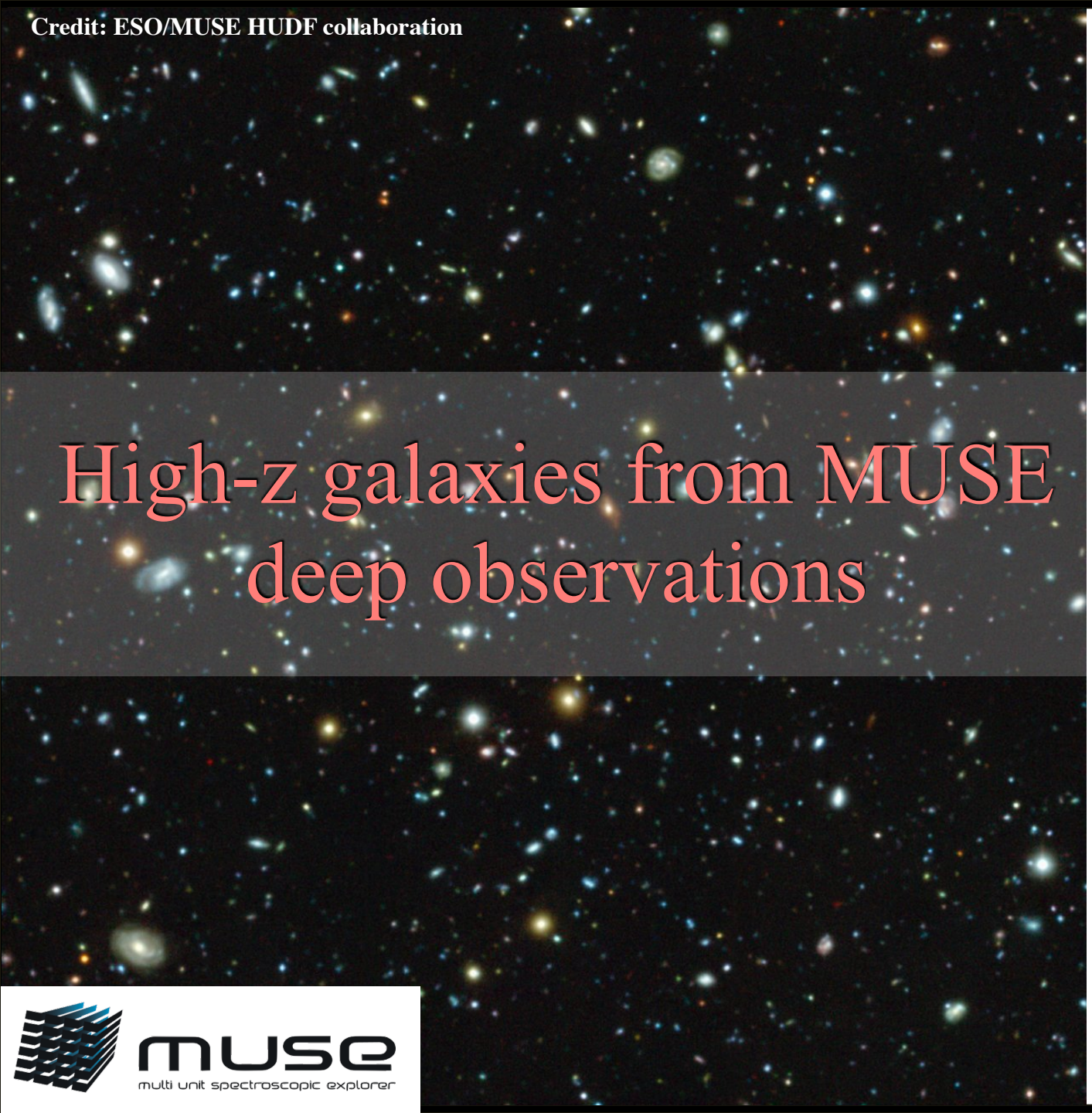


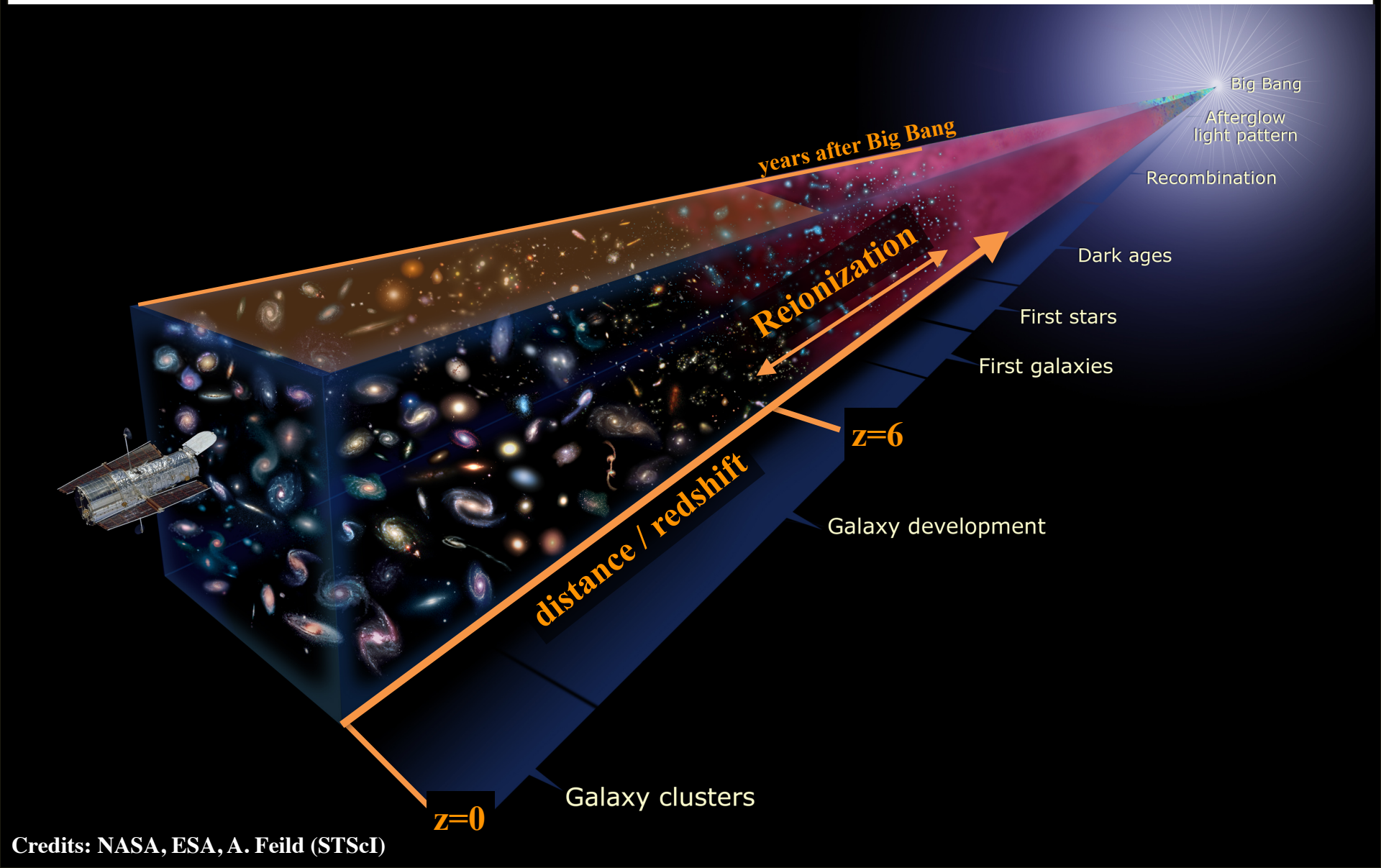
High-z galaxies from MUSE deep observations

