THE PREVALENCE OF CIII EMISSION AT 1.5 < z < 4

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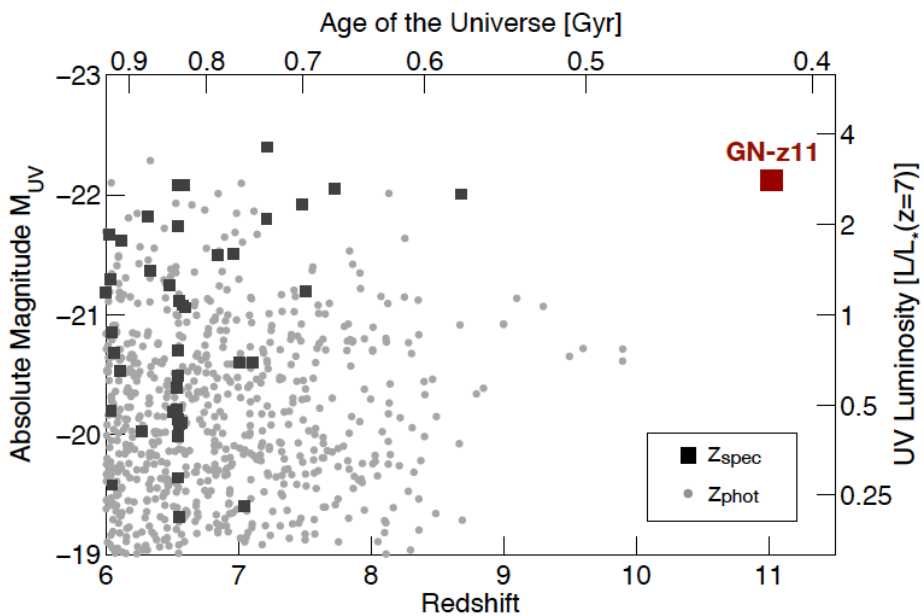
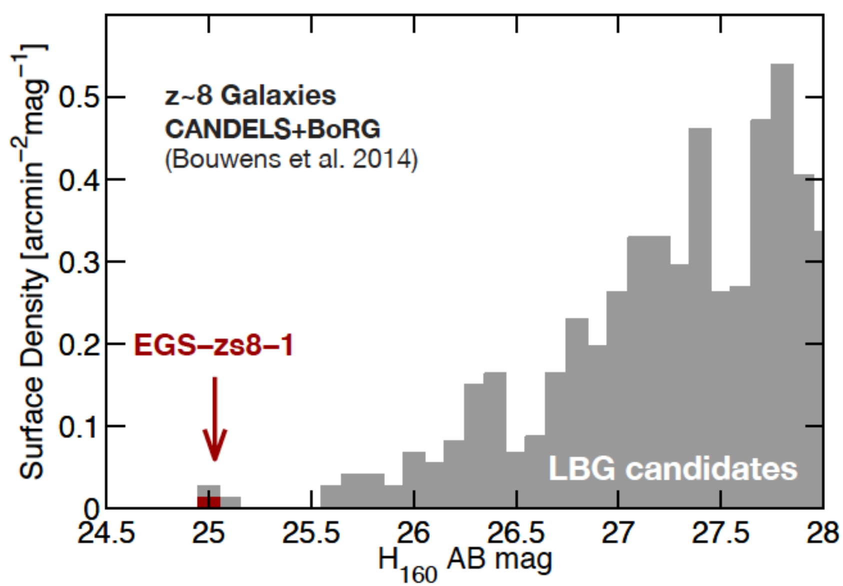
The current state of high-z studies

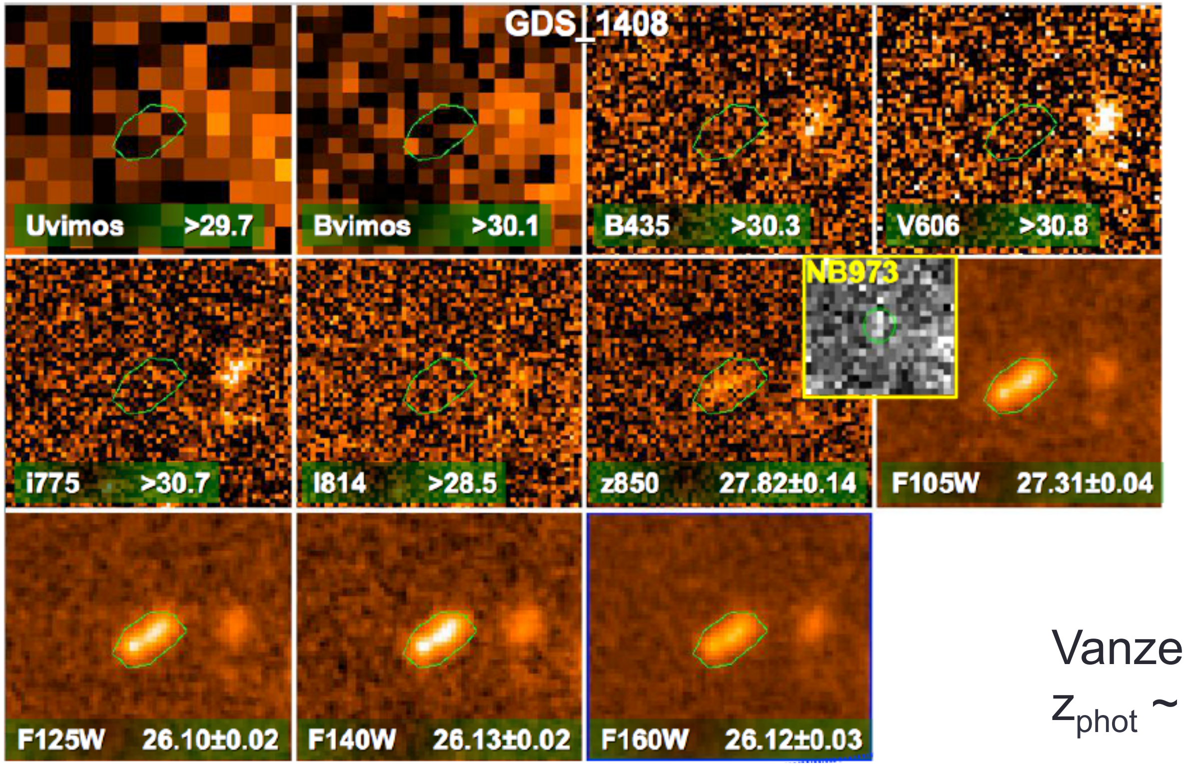
- Hundreds of photometric candidates at z > 5 from CANDELS, HUDF, BoRG, etc.
- But relatively few spectroscopic confirmations from Ly-α or continuum breaks





