The epoch of Reionization in the JWST Era

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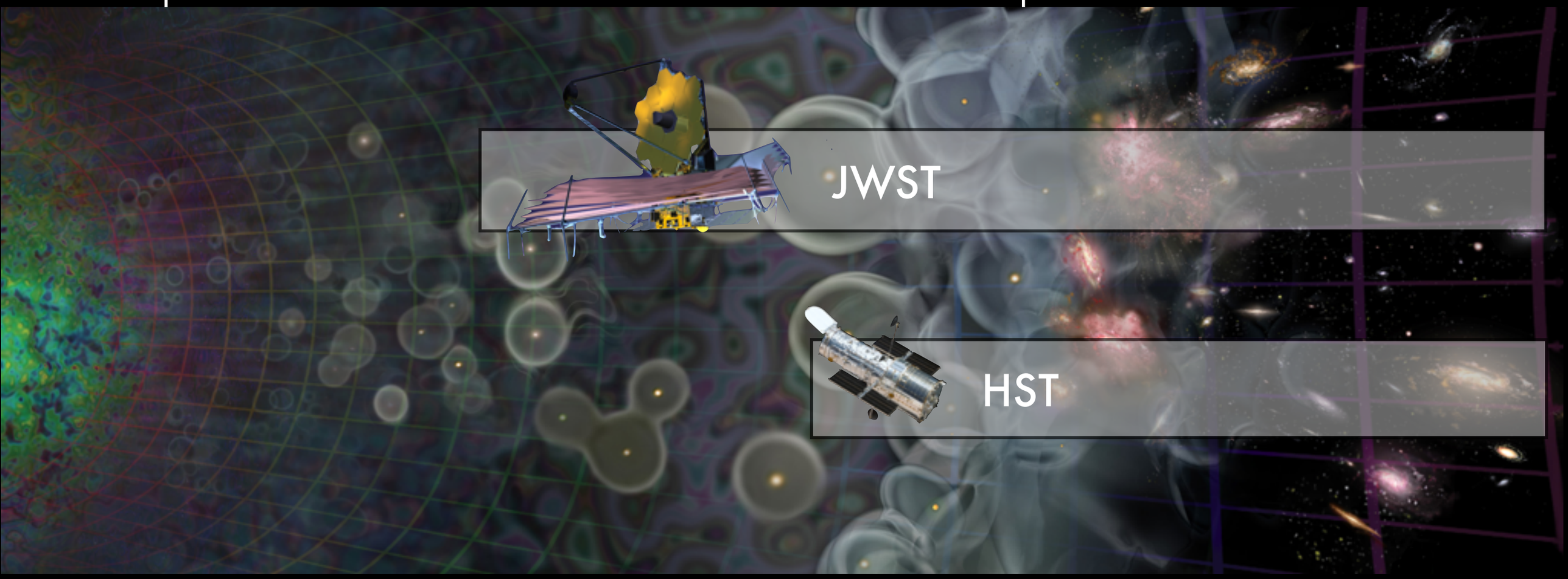
Ionized → ← Neutral → ← Ionized →

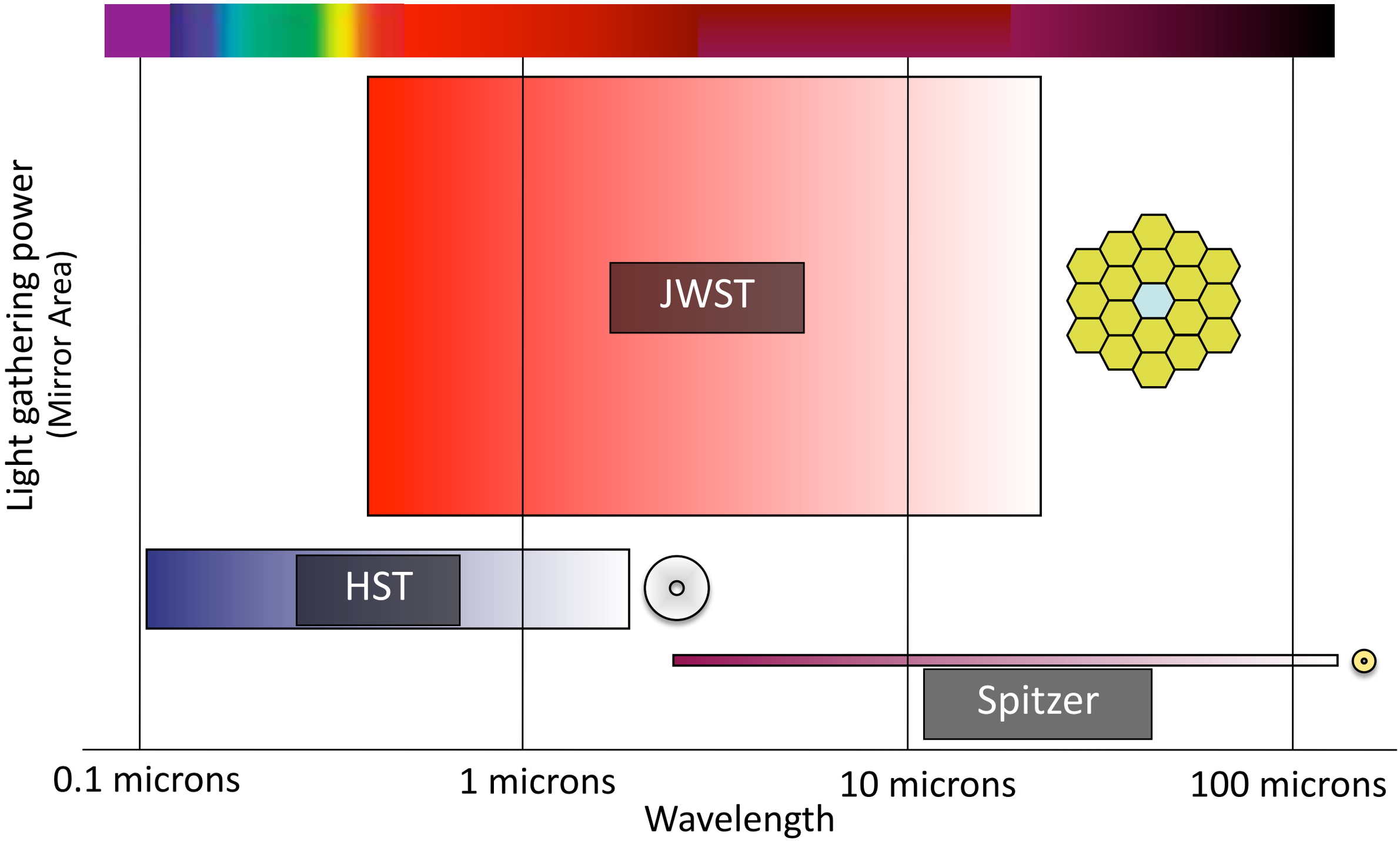


z=1100 z~30 z=10 z=6 z=2 z=0

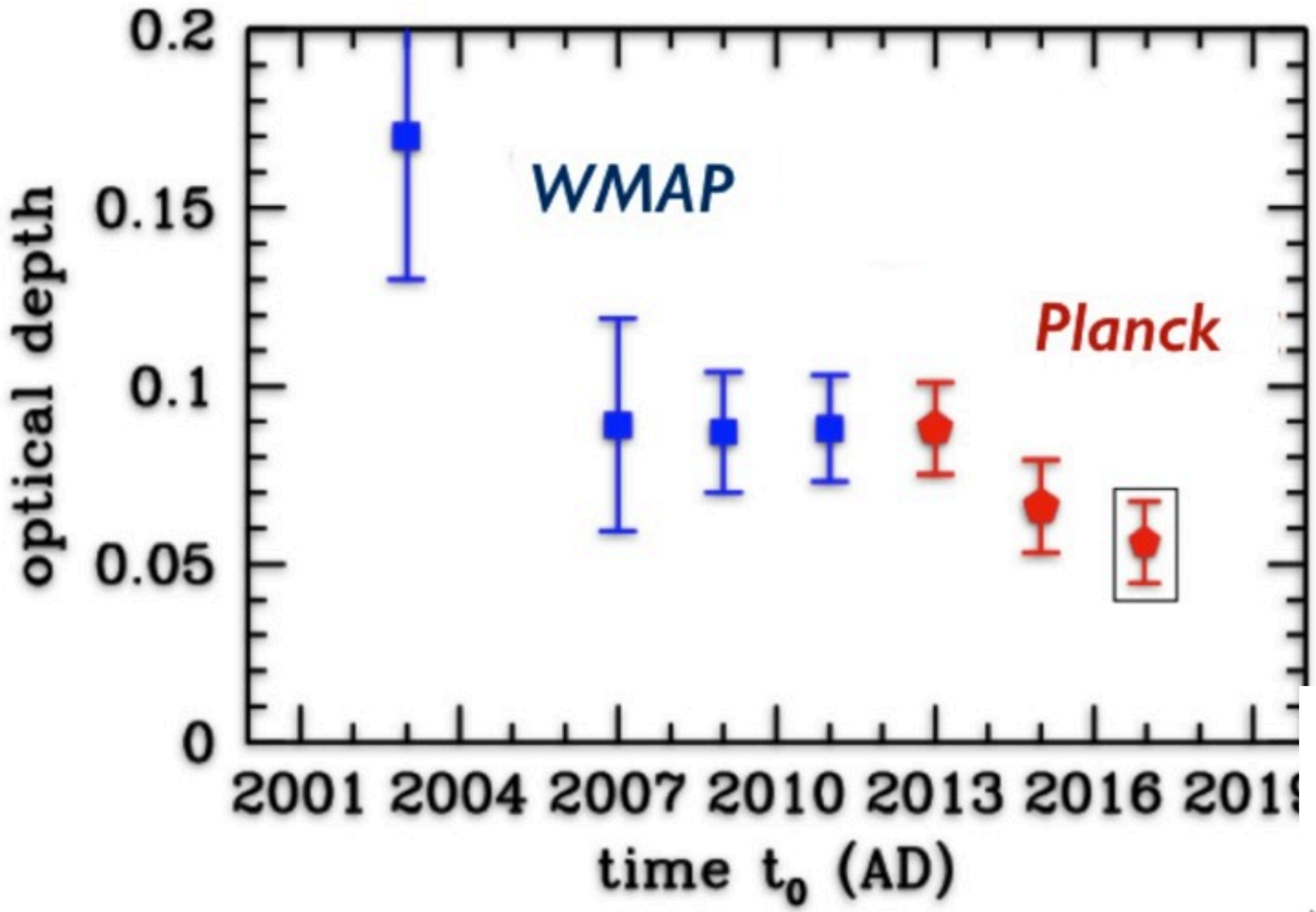
Age = 0.3Myr 100 Myr 500 Myr 1 Gyr 5Gyr 13.7Gyr