INAF
ISTITUTO NAZIONALE
DI ASTROFISICA

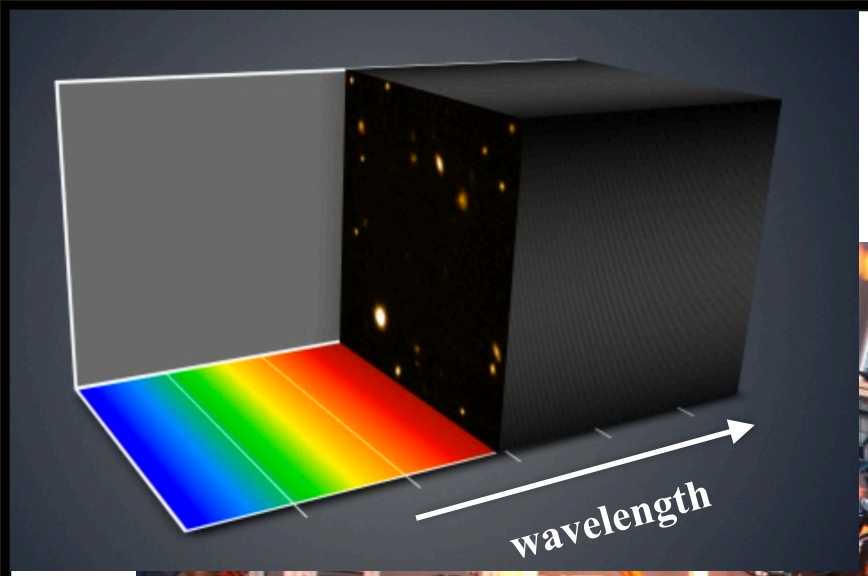
A. Feltre
(INAF/OAS)
&
MUSE consortium

muse
multi unit spectroscopic explorer

The context …



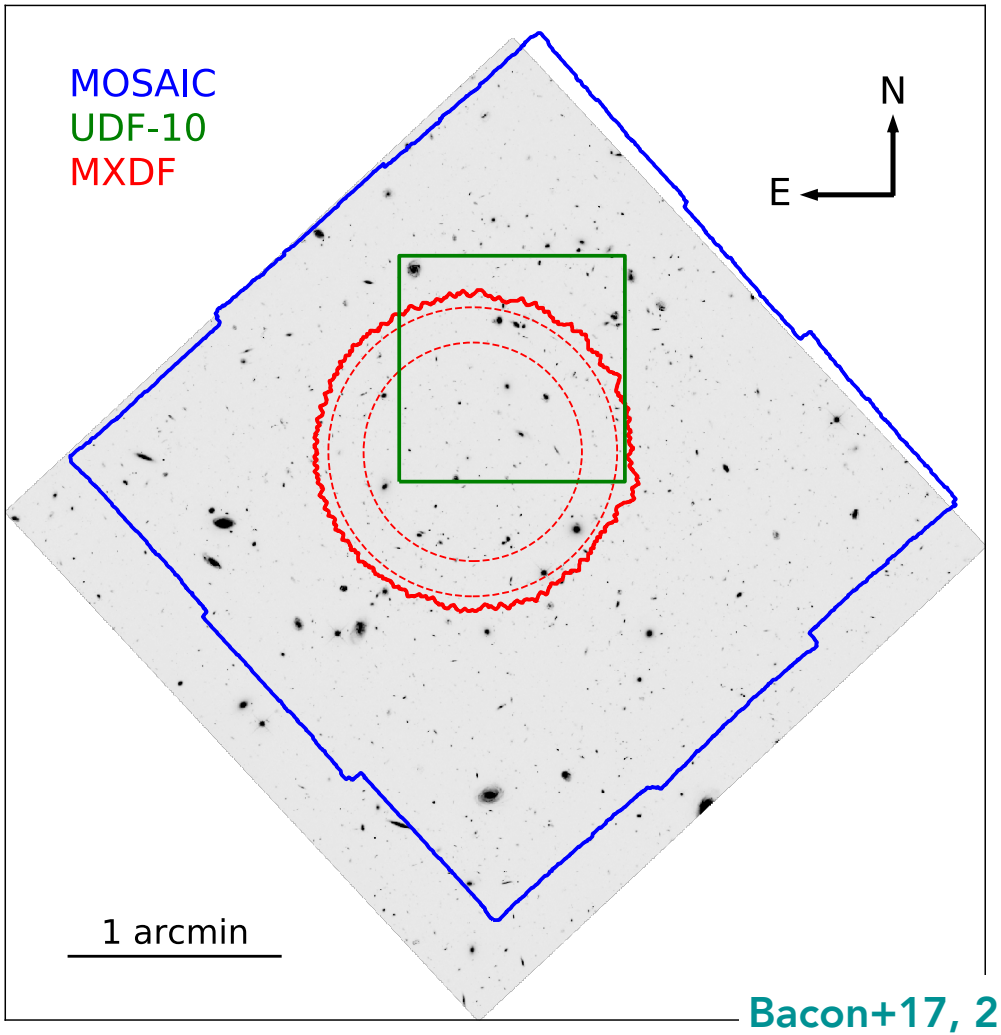
Credits: NASA, ESA, A. Feild (STScI)



muse
multi unit spectroscopic explorer

- Integral Field Unit on VLT
- 4750-9300 Å
- R~3000
- Field 1′x1′, sampled at 0.2″ (WFM)
- Field 7″x7″, 0.025″ (NFM)
- Coupled to ESO AO Facility

MUSE Surveys in the Hubble Ultra Deep Field



Bacon+17, 21

MUSE - Wide (100 fields in CDFS+COSMOS) 78 arcmin^2, 1h

MUSE - Deep (MOSAIC)

9 arcmin^2, 10 h

MUSE - Ultra Deep (UDF-10)

1 arcmin^2, 31 h

MUSE - eXtreme Deep (MXDF)

1 arcmin^2, >100h

3σ emission line detection limit :

- MOSAIC: 3.1 $\times 10^{-19}$ erg s^{-1}cm^{-2}
- UDF-10: 1.5 $\times 10^{-19}$ erg s^{-1}cm^{-2}

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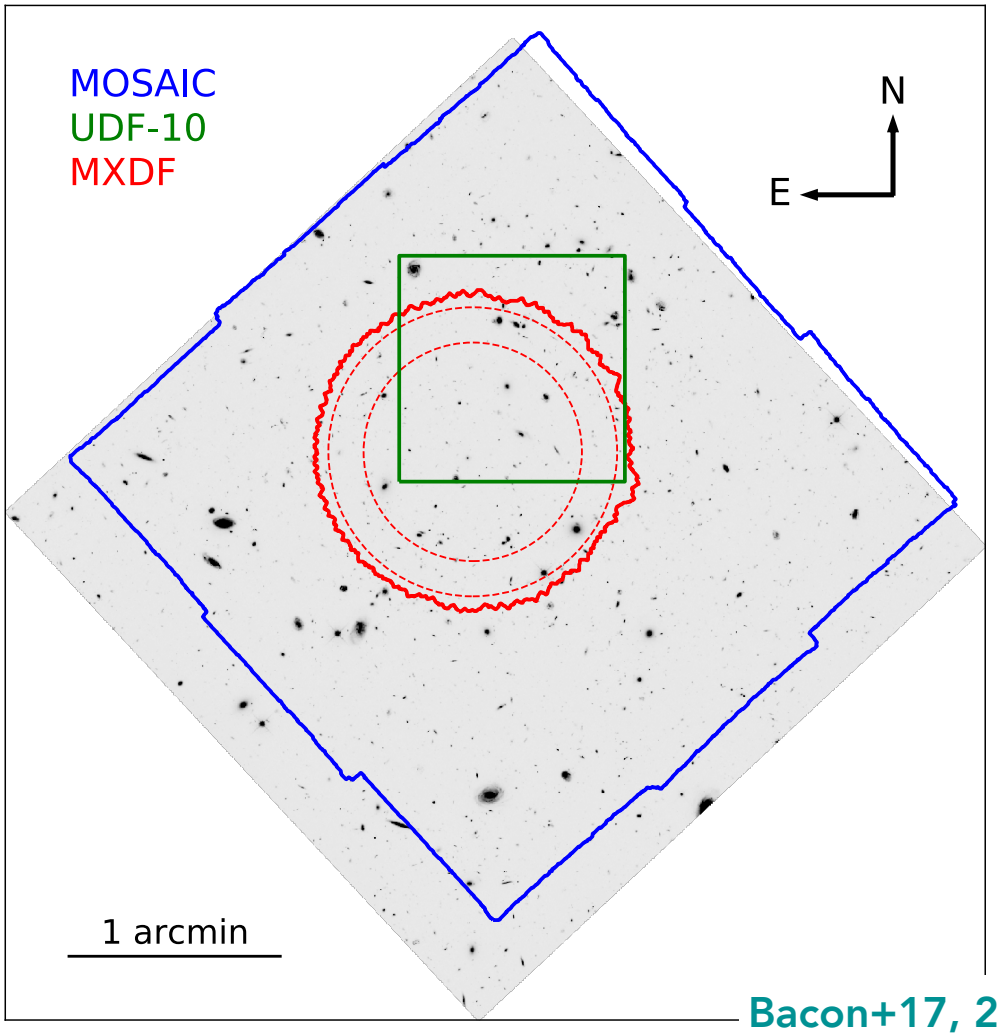