Oesch+15,16

We usually do OK with the brightest ones, but…

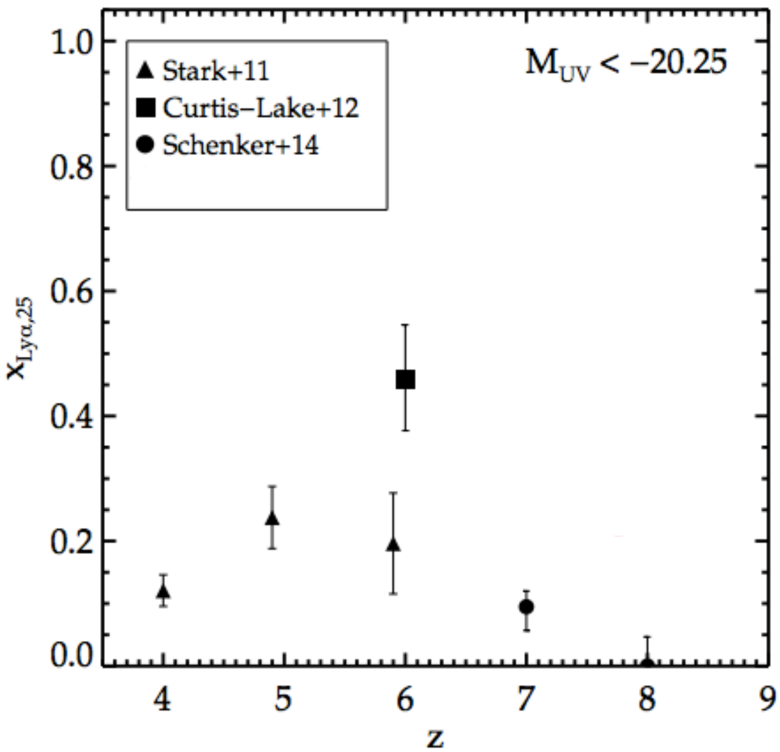


Vanzella+14
$z_{phot} \sim 7$

z-band dropout HUDF-J033242.56-274656.6

What's going on at high-z?

- Increasingly neutral IGM at z>6 leads to increased scattering of Ly-α photons (Stark+11, Pentericci+11, Treu+13, Dijkstra+14, …)



Stark+16

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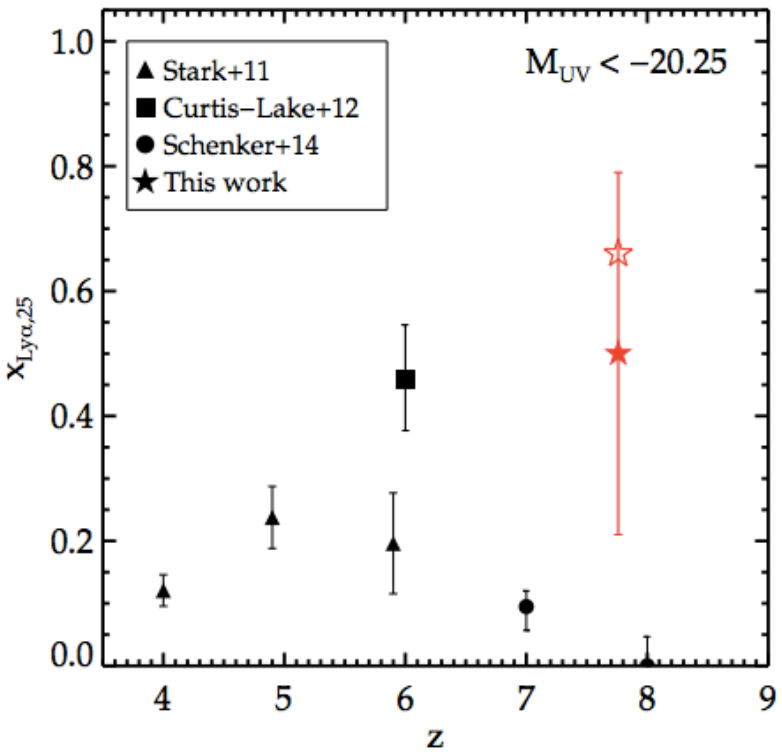
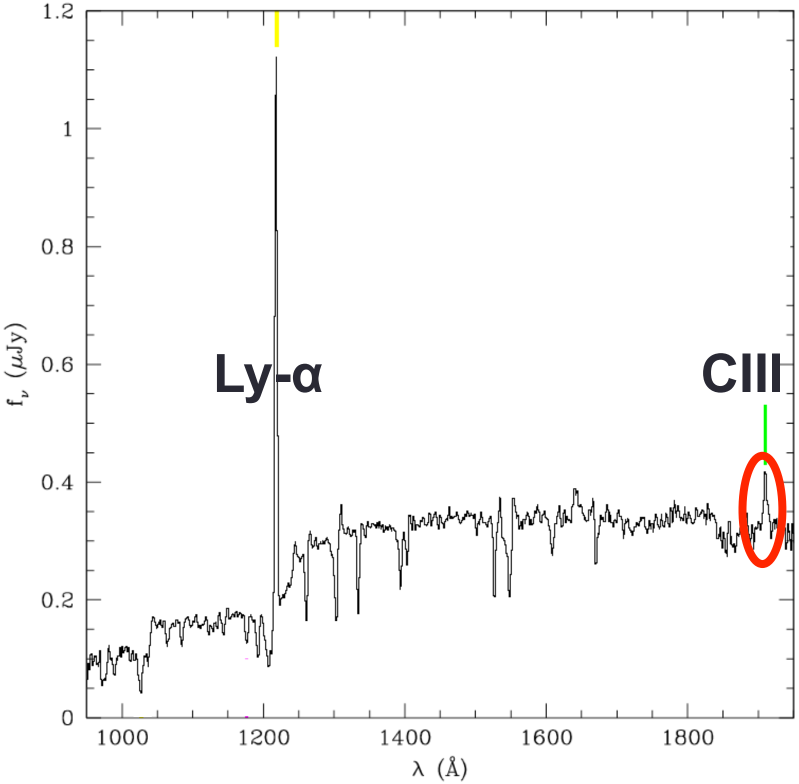
- (New results indicate that this may not be true around the most extreme galaxies)



Stark+16

CIII: the best thing since Ly-α?

- Up to 10% of Ly-α but is not energetic enough to ionize Hydrogen



Shapley+03
(z~3 LBG stack)

CIII: the best thing since Ly-α?

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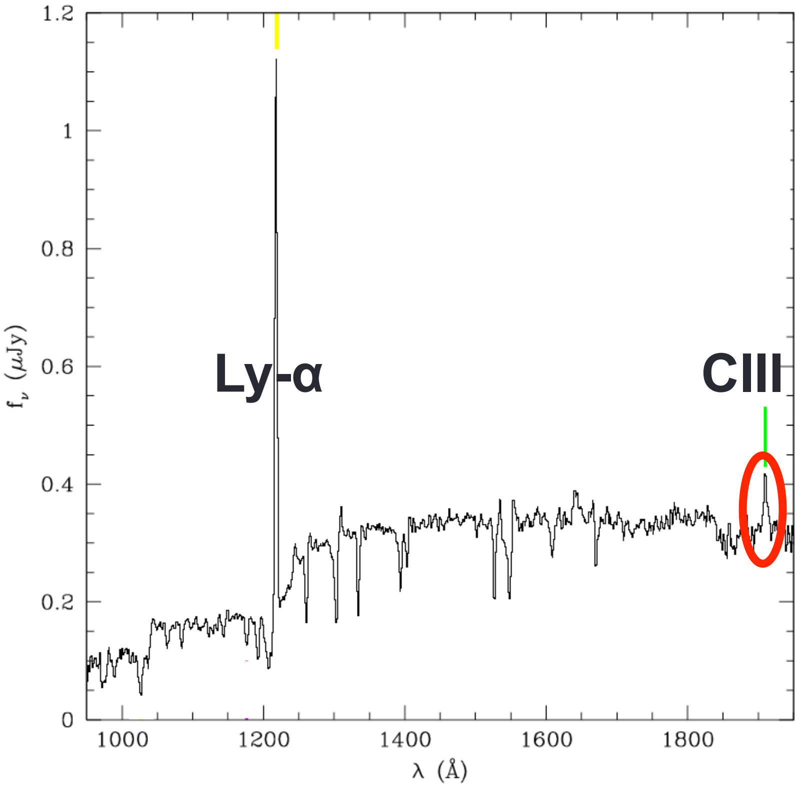
- Photoionization models ➔ high electron temperatures and ionization parameters, low metallicity
  - “Easier” to interpret than Ly-α