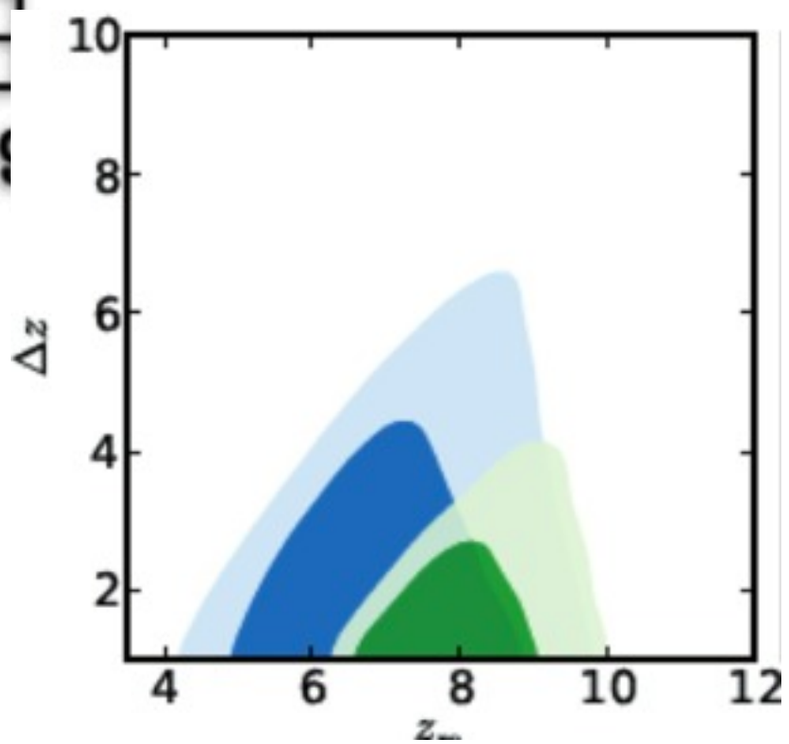
CMB **Dark Ages** **Epoch of Reionization**

JWST: a major stride in discovery power



Thomson optical depth as a function of “time”

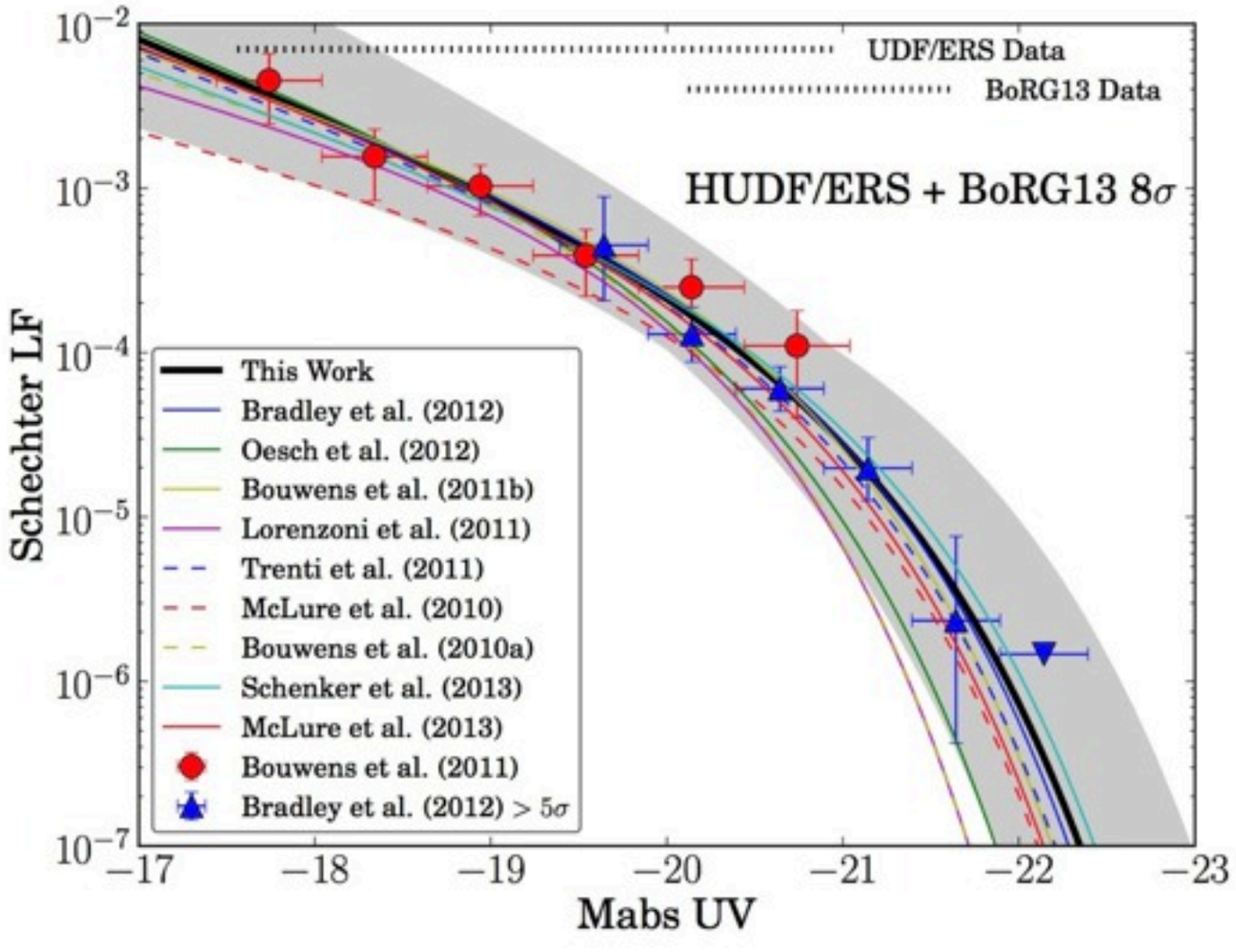




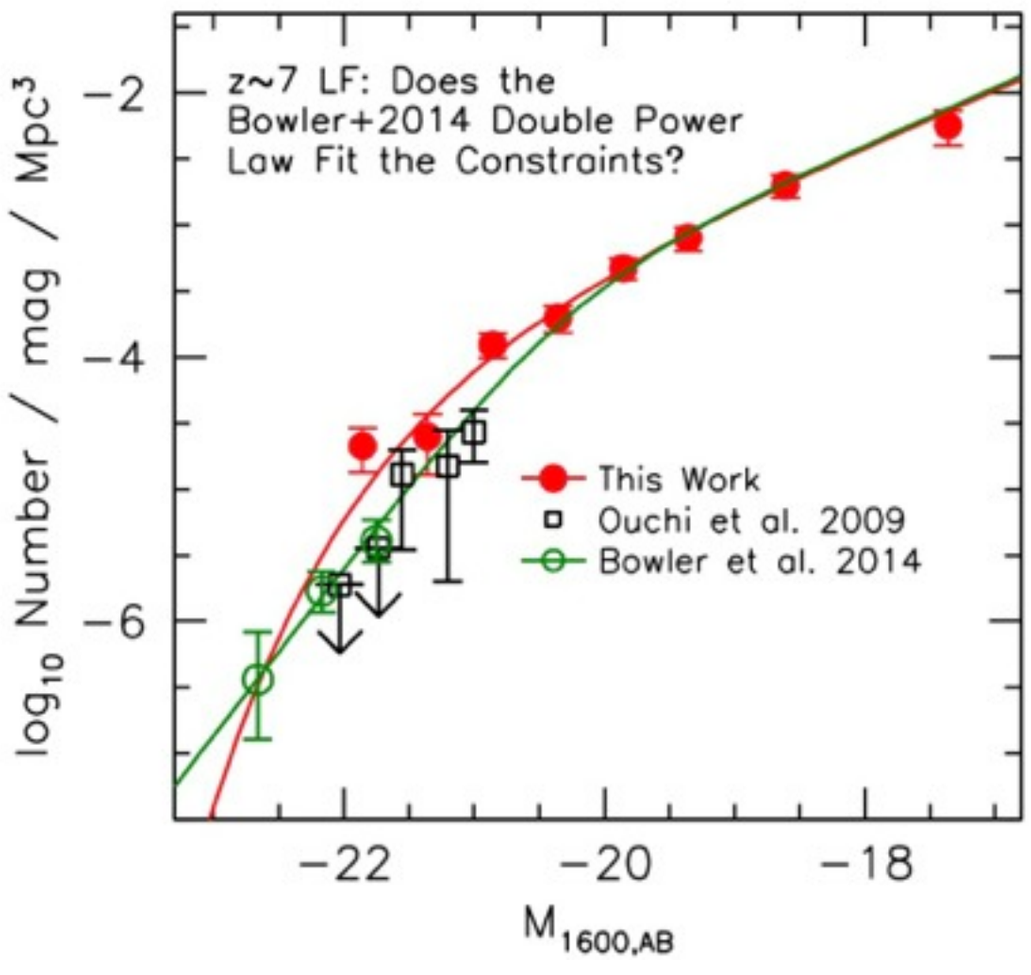
The Bright-end of the UV LF

- Wide Field surveys probe the brightest of the luminosity function at z>7
- Large uncertainties still affect the slope (shape ?) of the bright end.