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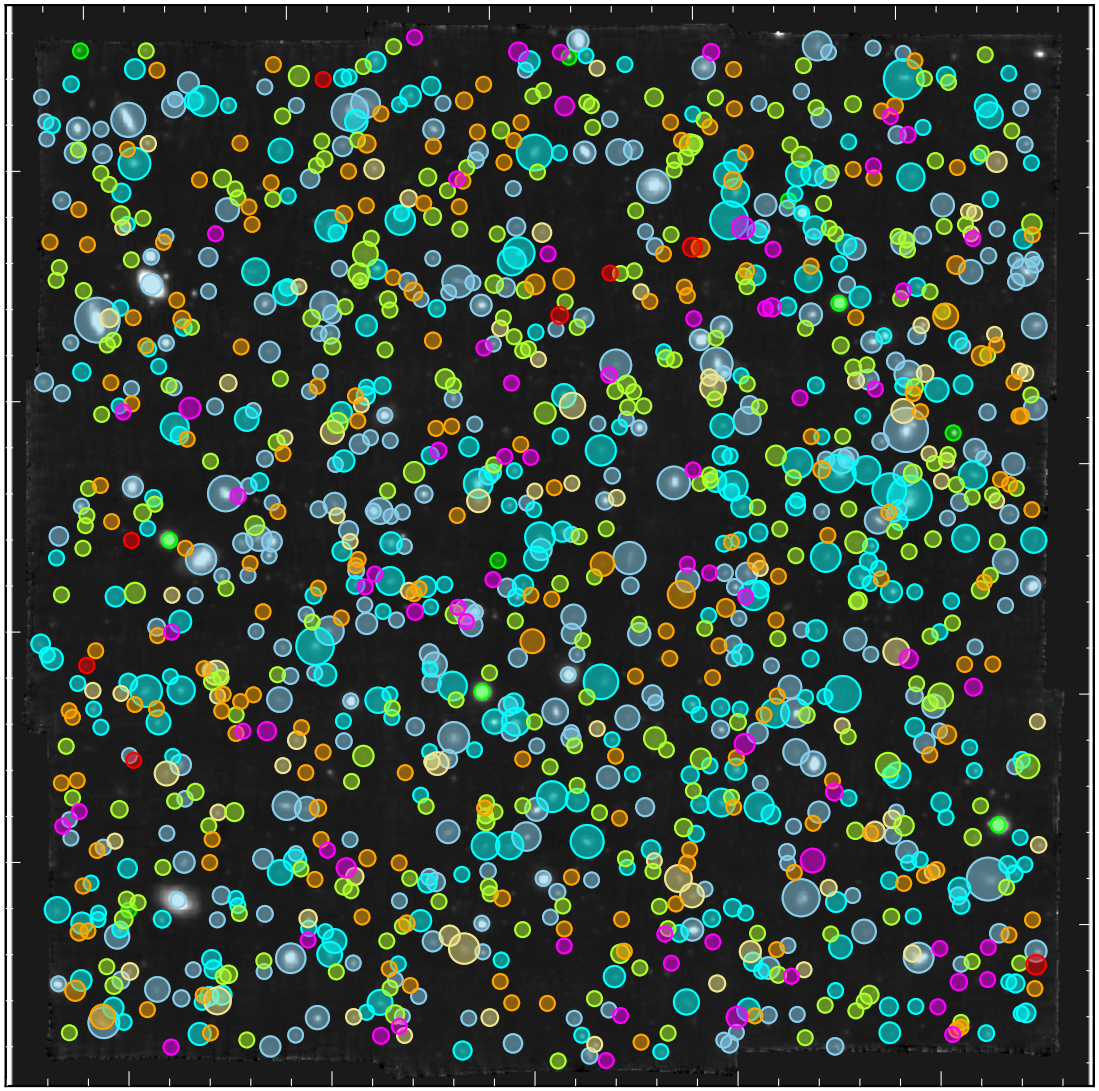
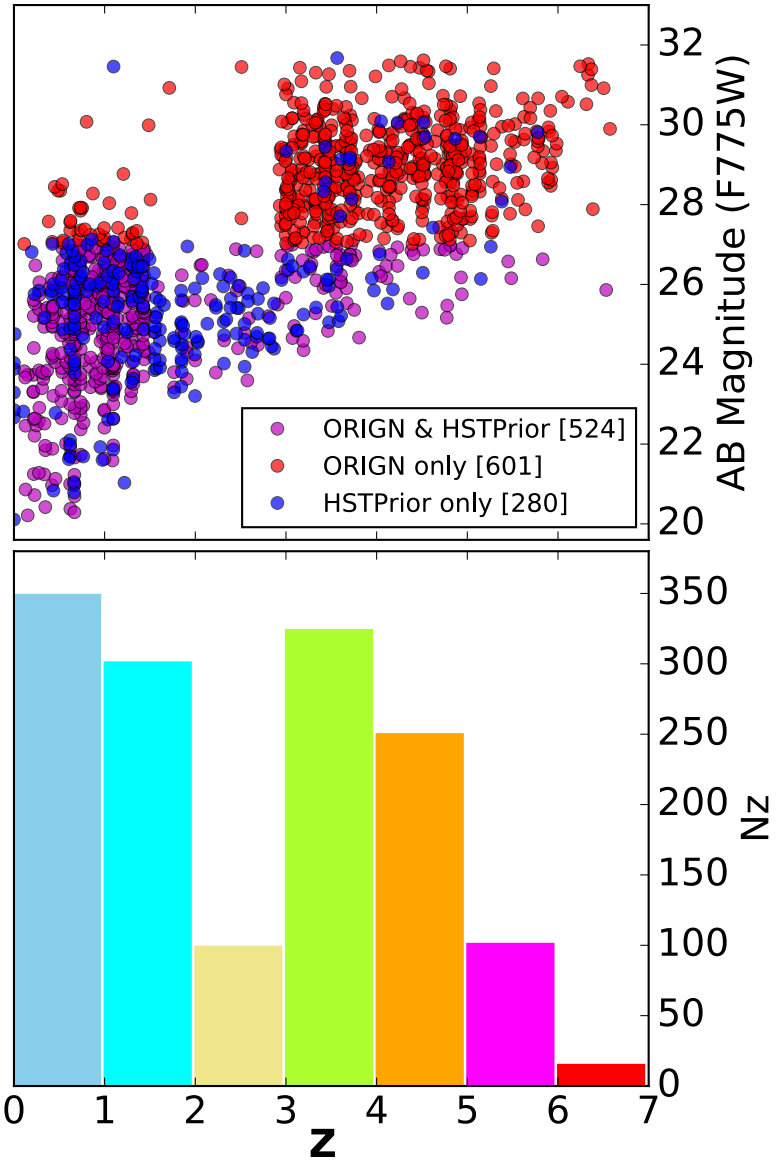
Bacon+17