Shapley+03
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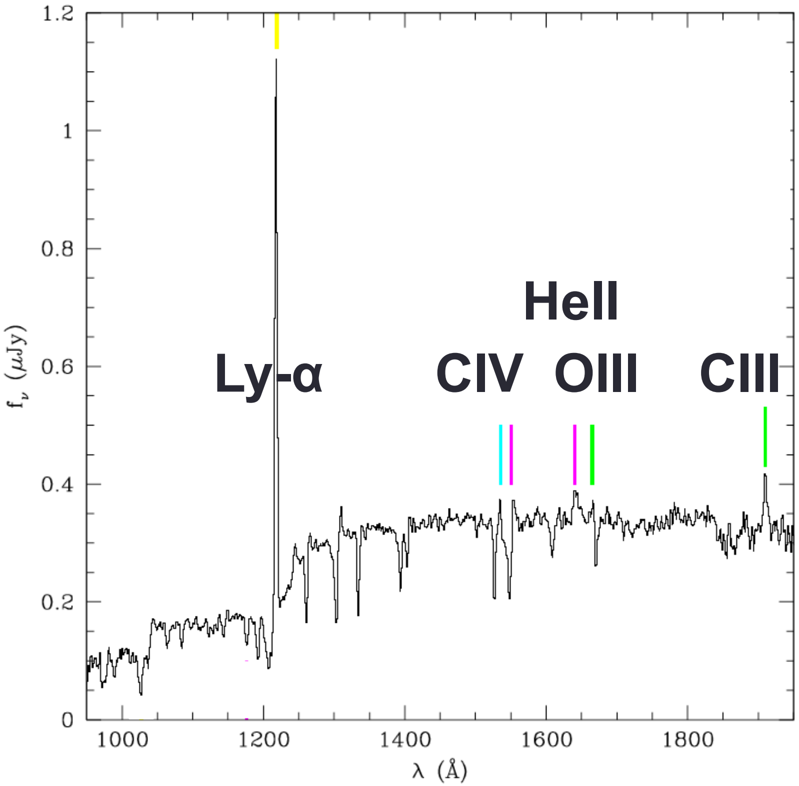
Physics with CIII and the rest-UV in general

- CIII doublet sensitive to electron density
- CIII and OIII 1665 (or 5007) can constrain C/O abundance
- These and other lines, like HeII 1640 and CIV 1549 can constrain:
  - Ionization parameter
  - AGN diagnostics
  - Metallicity



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Samples of CIII are small and targeted

- Focused on local/low-mass populations (e.g. Stark+14, Zitrin+15, Rigby+15)
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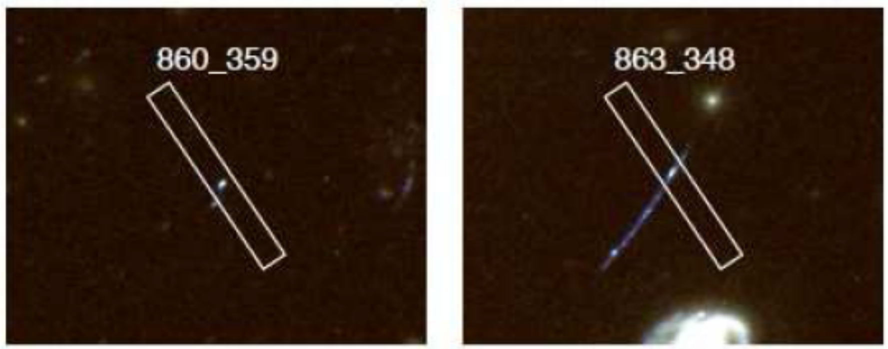
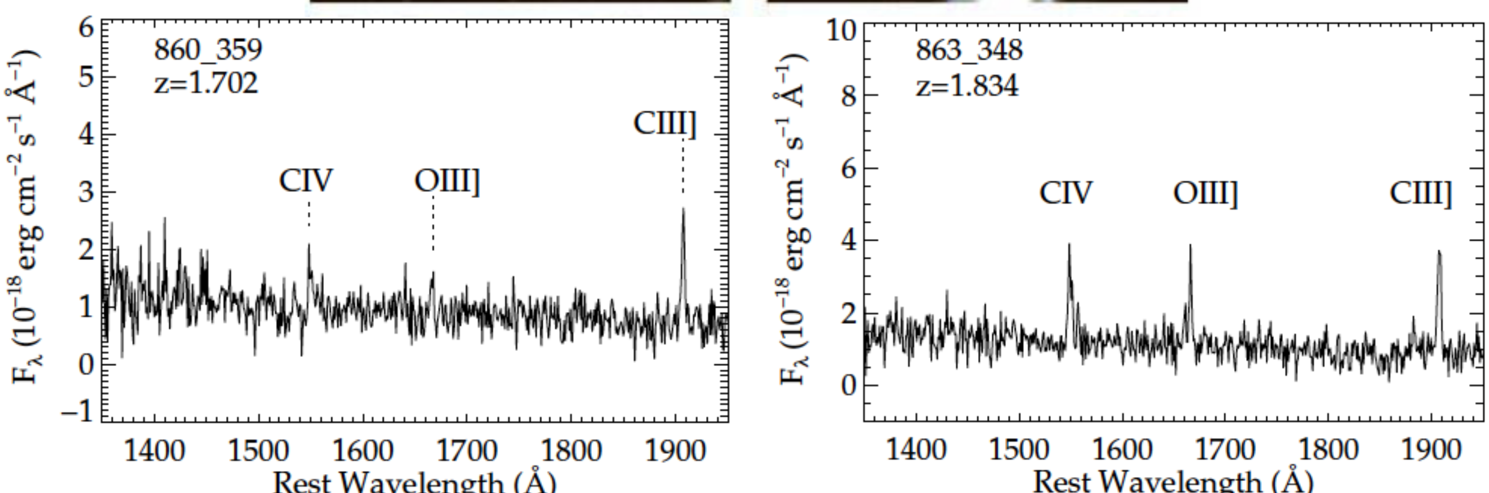


z ~ 2
(lensed)