Schmidt et al. (2014)



Bouwens al. (2014)



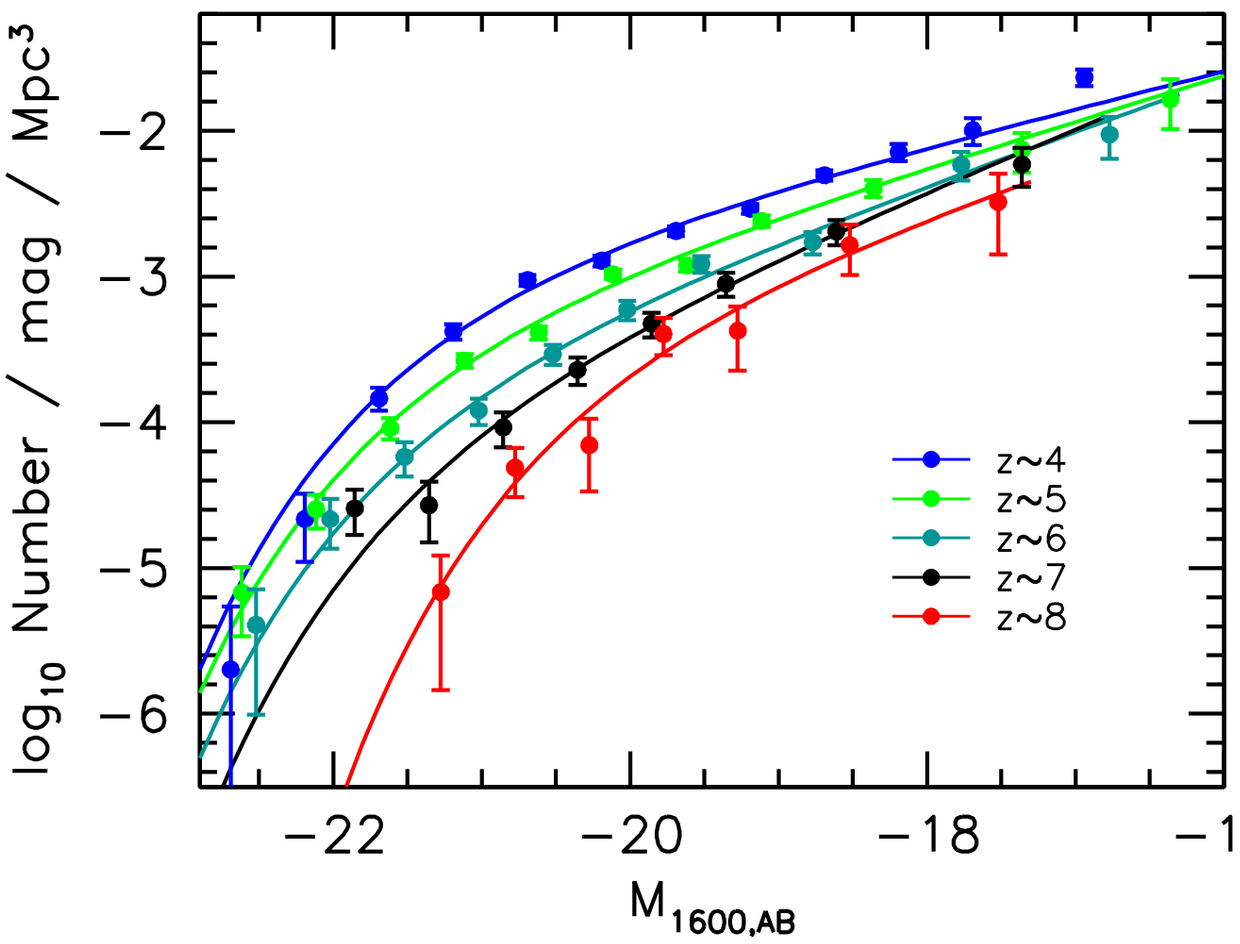
Constraints from Deep Blank Field Surveys

more than 800 galaxies at z >7
from all HST legacy fields

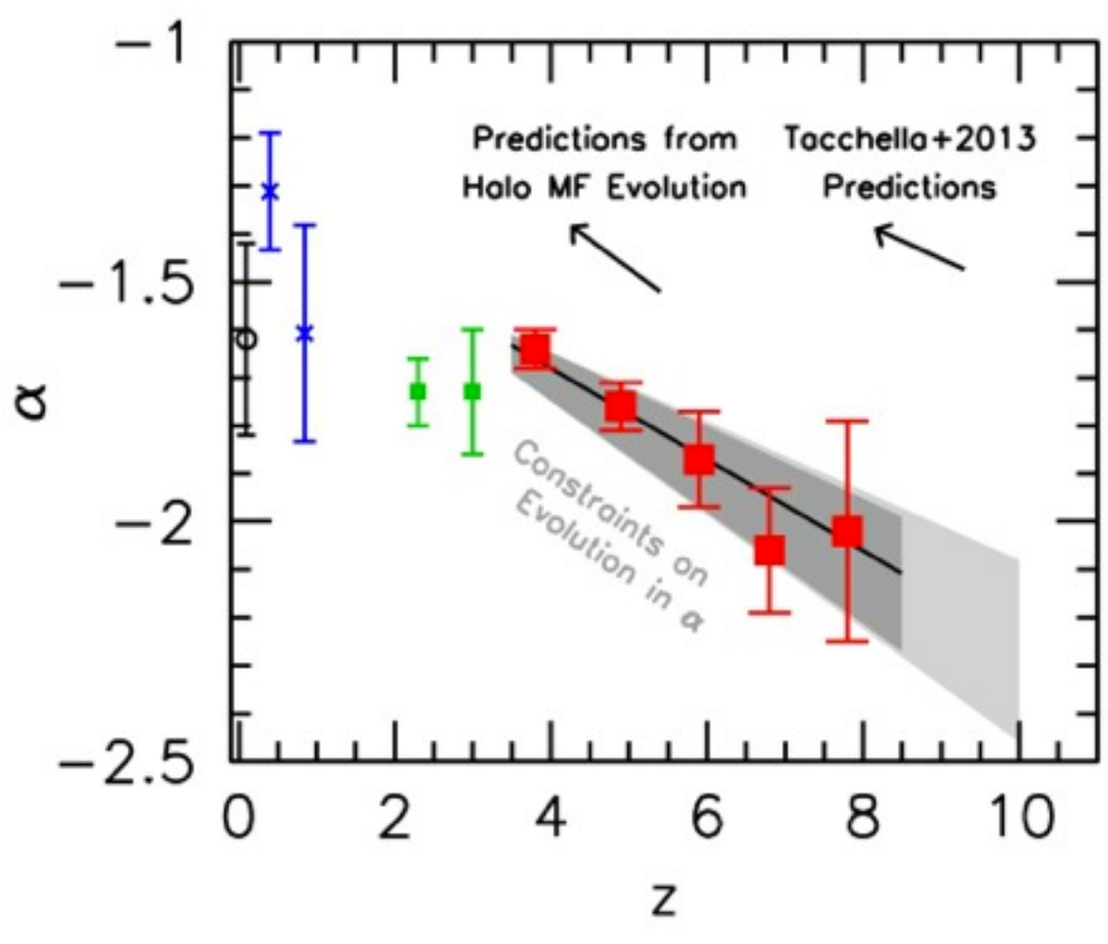
see also Bunker et al. (2010), Oesch et al. (2012)
McLure et al. (2013), Schmidt et al. (2014),
Finkelstein et al. (2014)

better constraints on the overall
shape of the luminosity function.