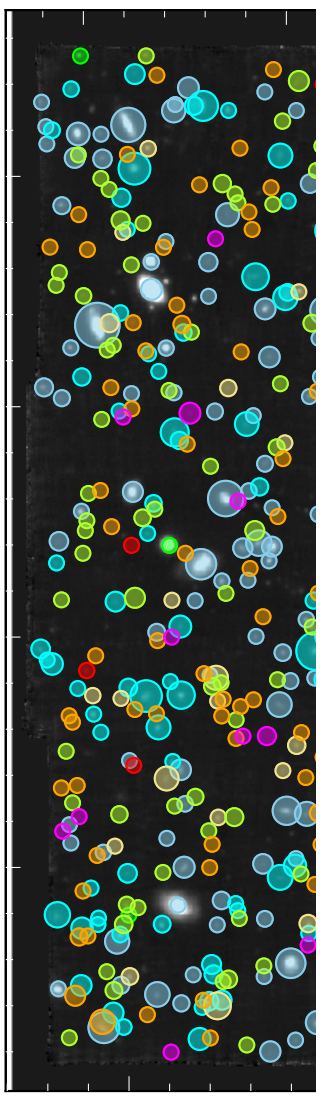


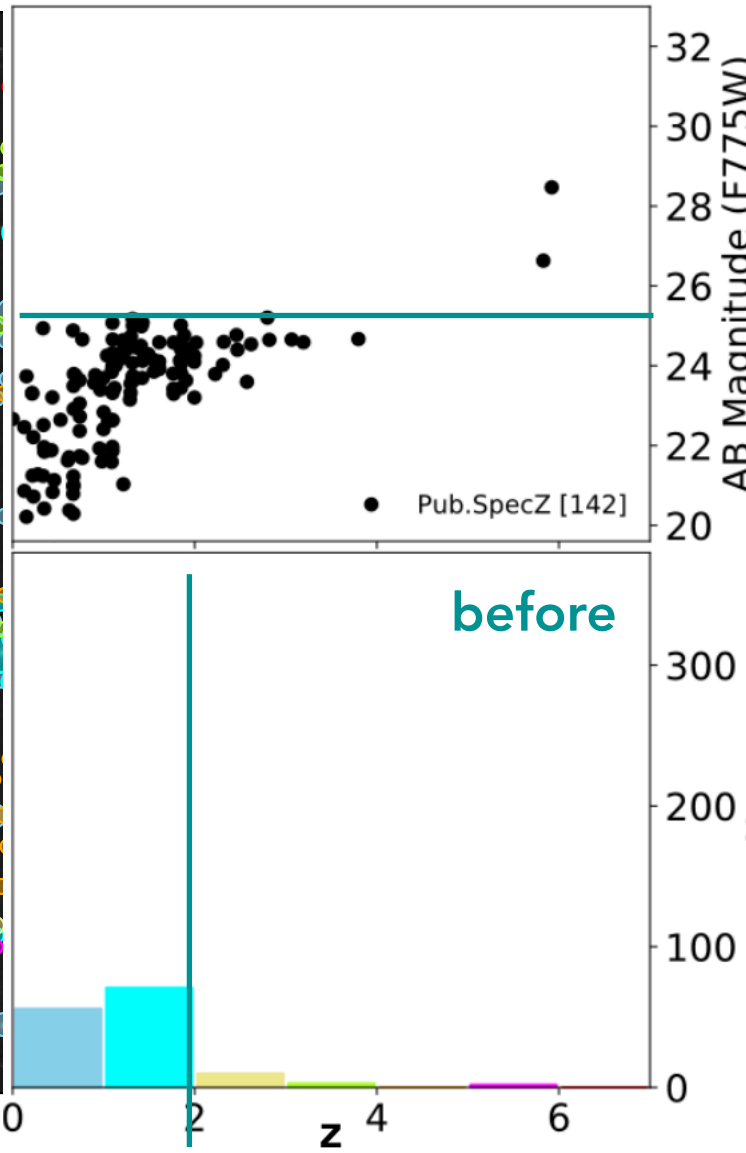


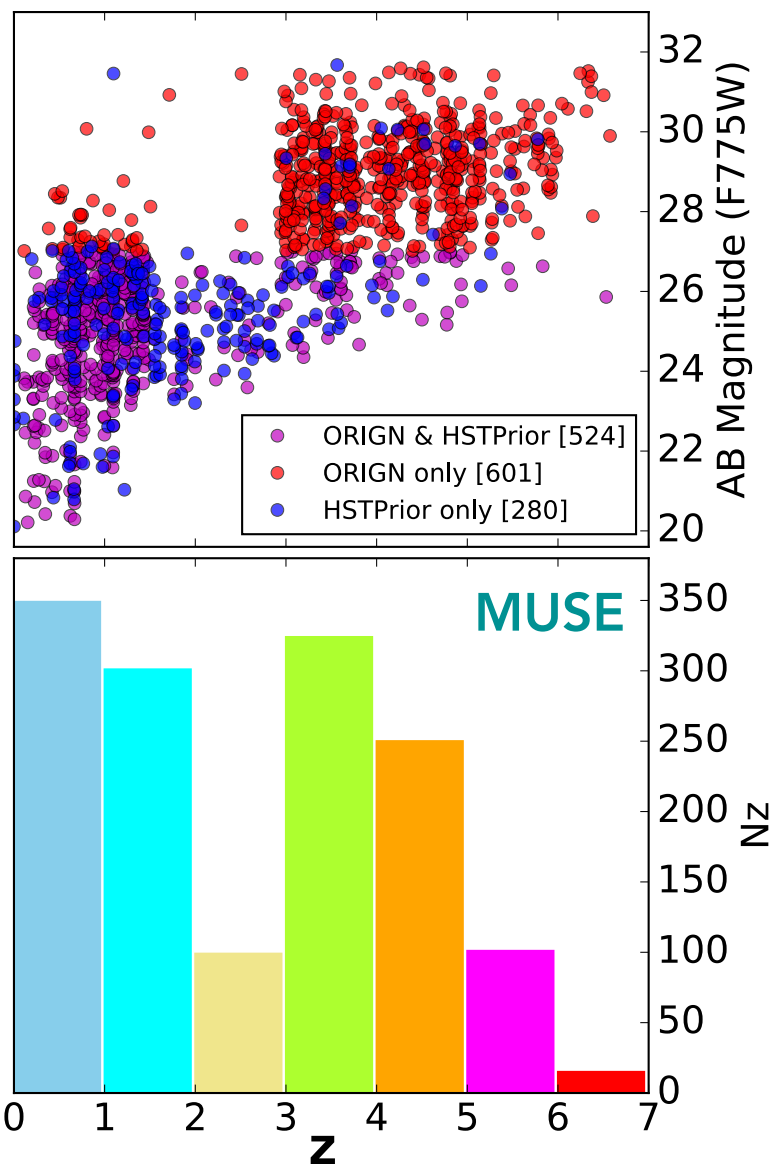
Courtesy of R. Bacon

MUSE Hubble Ultra Deep Field Survey

Bacon+17



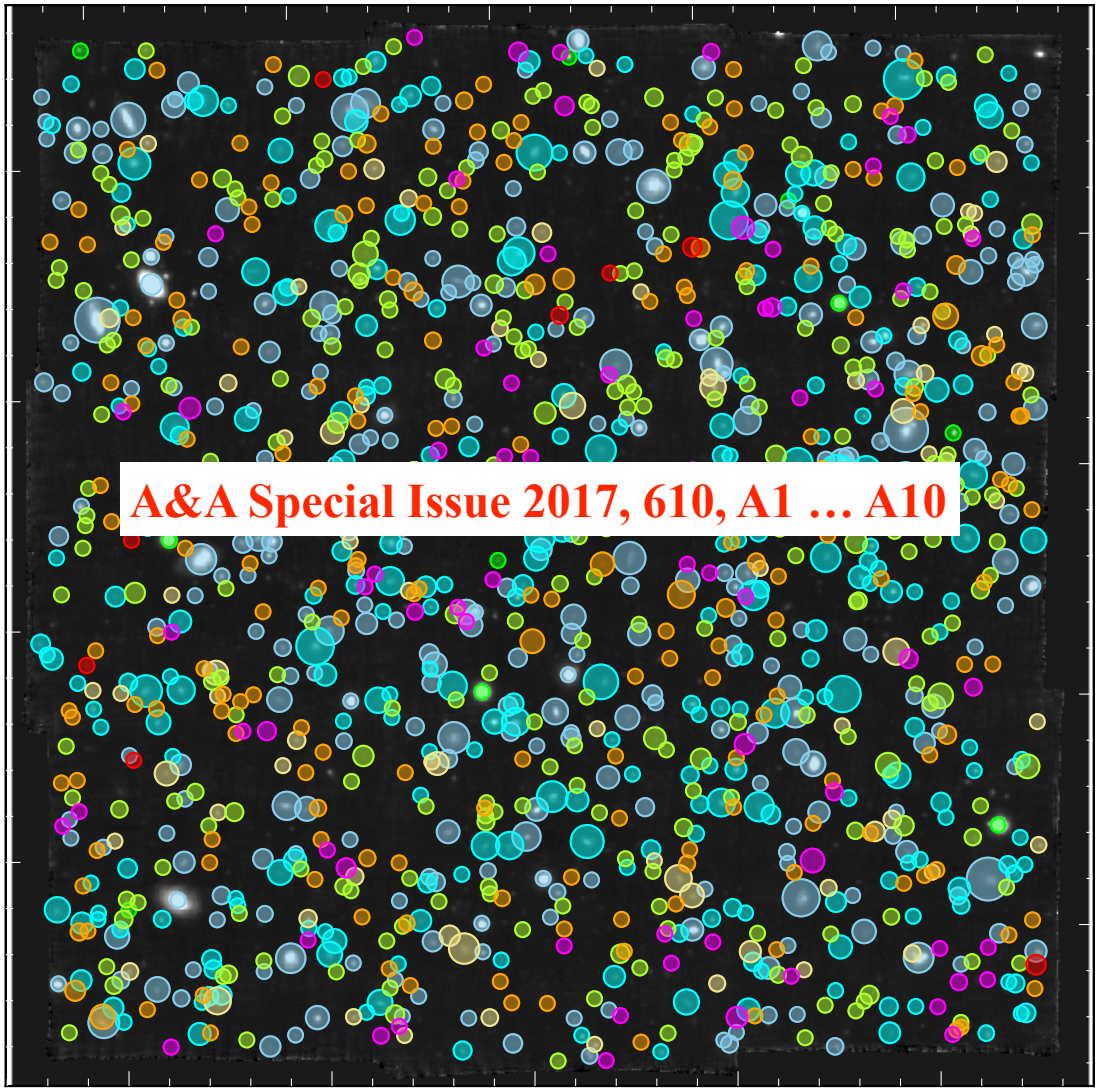


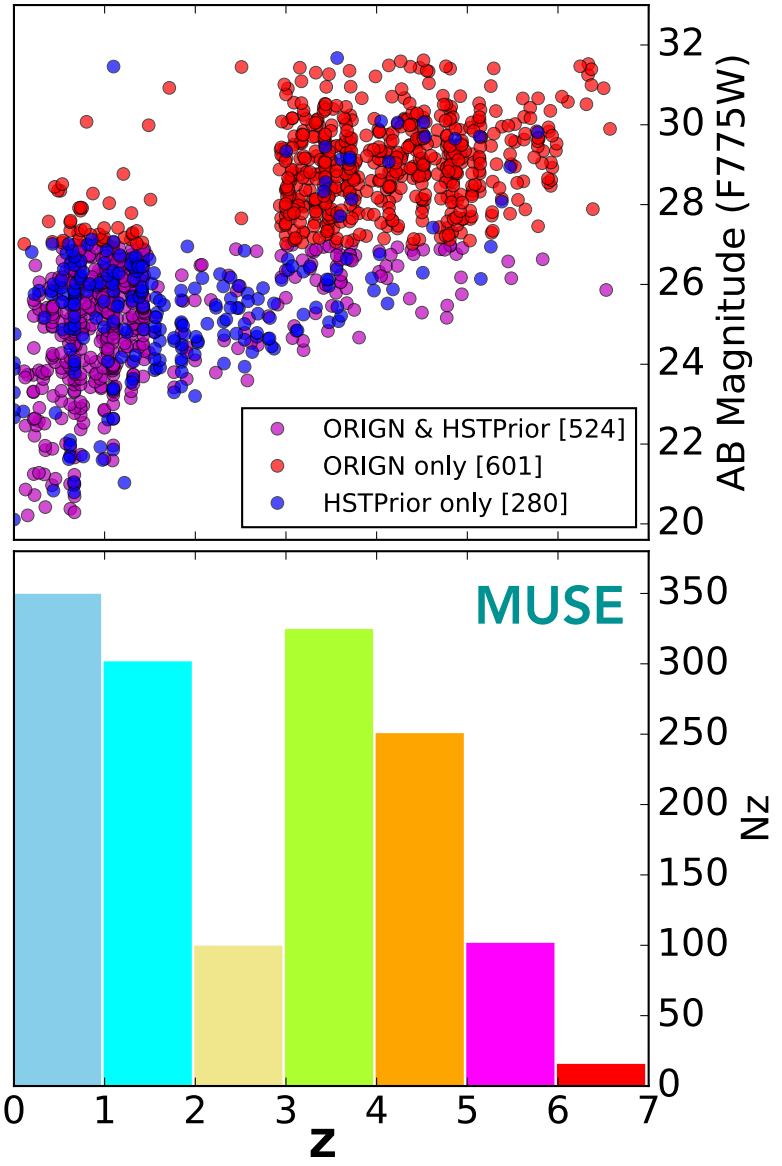


Courtesy of R. Bacon

MUSE Hubble Ultra Deep Field Survey

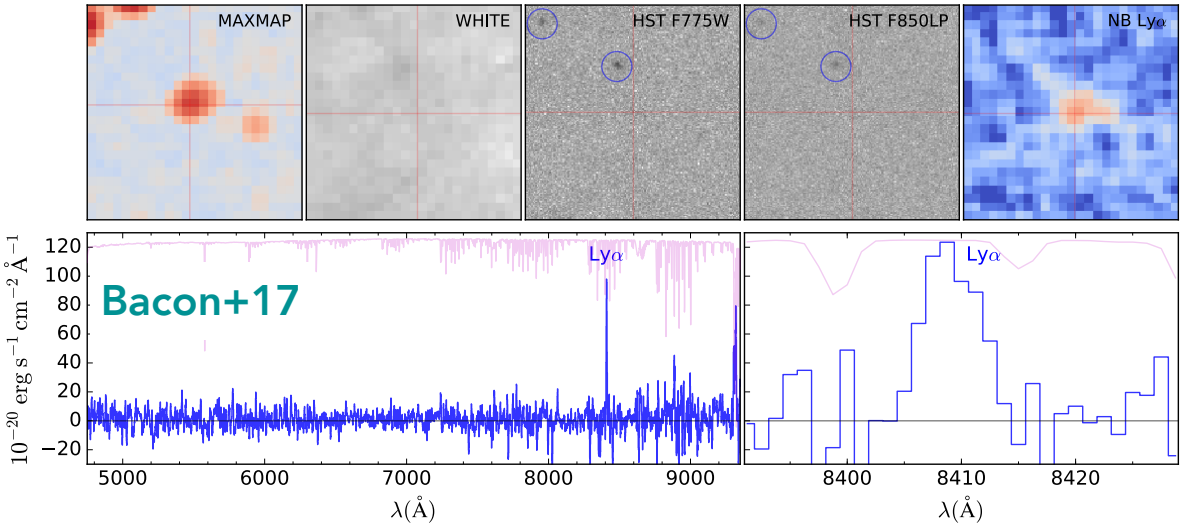
Bacon+17





Courtesy of R. Bacon

Lyα emitters (LAEs) in the MUSE HUDF Survey



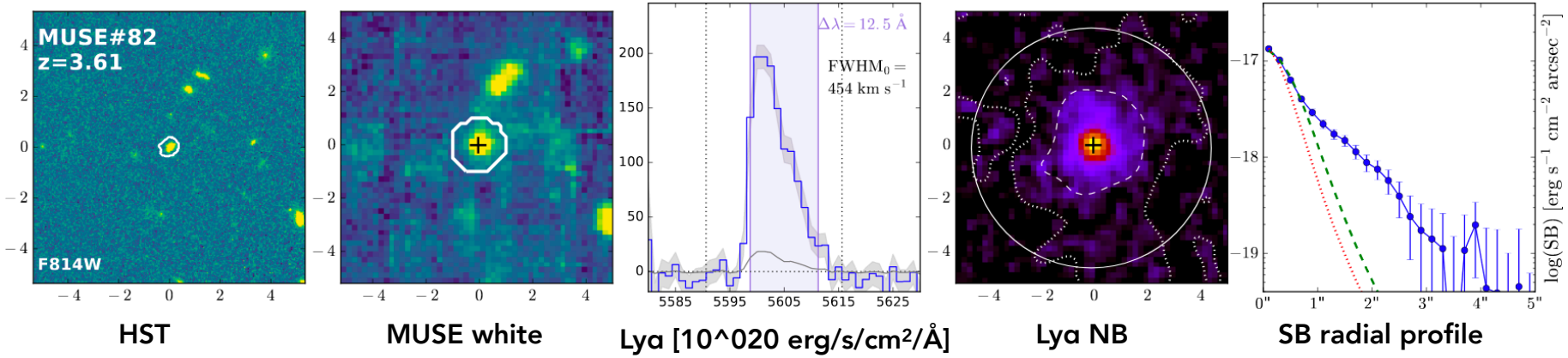
88 missed in the HST catalog

72 beyond the HST detection limit Maseda+18,20