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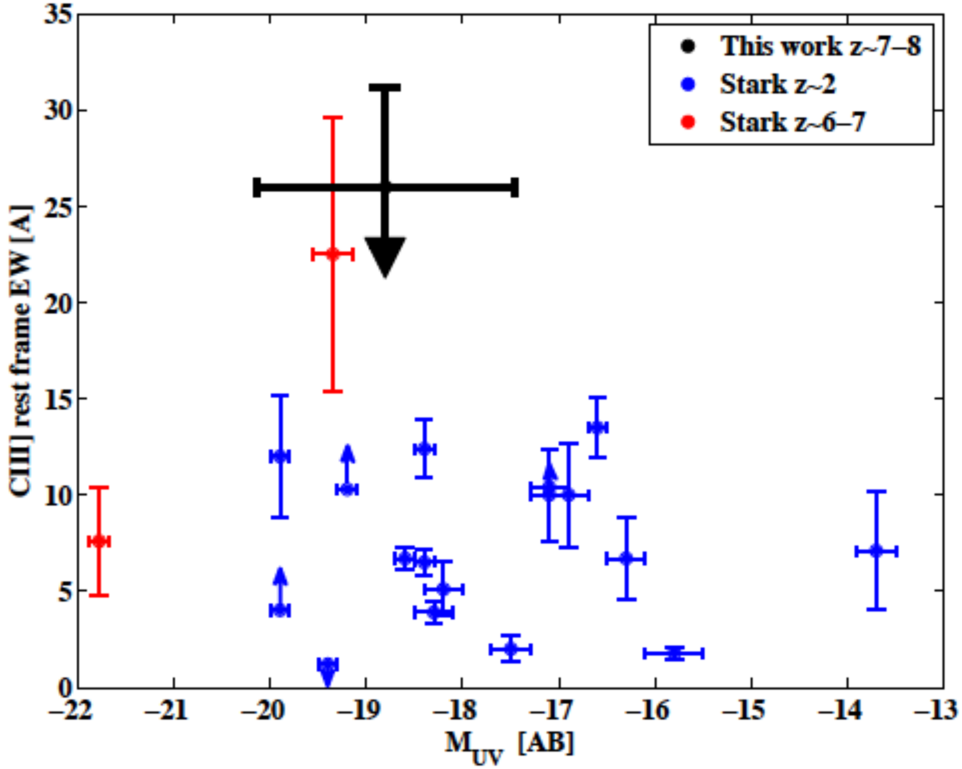

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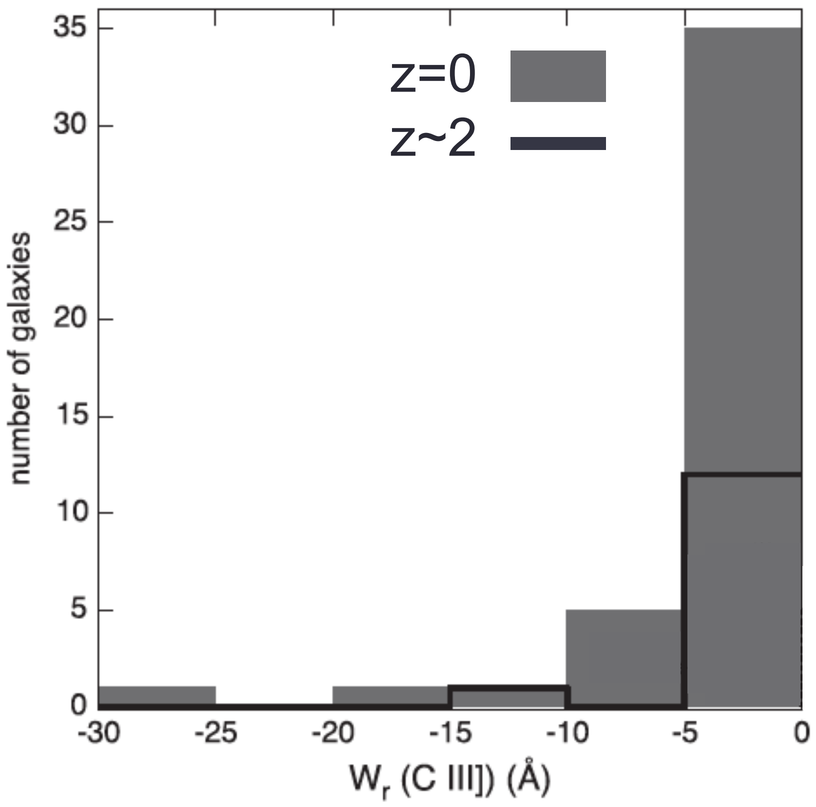
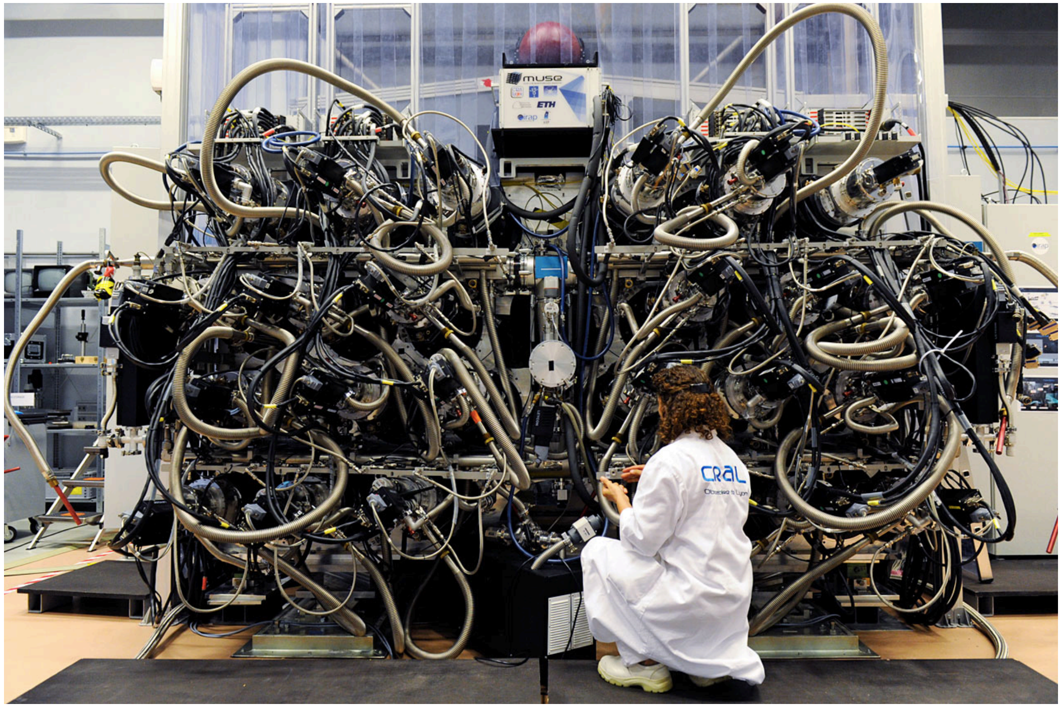