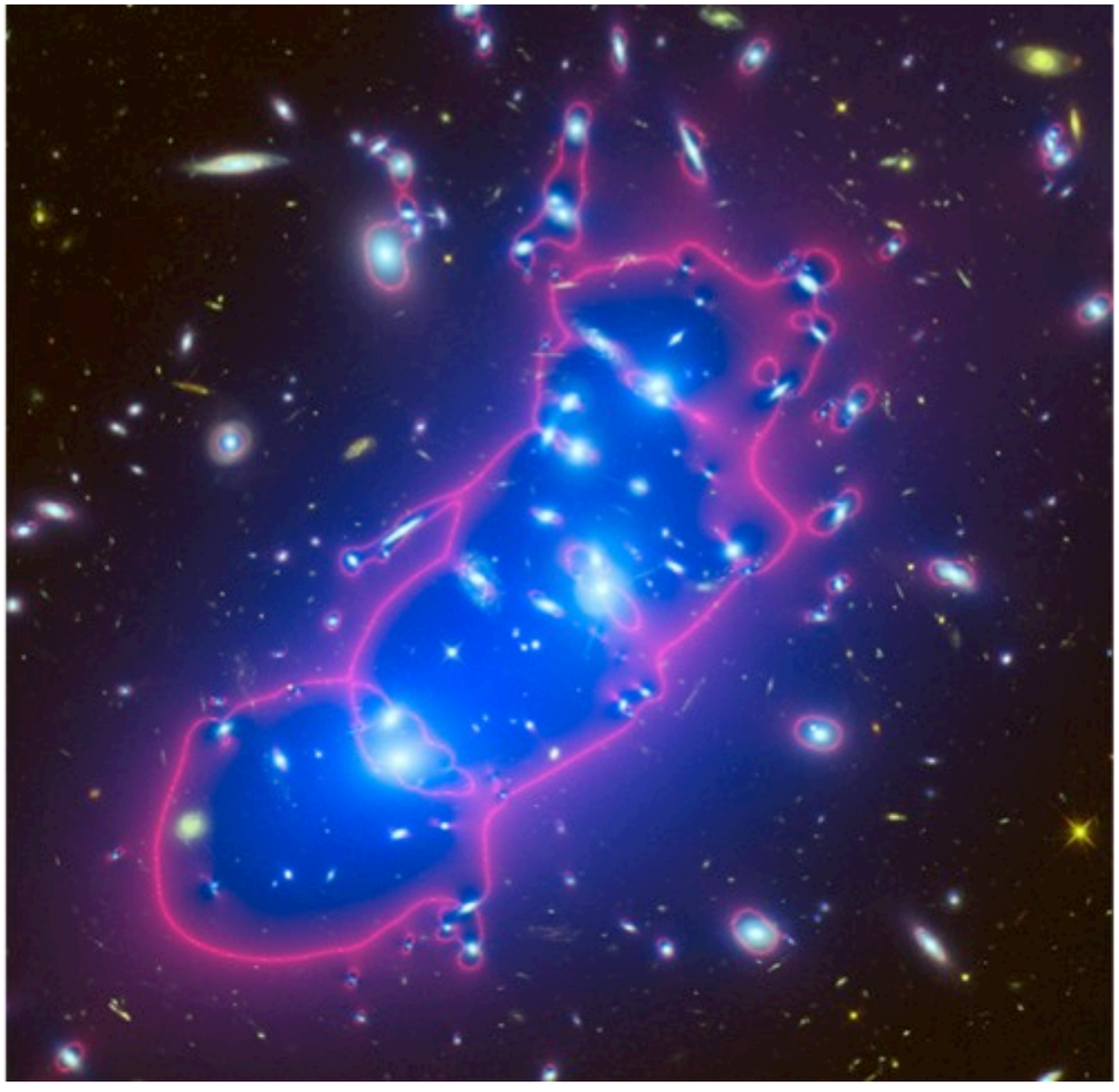
Bouwens et al. (2014)

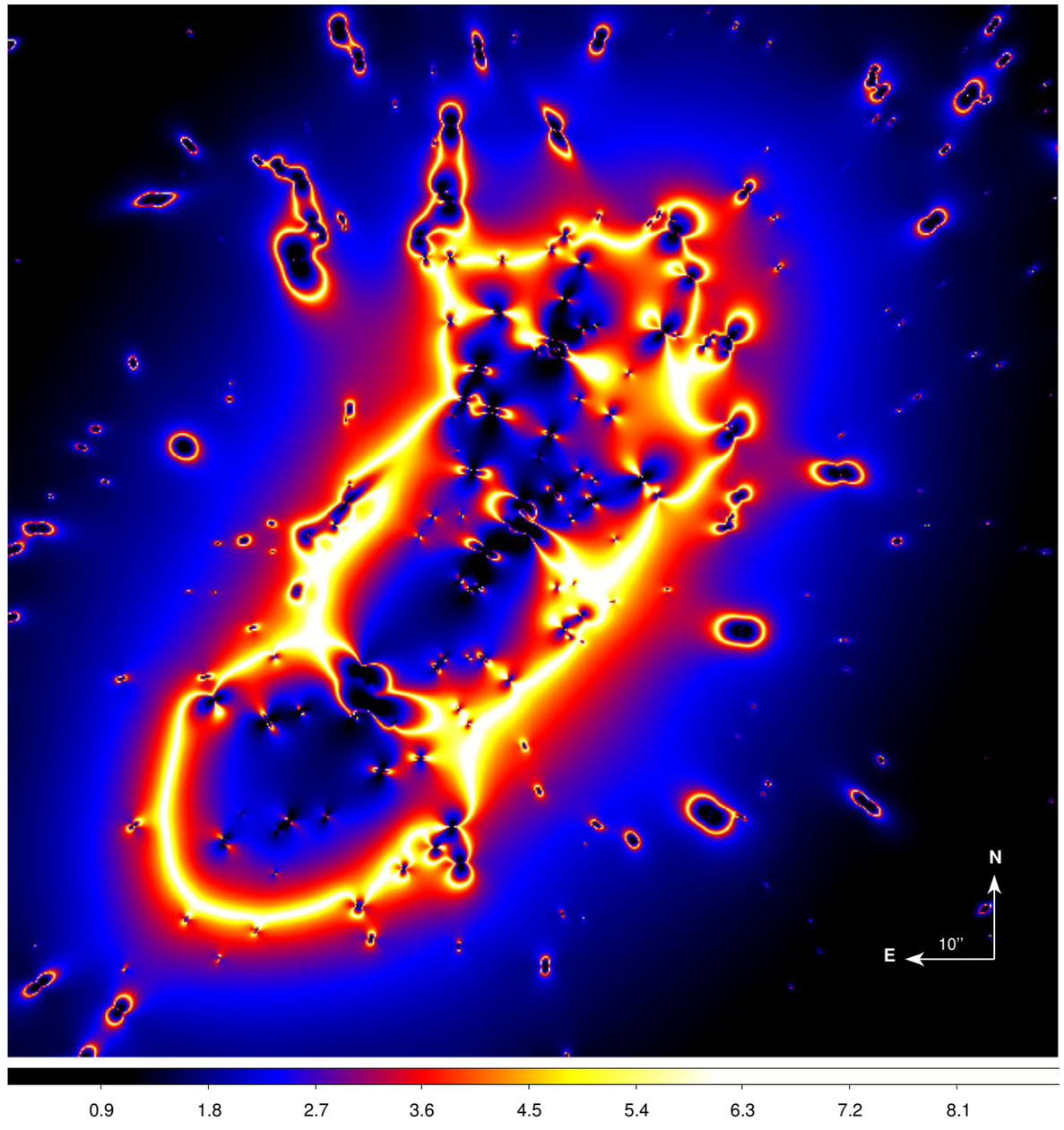


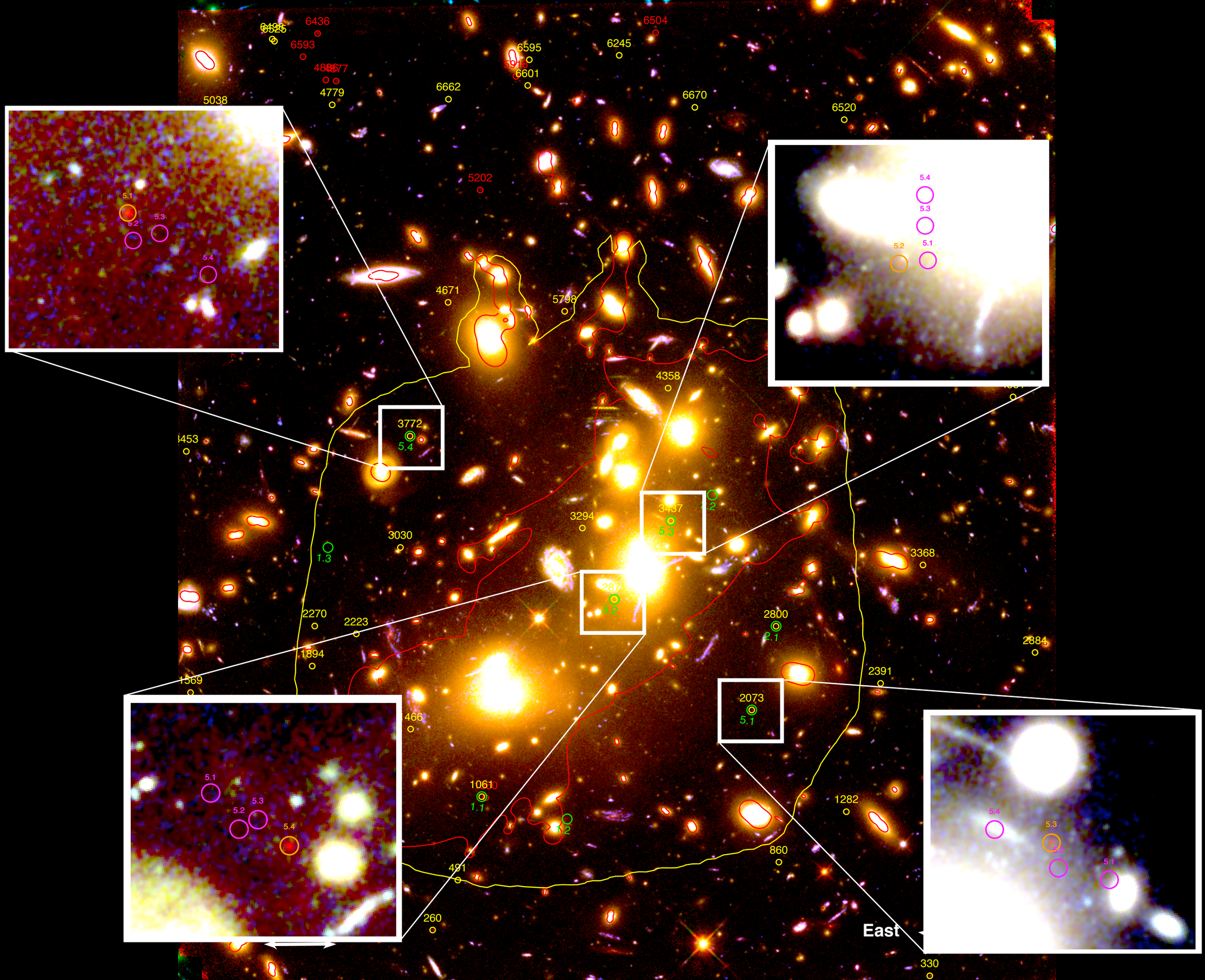
redshift evolution of the
UV LF faint-end slope