Lyα extended emission from the **circumgalactic medium** (CGM) of high-z galaxies

- observed in 80% of the sample
- > 50% of the CGM virial radius
- up to 70% of Lyα flux in the halo

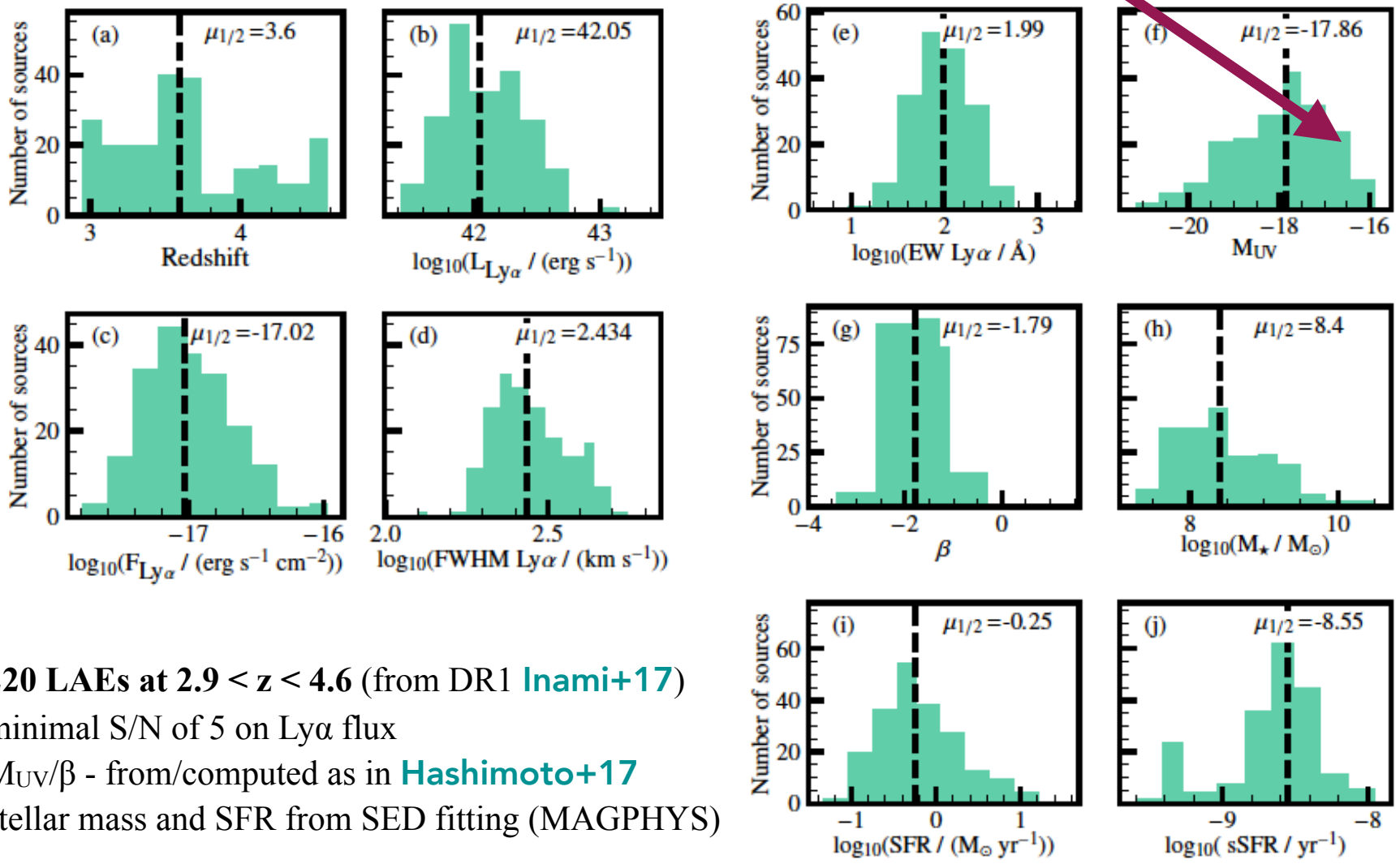
Leclercq+17,20, Wisotzki+16,18



Properties of the MUSE LAEs

at least 2 orders of magnitude fainter than other surveys

Feltre+20



- **220 LAEs at 2.9 < z < 4.6** (from DR1 Inami+17)
- minimal S/N of 5 on Lyα flux
- M_{UV}/β - from/computed as in Hashimoto+17
- stellar mass and SFR from SED fitting (MAGPHYS)