MUSE spectroscopy

- MUSE at the VLT
- R~3000
- 4650-9300 Å
- 1’x1’ Integral Field Unit

muse
multi unit spectroscopic explorer



ESO

MUSE spectroscopy

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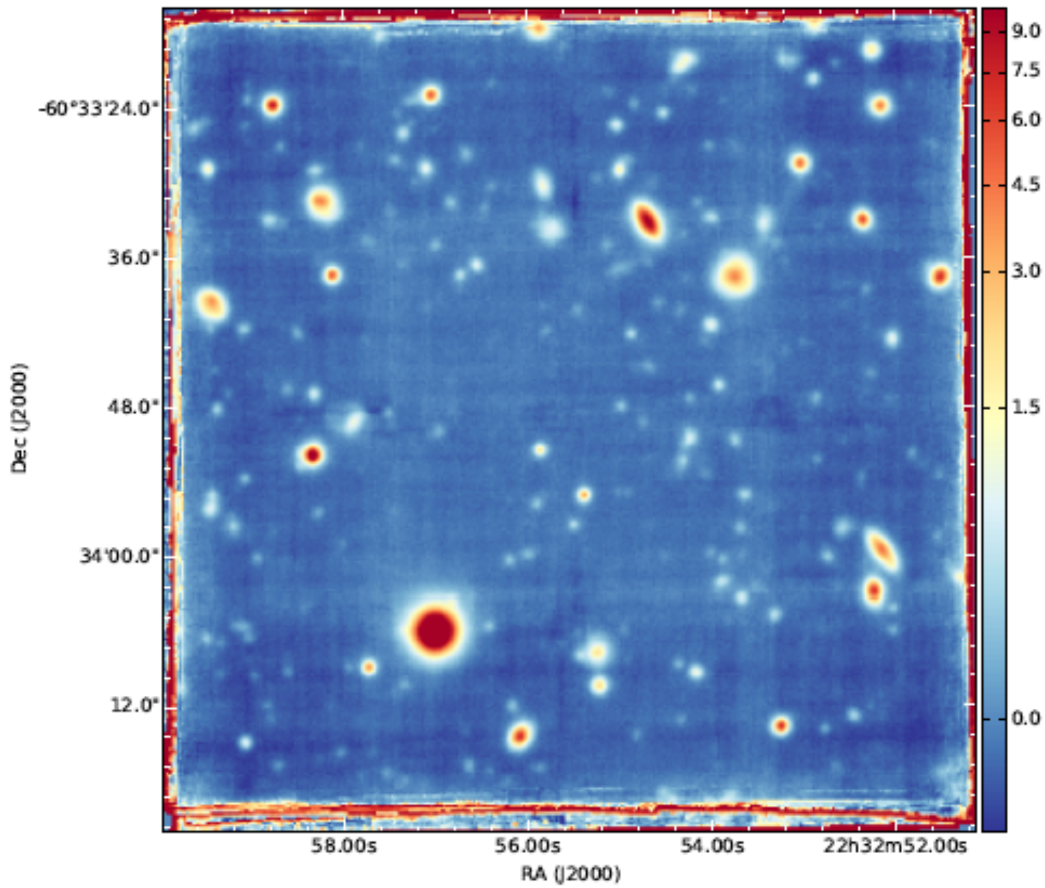
- 20 hours in the UDF (GTO)
- 27 hours in the HDF-S (Bacon+15)

- SB limit: 10^{-19} erg/s/ cm^2/arcsec^2



HDF-S

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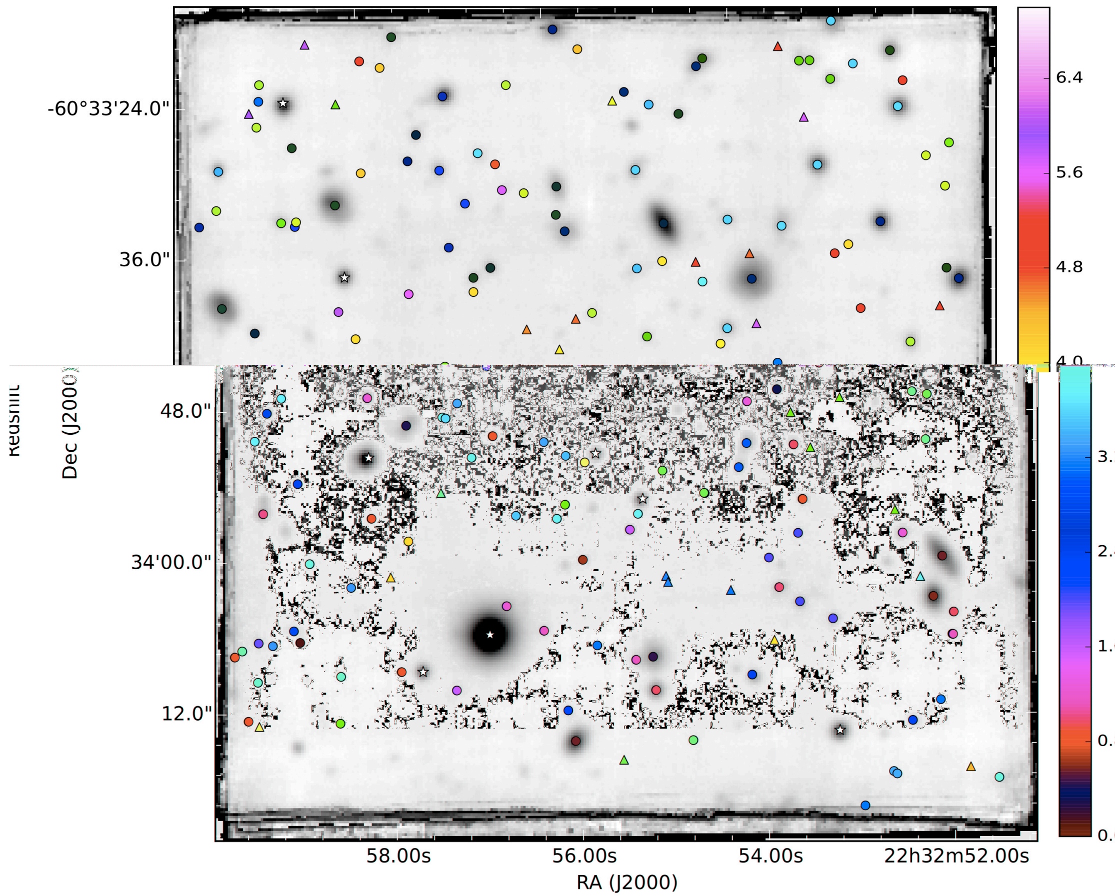
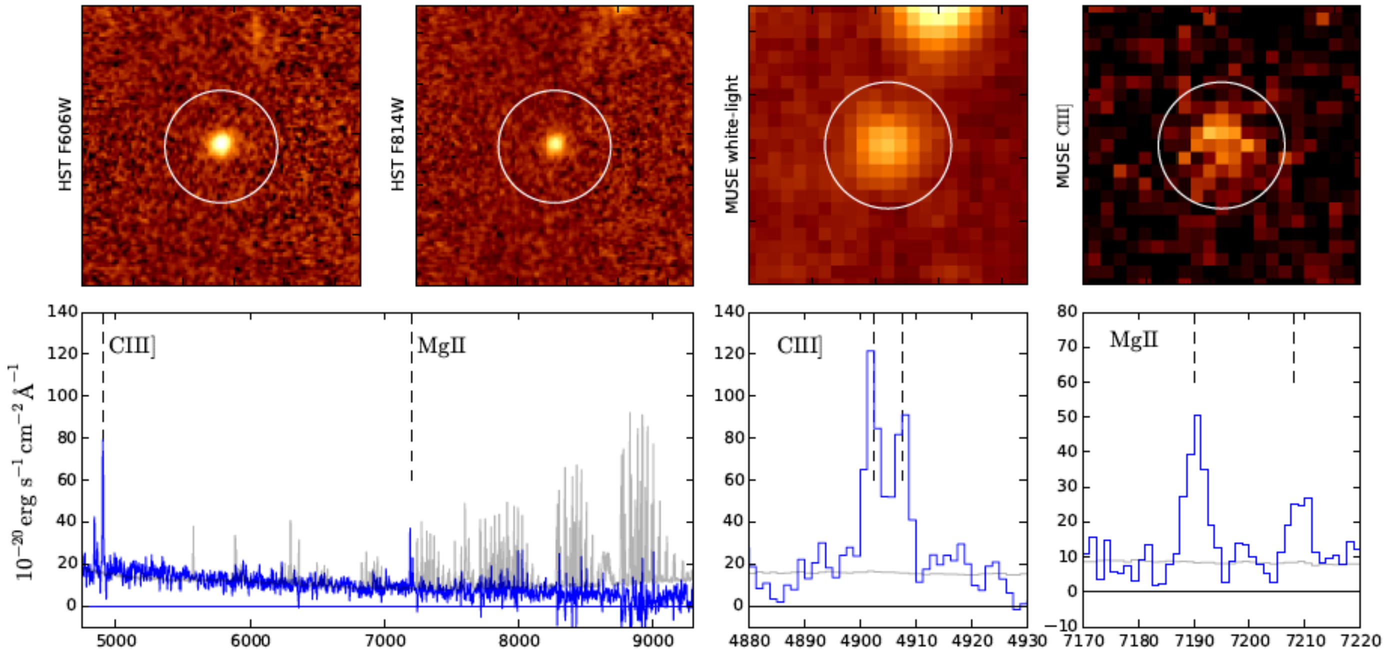


HDF-S

Redshift determinations and line measurements

- Continuum-detected (HST and/or MUSE white-light) sources are visually inspected (Bacon+15, Inami+ in prep.)