With a Little Help From Gravitational Lensing



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1282
860
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260
East
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5.1
5.2
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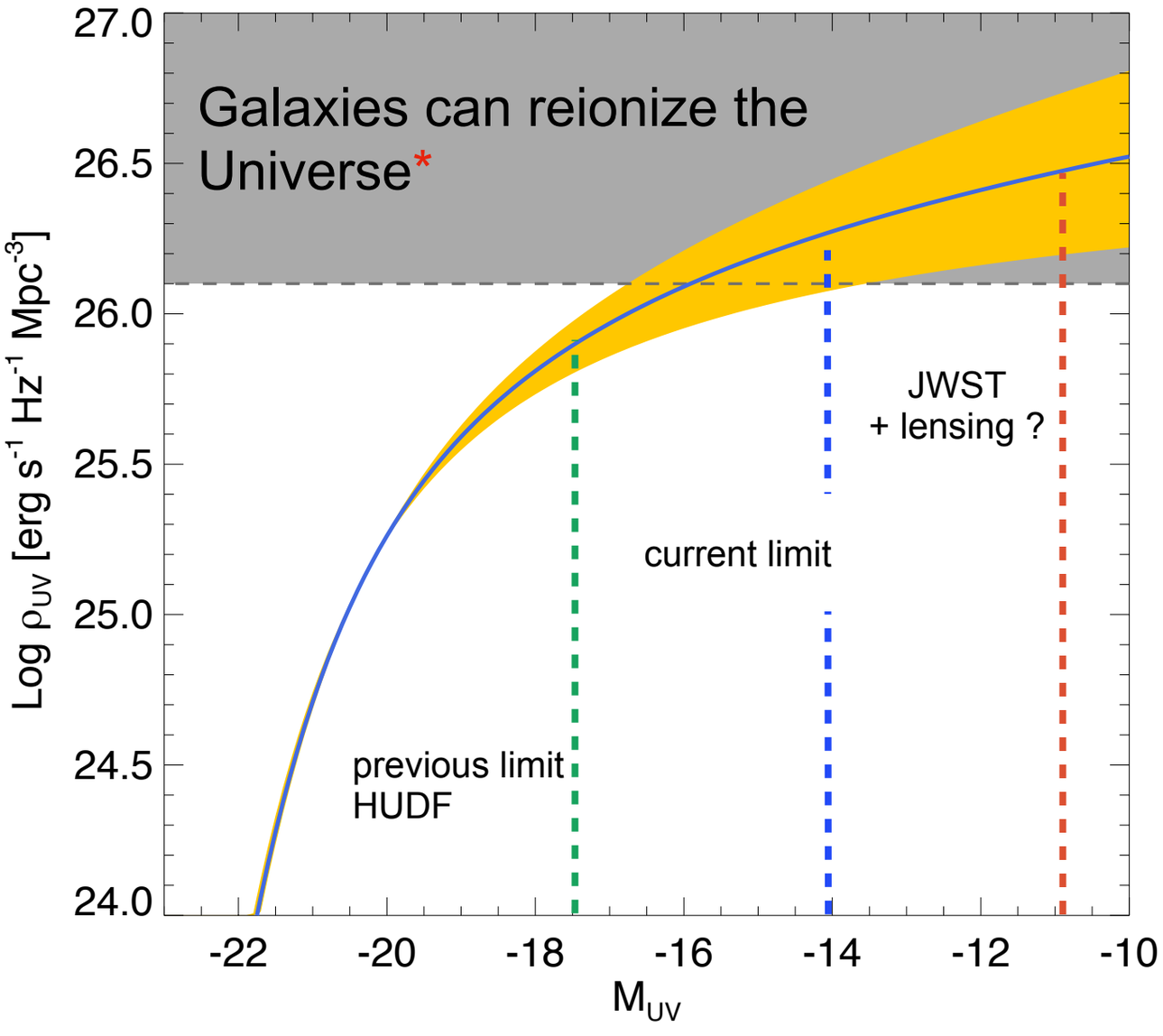
5.4

Star-forming Galaxies and Cosmic Reionization

Contribution of star-forming galaxies
to the ionizing background
Universe mostly (90%) ionized at z~6