LAEs stacked spectrum

- **nebular emission lines**

ionized gas
(density, metallicity, ionization)

- **ISM absorption**

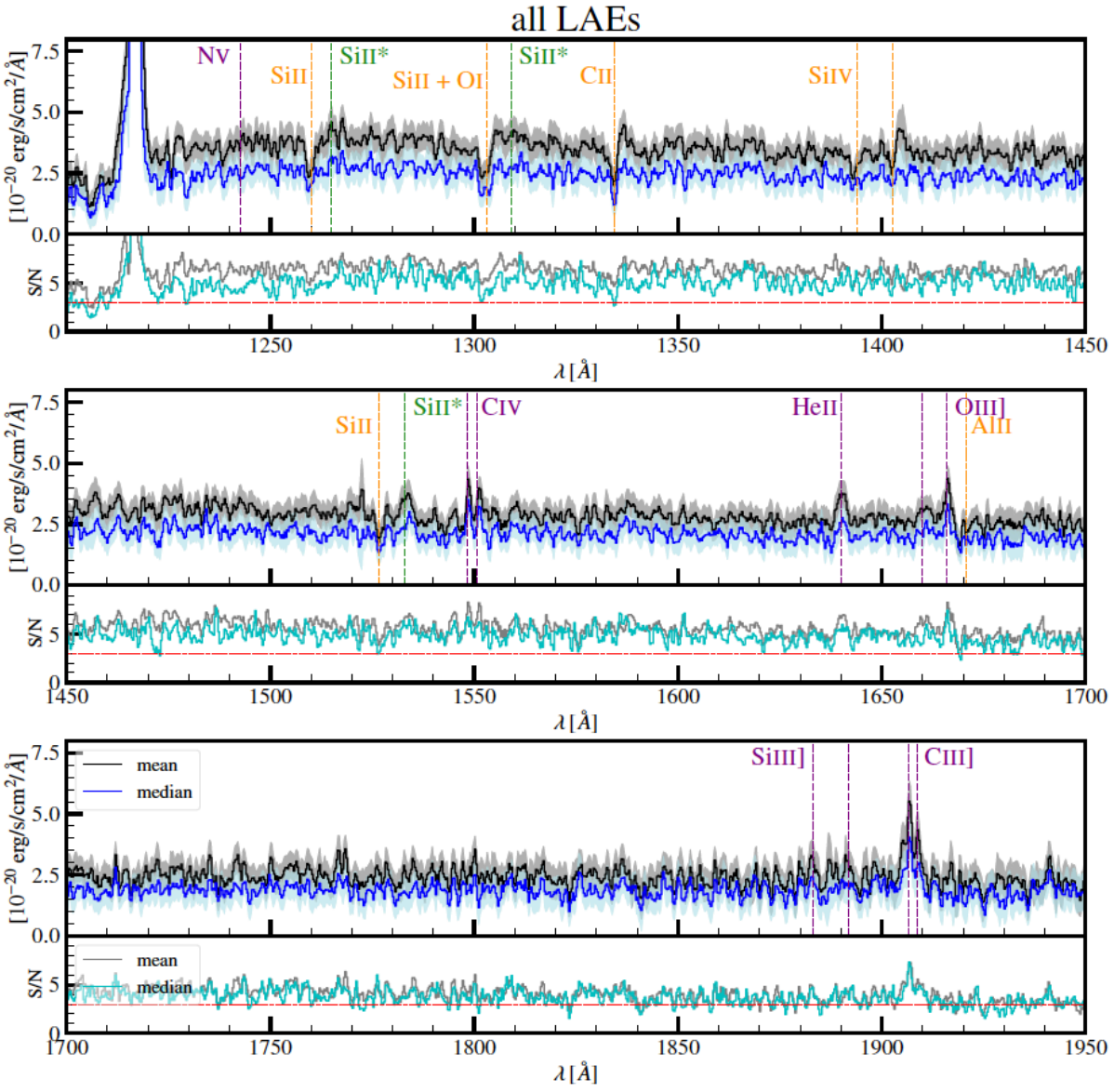
outflows, optical depth

- **stellar features**

stellar population
(e.g. hot/massive stars)

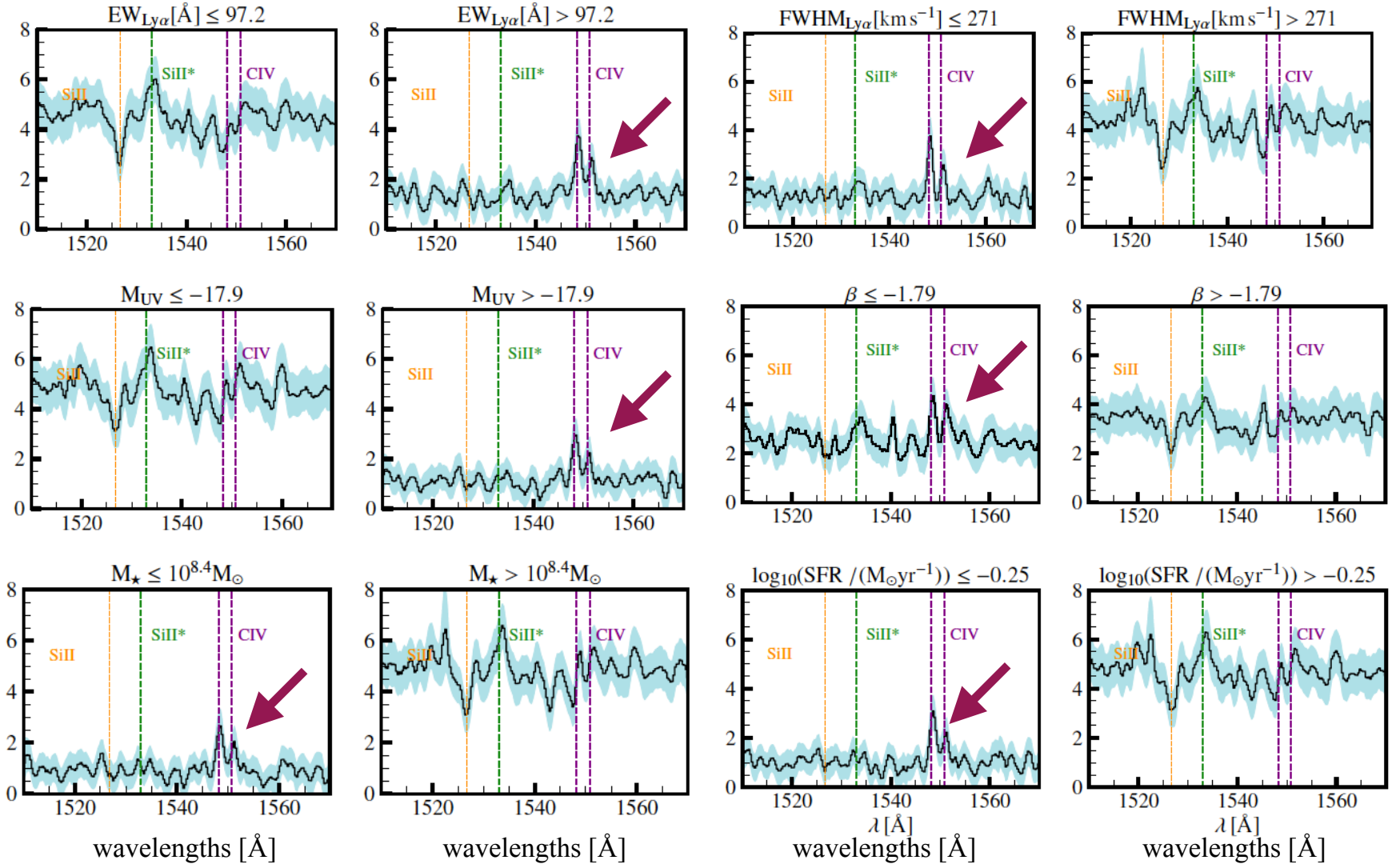
- **fine-structure transitions**

origin ambiguous
(e.g. outflows?)