Bacon+15

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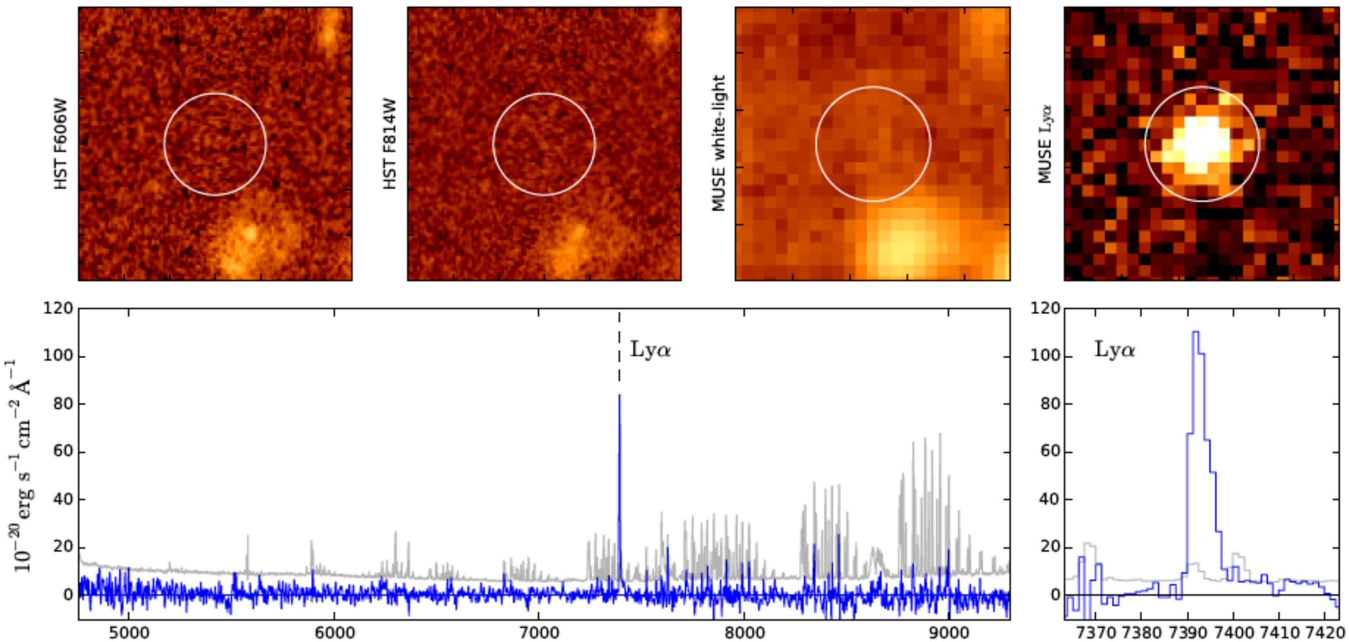

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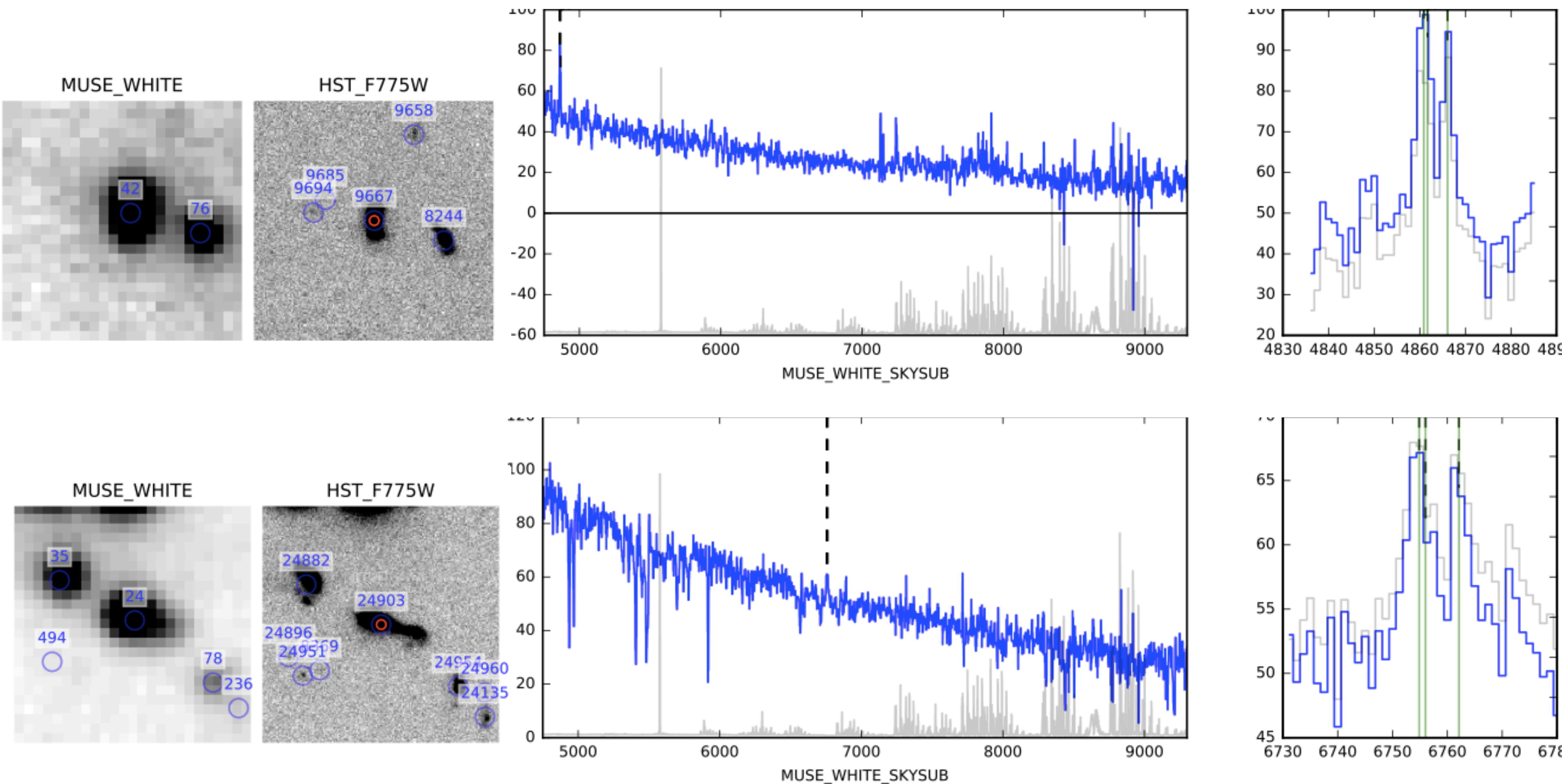
- Source detection in MUSE narrow-band images for line-dominated objects (Richard+15)
- Line fluxes and EWs determined with **platefit** (Tremonti +14, Brinchmann+14)
- Redshifts for other sources from 3D-HST grism spectroscopy (UDF only) or photometry