f_{esc} =0.2, ξ_{ion} = 25.2, C_{HII} = 3



Measuring the ionizing emissivity of galaxies

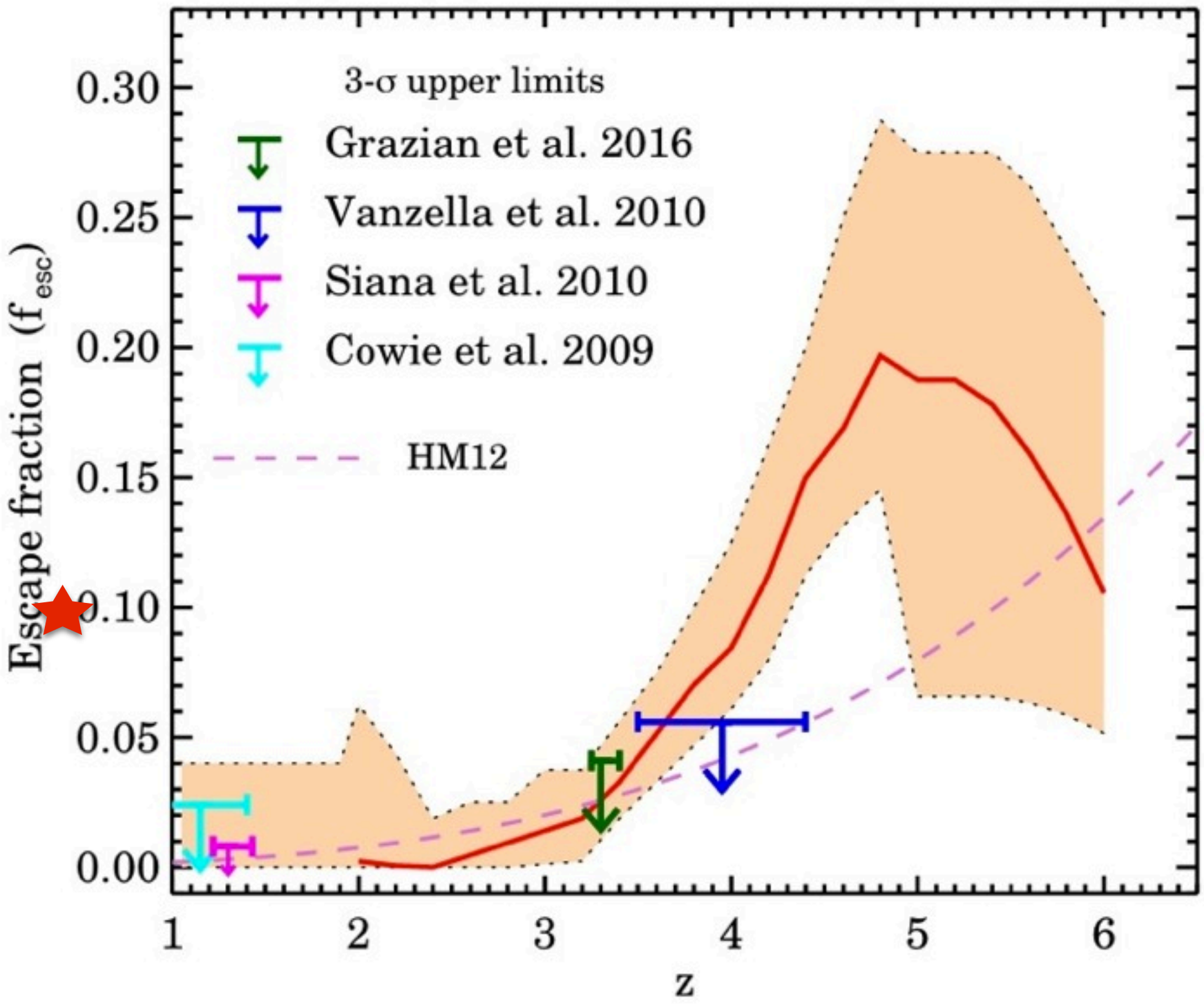
Conversion factor to ionising UV

$$\dot{n}_{\rm ion} = \rho_{\rm UV}\, \xi_{\rm ion}\, f_{\rm esc}$$

UV continuum density

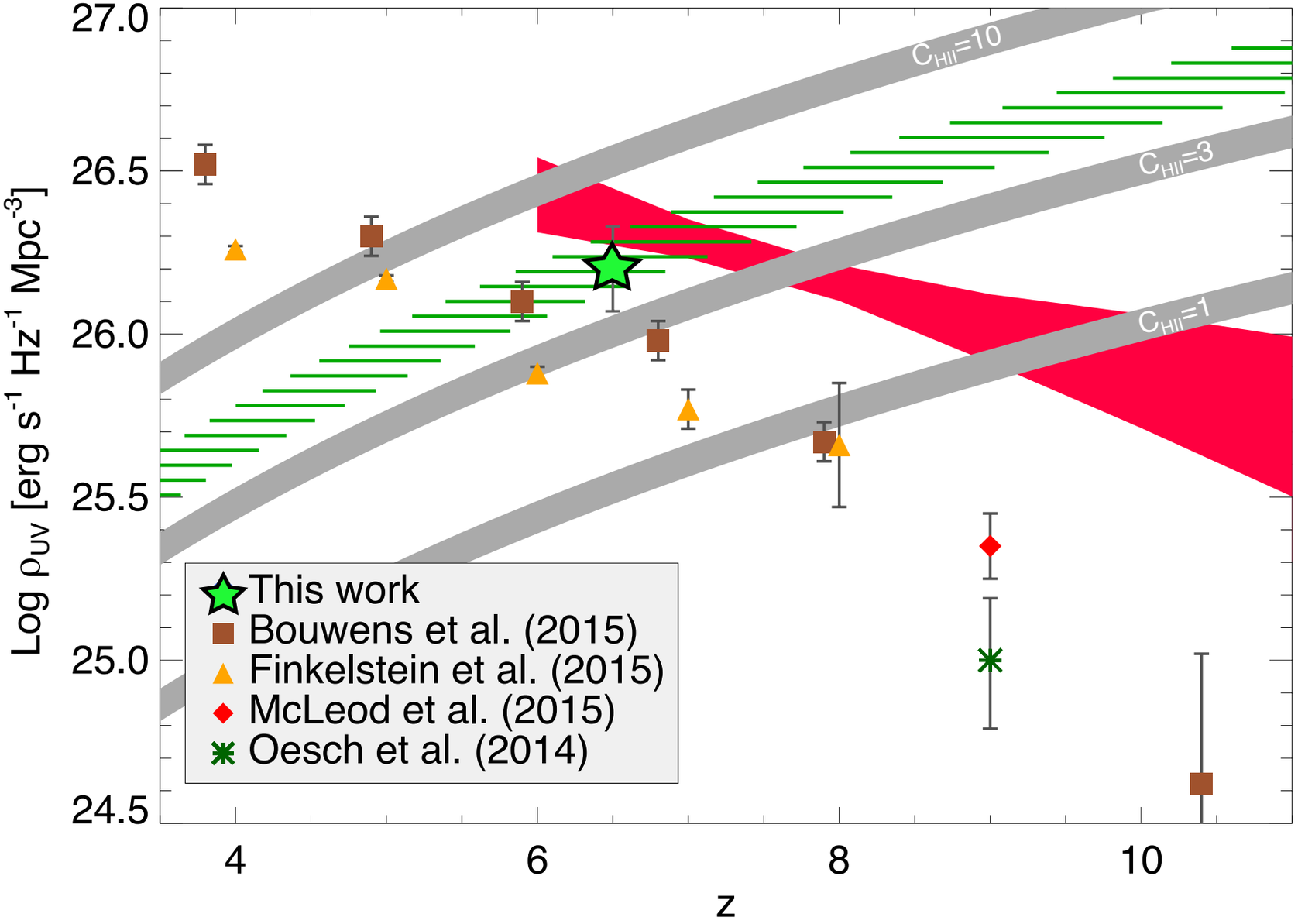
fraction of ionizing photons that escape

Khaire et al. 2016



UV Luminosity density and Reionization

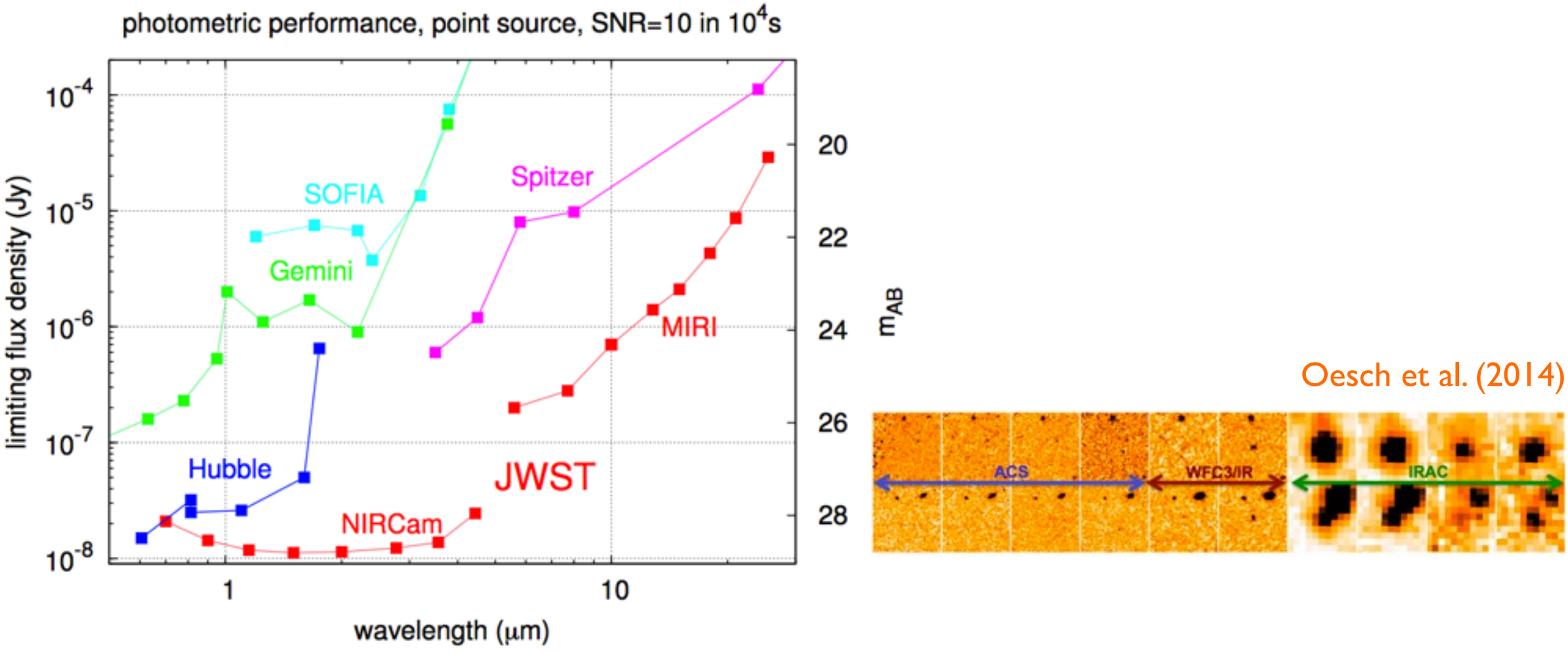
- Evolution of the UV luminosity density:
  depends on faint-end slope + integration limit
- Ionizing emissivity from galaxies :
  depends on fesc, clumping factor, ionizing conversion factor



Atek et al. (2015b)

HST/WFC3 & ACS reaching AB=28-29.0 mag (5-σ) at 0.06–0.13” FWHM from 0.2–1.7 μm

JWST adds 0.03–0.2” FWHM imaging to AB=31.5 mag (1 nJy) at 1–5 μm, and 0.07–1.2” FWHM at 5–29 μm



Oesch et al. (2014)

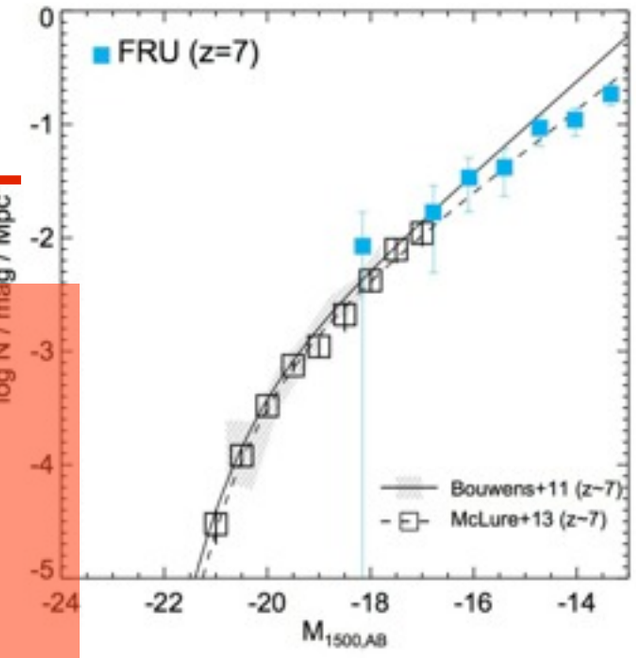
JWST Imaging: Wide wavelength coverage and very reliable photometry requirement for accurate photometric redshifts and SED fitting to access the formation of early galaxies z>20
Crucial for the Stellar mass estimate Dominguez et al. (2014), Mobasher et al. (2015)