Feltre+20

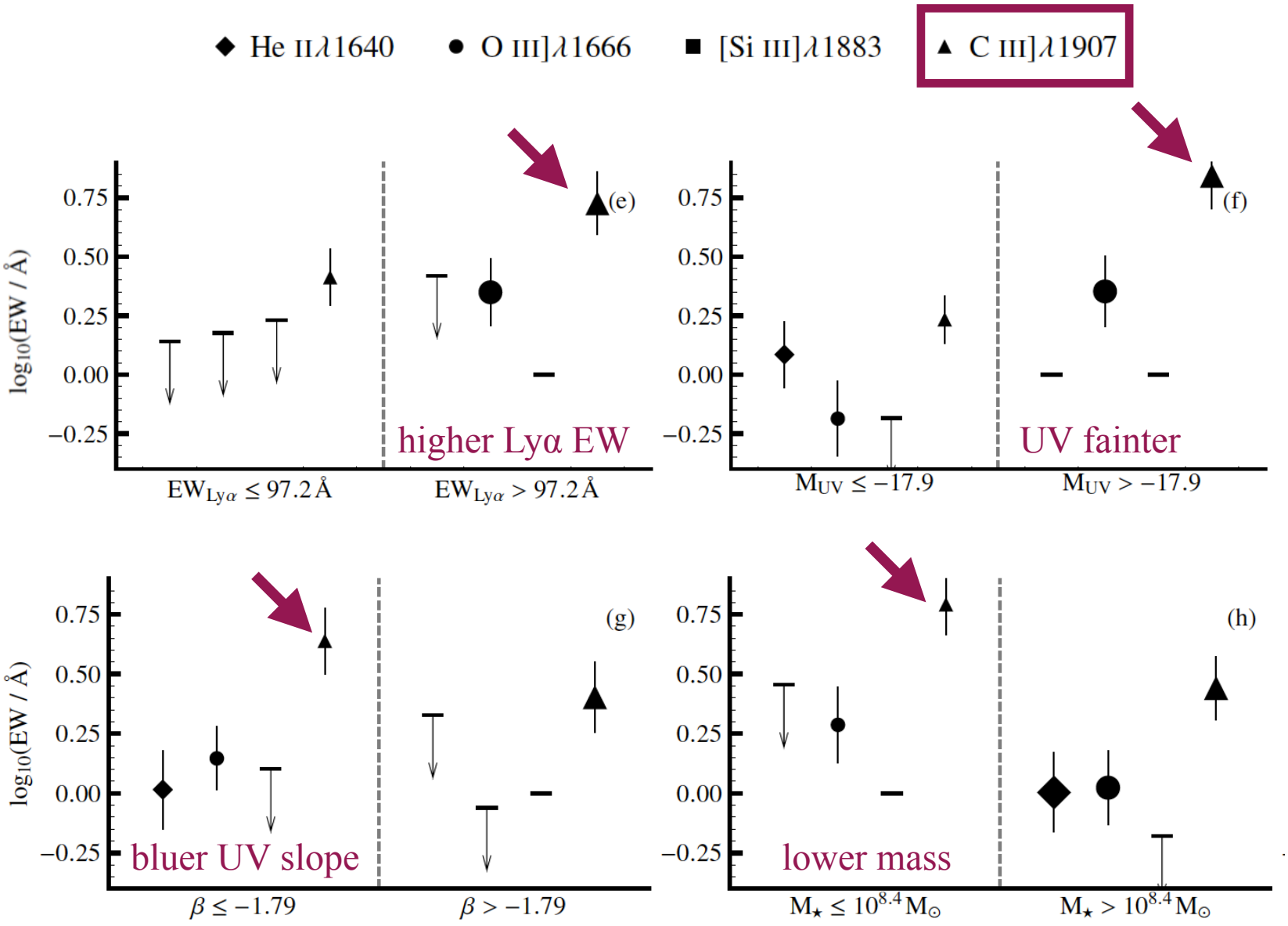
CIV resonant doublet and absorption features