37 CIII emitters from 1.5 < z < 4



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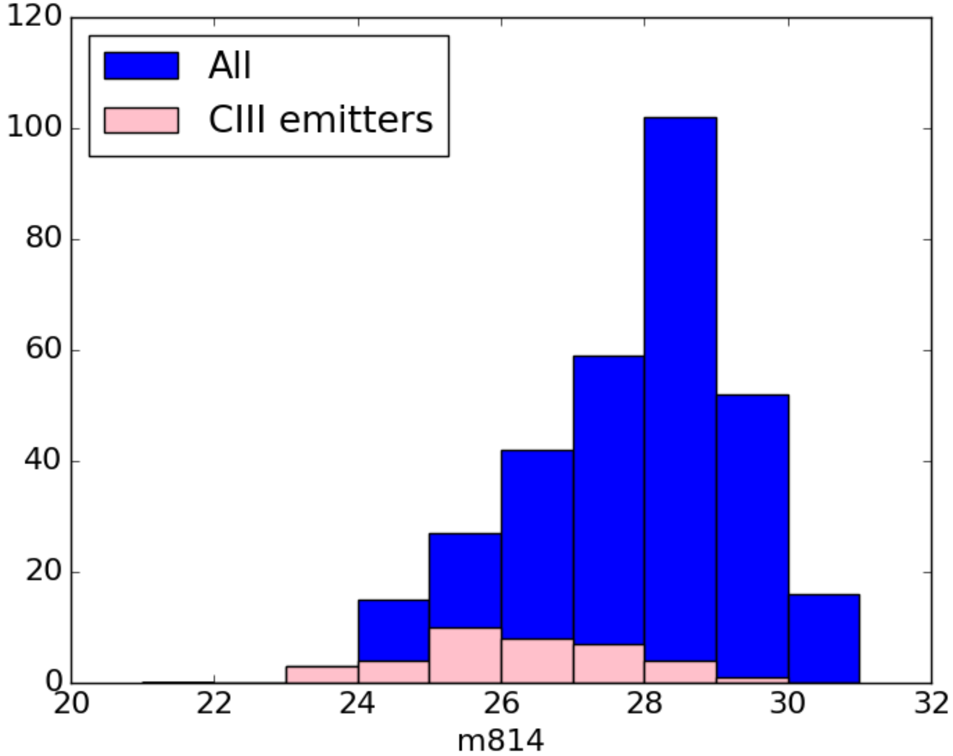
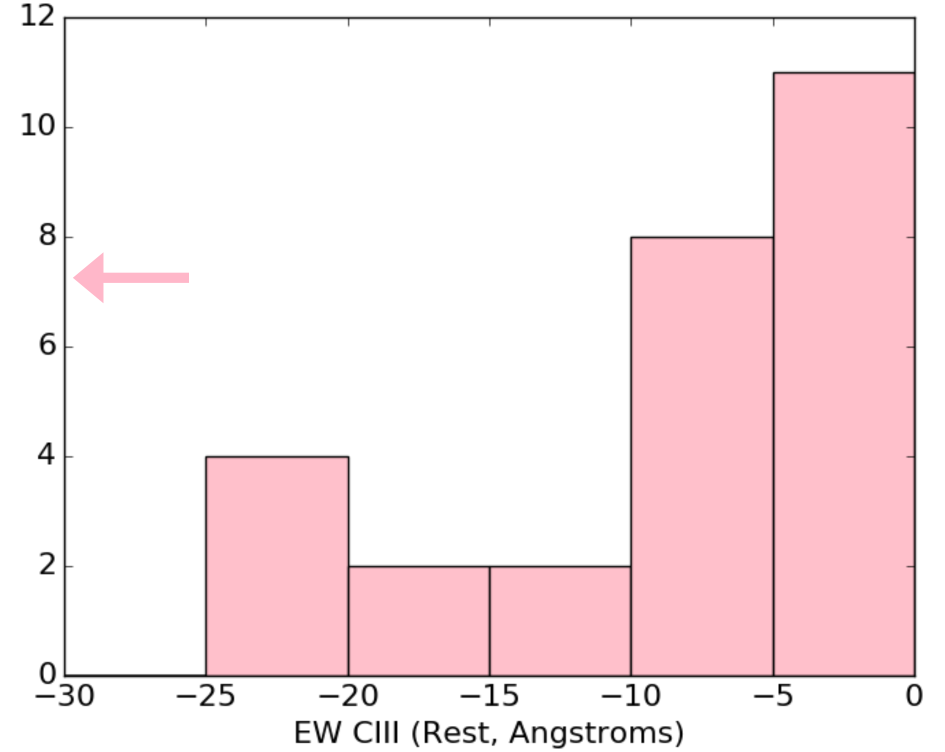
- 38% (17/45) of m814 < 26 galaxies at these z's have CIII detection