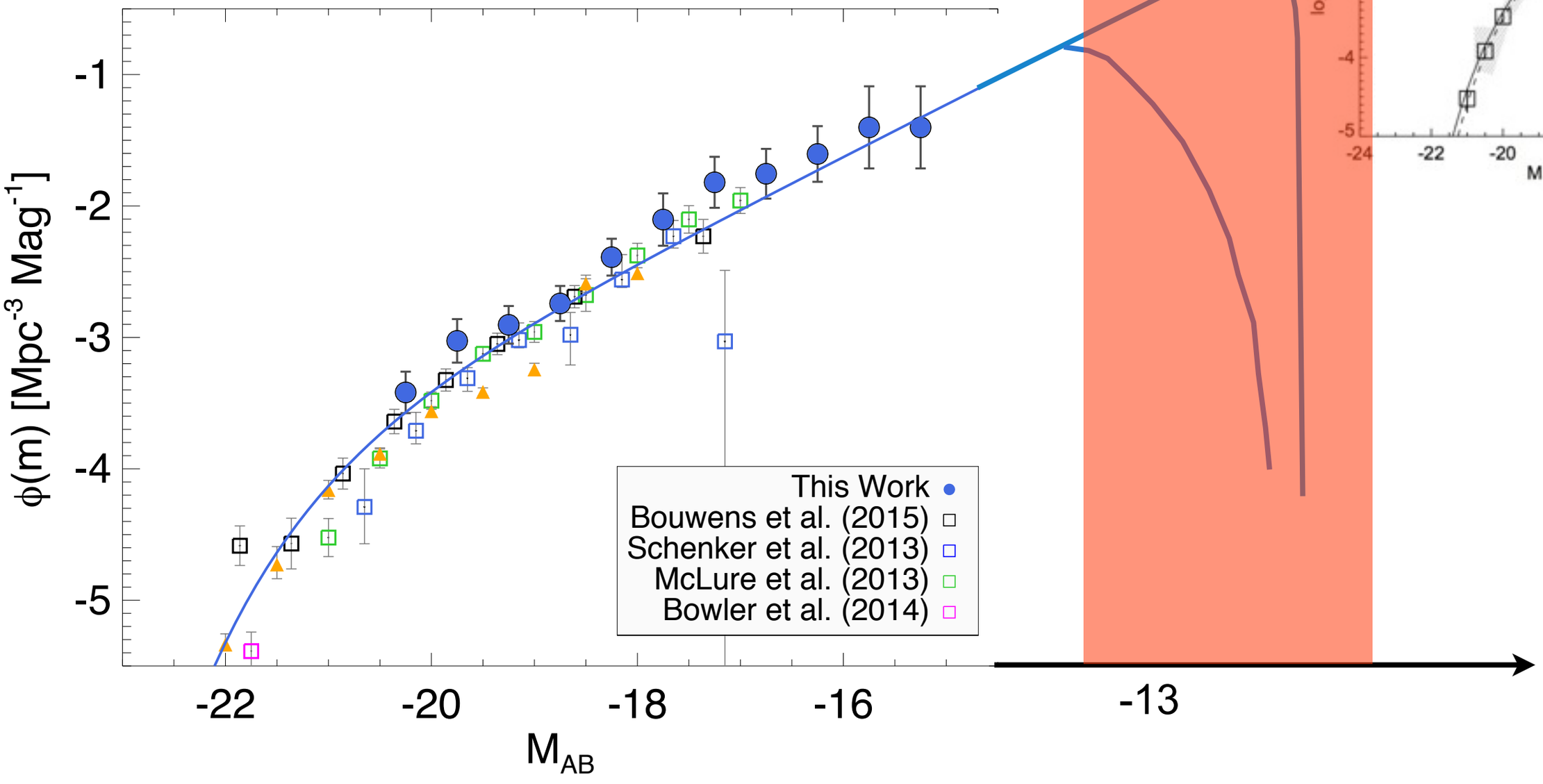
The Faint-end of the UV LF at z>6

Too Many to Fail ?

Kimm & Cen (2014)