CIV EW (emission doublet) = 2 - 5 Å

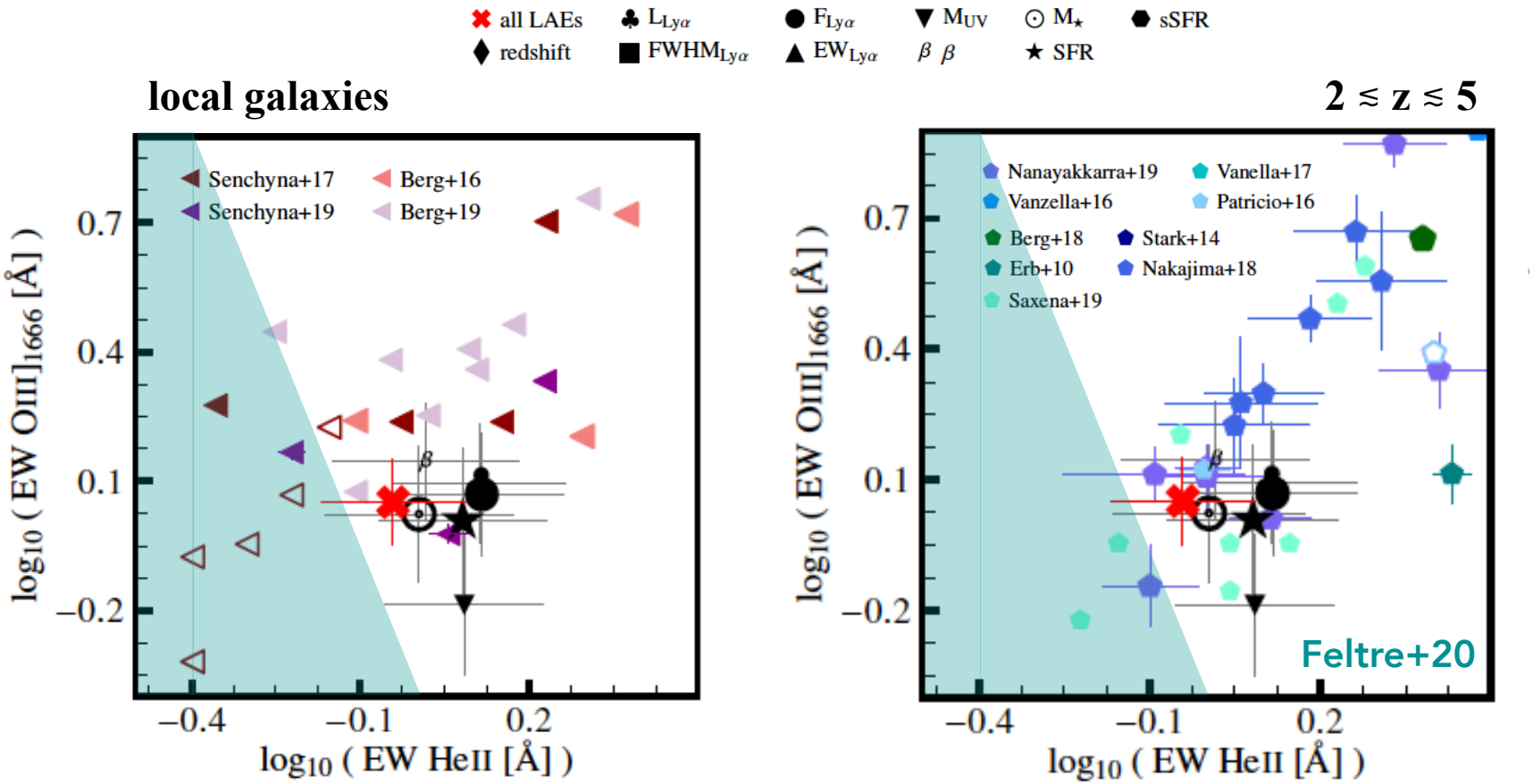
Feltre+20

Nebular emission lines



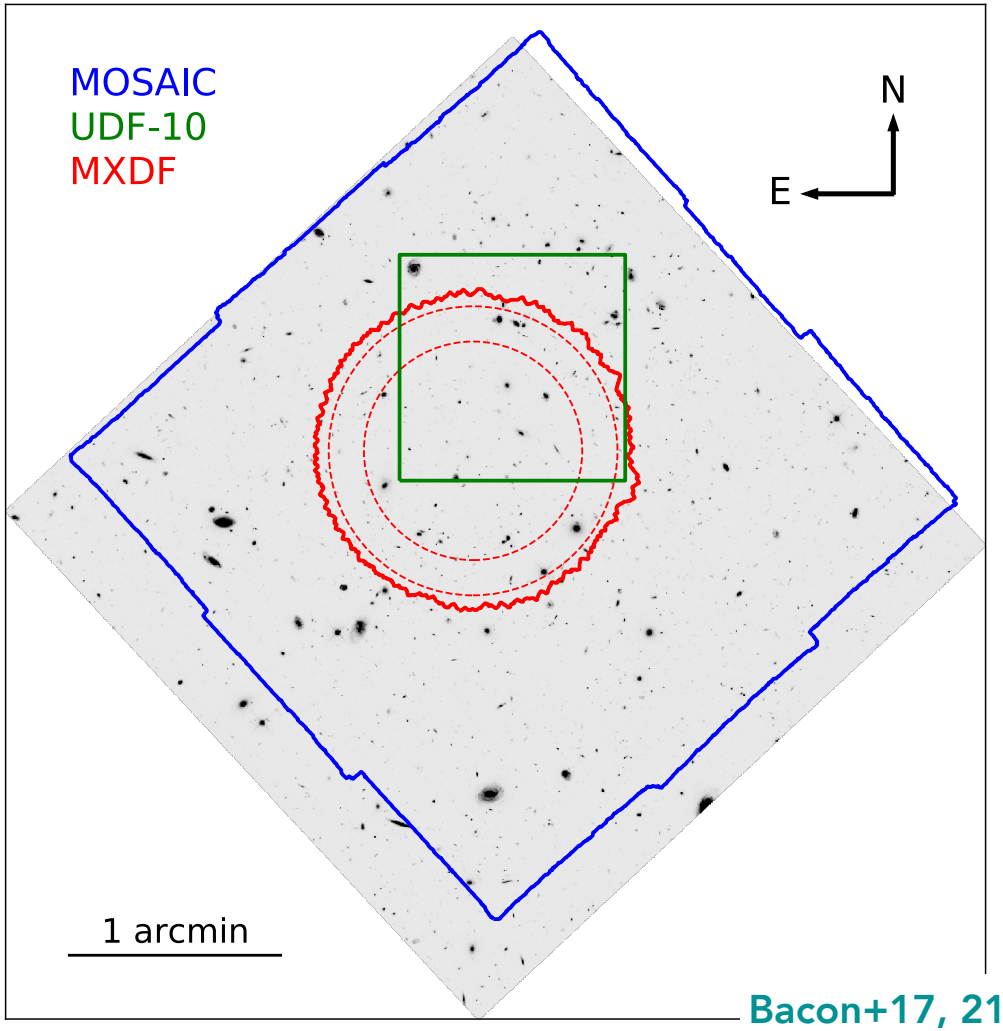
Feltre+20

Comparison with the literature



- emission lines in overall agreement with other z>2 sources and local metal-poor galaxies
- current spectral models can not fully account for the observed HeII nebular emission (requiring photons with energy > 54 eV, **Berg+18, Nanayakkara+19, Plat+19**)

MUSE - eXtreme Deep Field (MXDF)



Bacon+17, 21

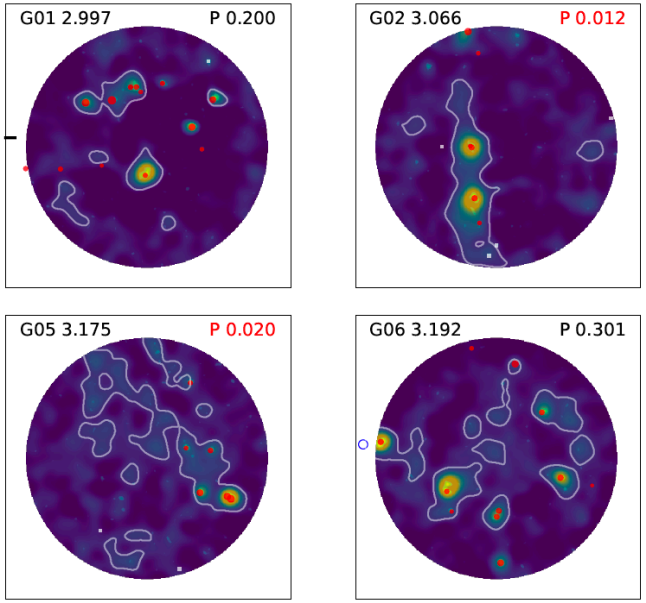
- maximum depth of 140h
- 1 arcmin^2 assisted with AO
- improved image quality

Catalog of 733 sources in the MDXF

Bacon+21, Bacon+ in prep

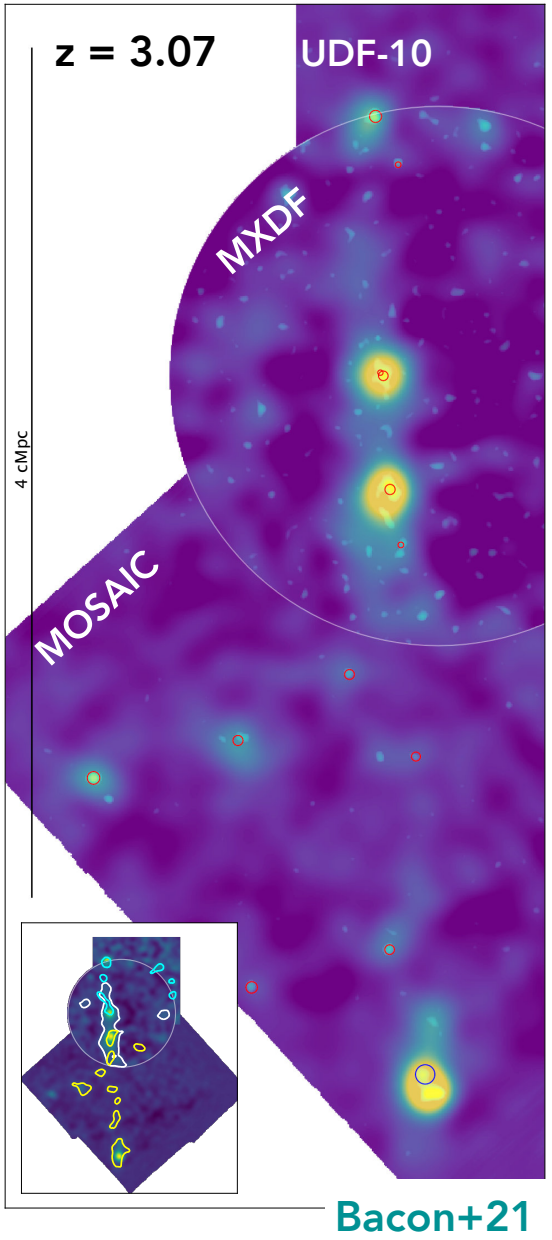
1258 LAEs at z>2.9 in all the 9 arcmin^2

MUSE - eXtreme Deep Field (MXDF)



22 overdensities

- 370 LAEs in groups (29% of the total sample)
- 17 members on average (min. 10 - max. 26)
- mean overdensity $\delta = 3.2$
- 31% of the members are HST-undetected LAEs



14 overdensities show extended Lyα emission

- 70% Lyα flux of filaments comes from beyond the the CGM
- 5 have extended Lyα emission with high significance (average surface brightness of 5×10^{-20} erg/s/cm^2/arcsec^2)

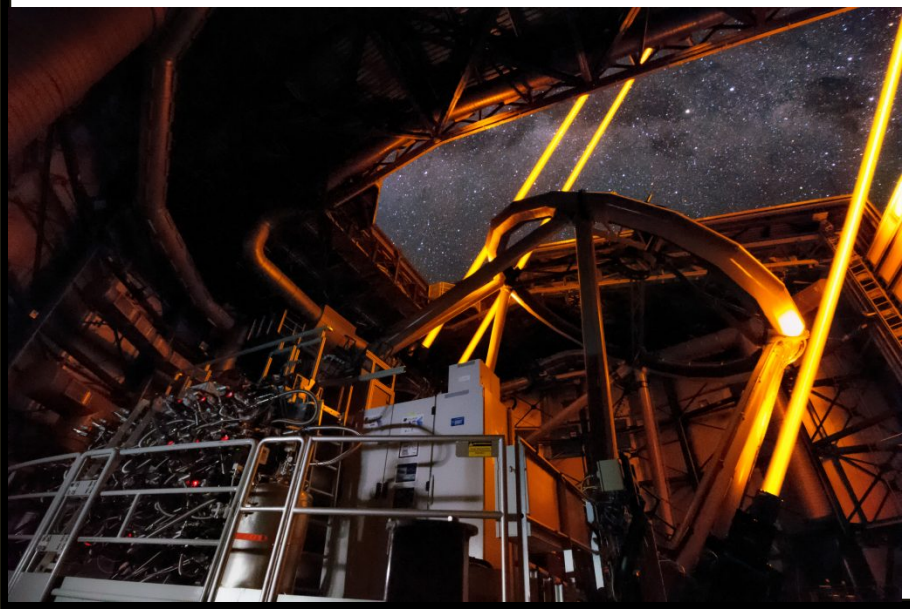
Origin of diffuse Lyα emission in the filaments?

- UV background Lyα fluorescence: <30% at z~3, <10% at higher z
- **population of undetected ultra low luminosity LAEs**

(steep Lyα LF($\alpha<-1.84$), extends to luminosities $<10^{38}-10^{37}$ erg/s and significant faint LAEs clustering, ie. filling factor<1/6)

MUSE deep fields and high-z

- first access to a population of low-mass galaxies at high-z
- study of the ISM and CGM at z>3
- UV lines ubiquitous in faint and low-mass LAEs. The variety of profiles encodes information on galaxy properties and is mainly driven by M★ and SFR
- synergy with HST and JWST to understand galaxy evolution
- first detection of the cosmic web in emission in typical filamentary environments



Thank you!