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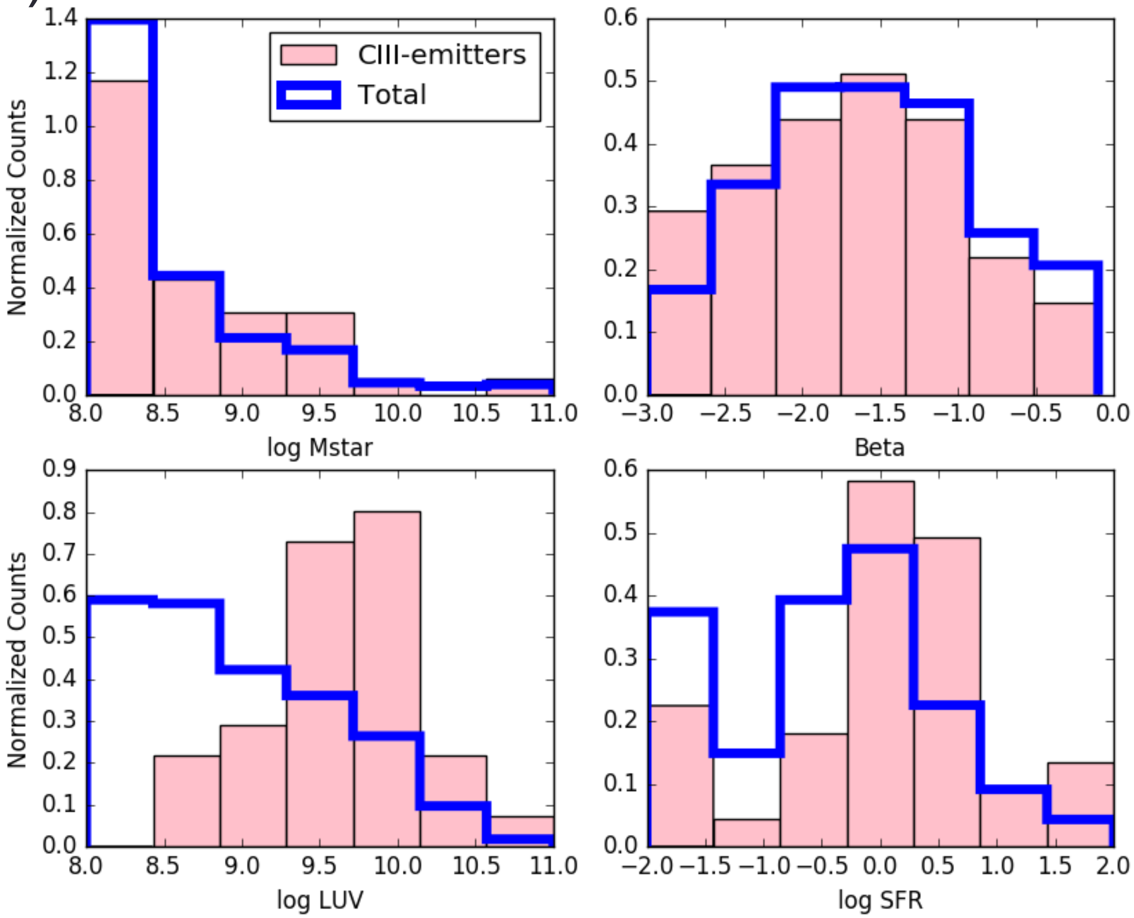
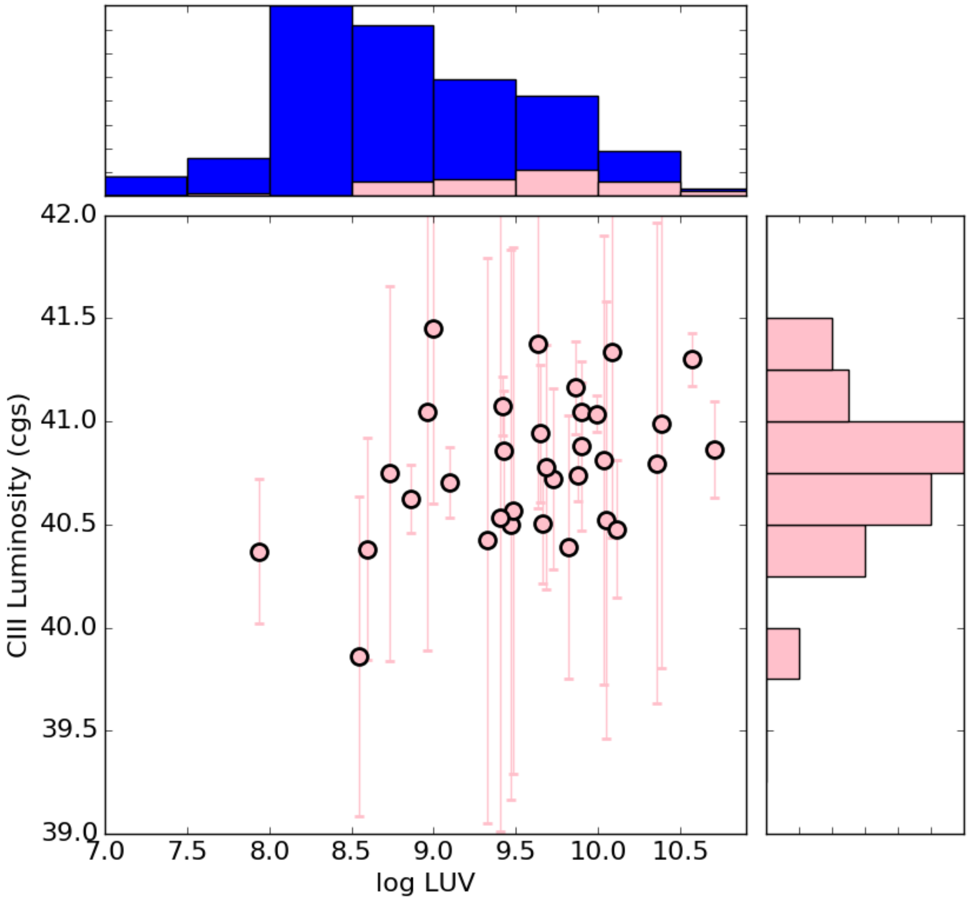


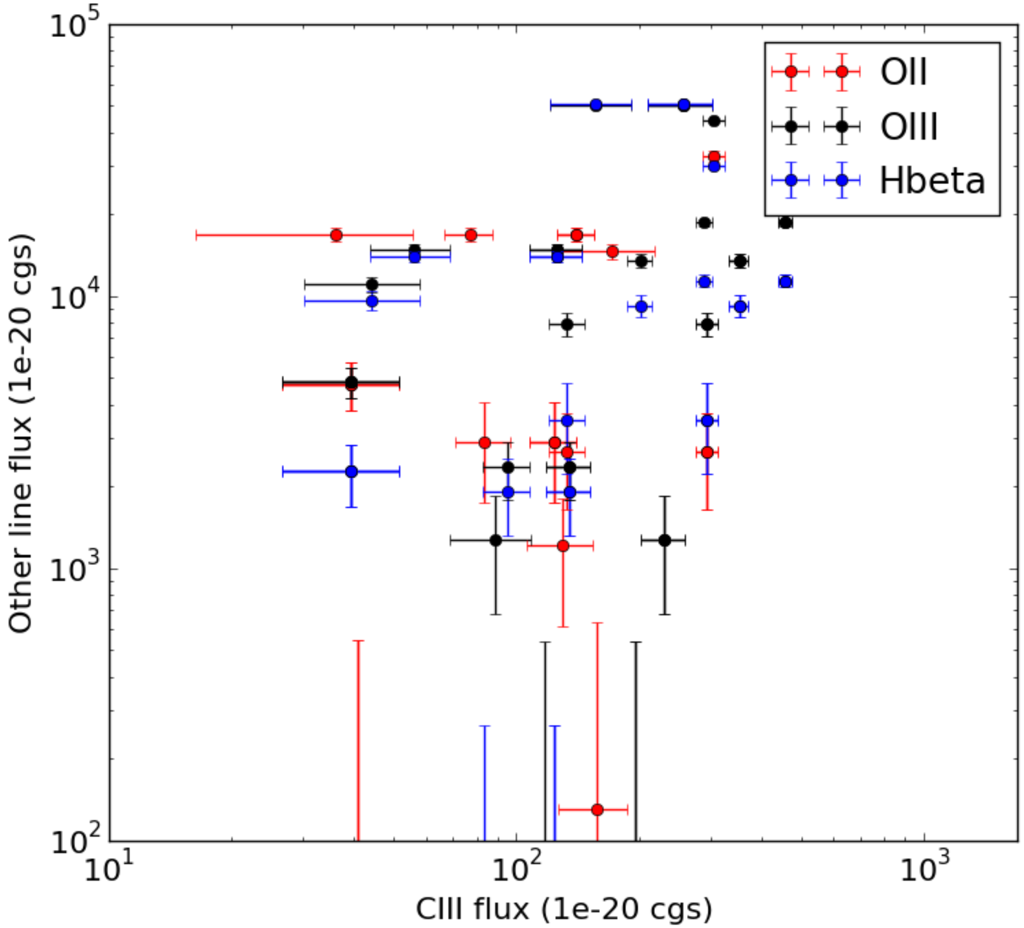
Are the CIII emitters intrinsically different?

- Relation between LUV and CIII luminosity tentative



Are the CIII emitters intrinsically different?

- Brighter optical emission lines (OIII, Hβ, OII; from 3D-HST in UDF) ➔ brighter CIII



Conclusions and Outlook

- Sample of 37 $1.5 < z < 4$ CIII emitters down to $\sim 10^{-19}$ erg/s/cm^2/arcsec^2
- Will be supplemented by:
  - Deeper UDF pointing (up to 80h)
  - 9 additional MUSE pointings in UDF to 10h depth

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In general, CIII (and other rest-UV emission) is "common" in galaxies – **Go deep!**

- At z>12, these lines may be our only chance with NIRSpec
- Otherwise, can use this information to improve modeling and learn about physical properties