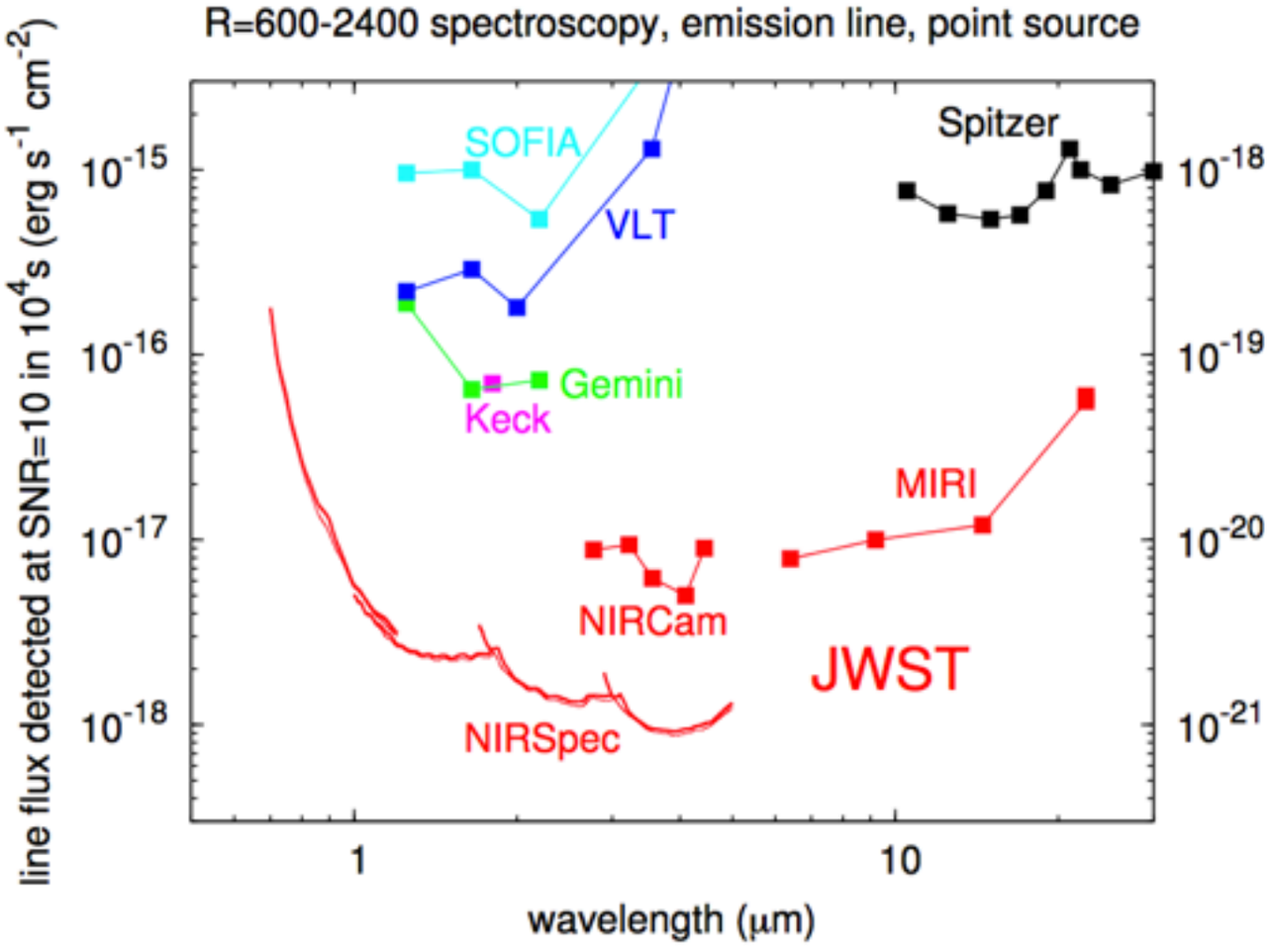
JWST

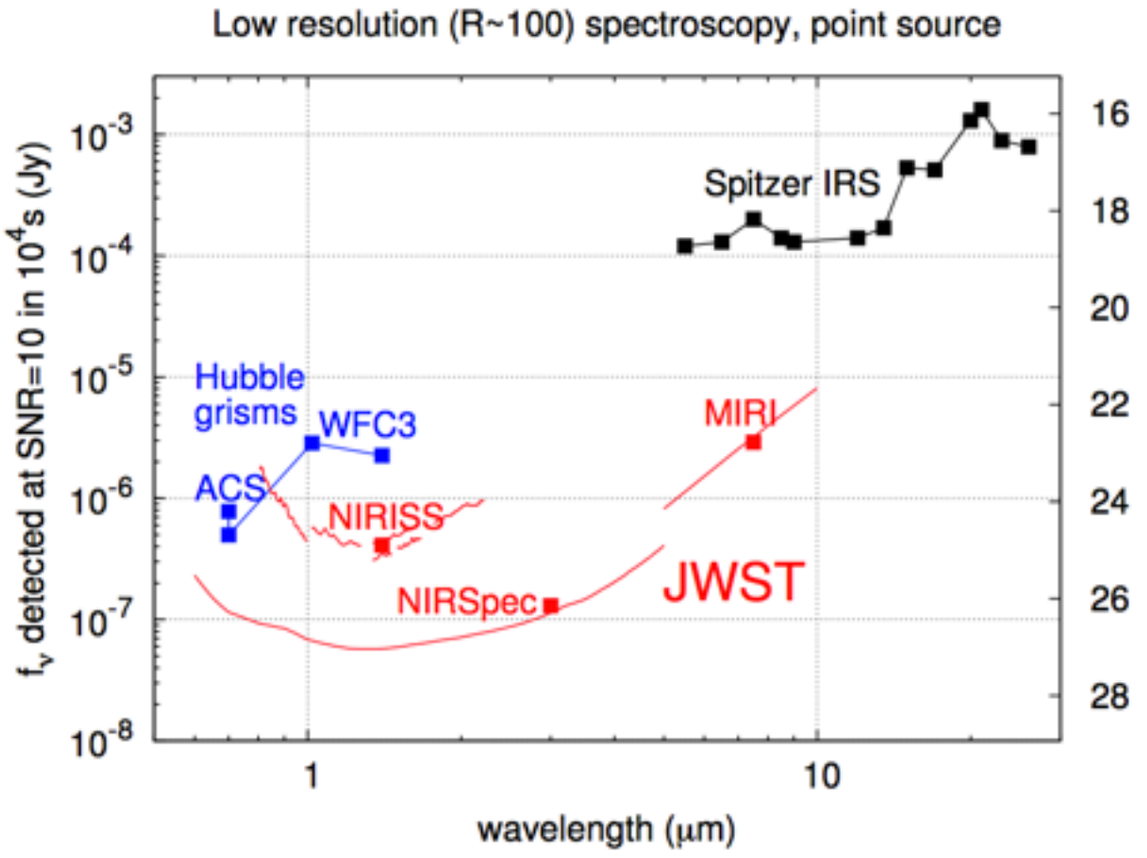




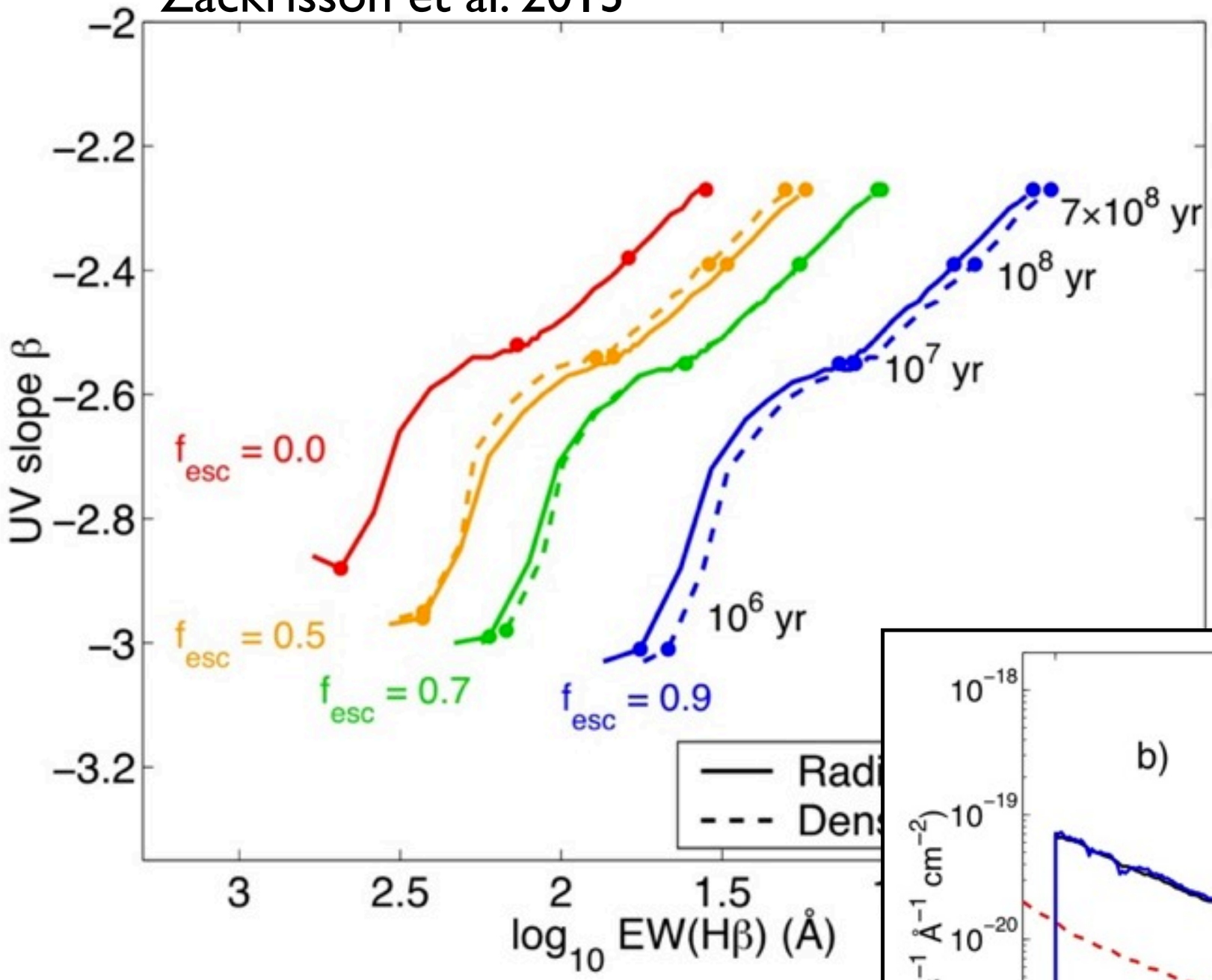
JWST Spectroscopic Performances

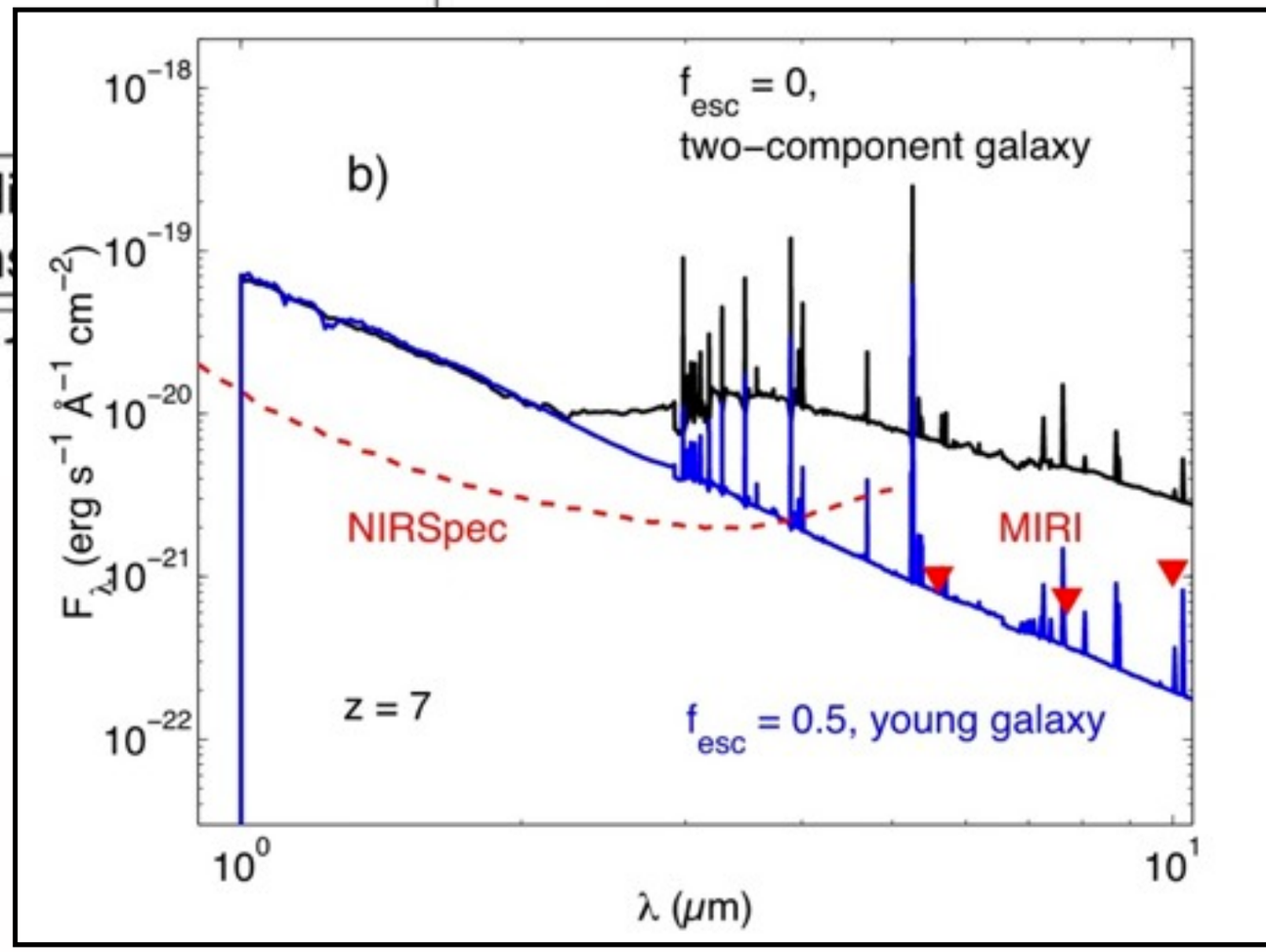
- NIRSpec: 1) to confirm candidates for very high-redshift galaxies (z>10) and look for spectral signatures of young, extremely-metal-poor stellar populations.
- NIRISS observations: slitless spectroscopy enables a blind search for z>7 galaxies (is the Lyman-alpha emission still a good tracer beyond z=7 ?)
- candidates selected from NIRCam and/or NIRISS observations
- MIRI: Optical emission line diagnostics at z>7



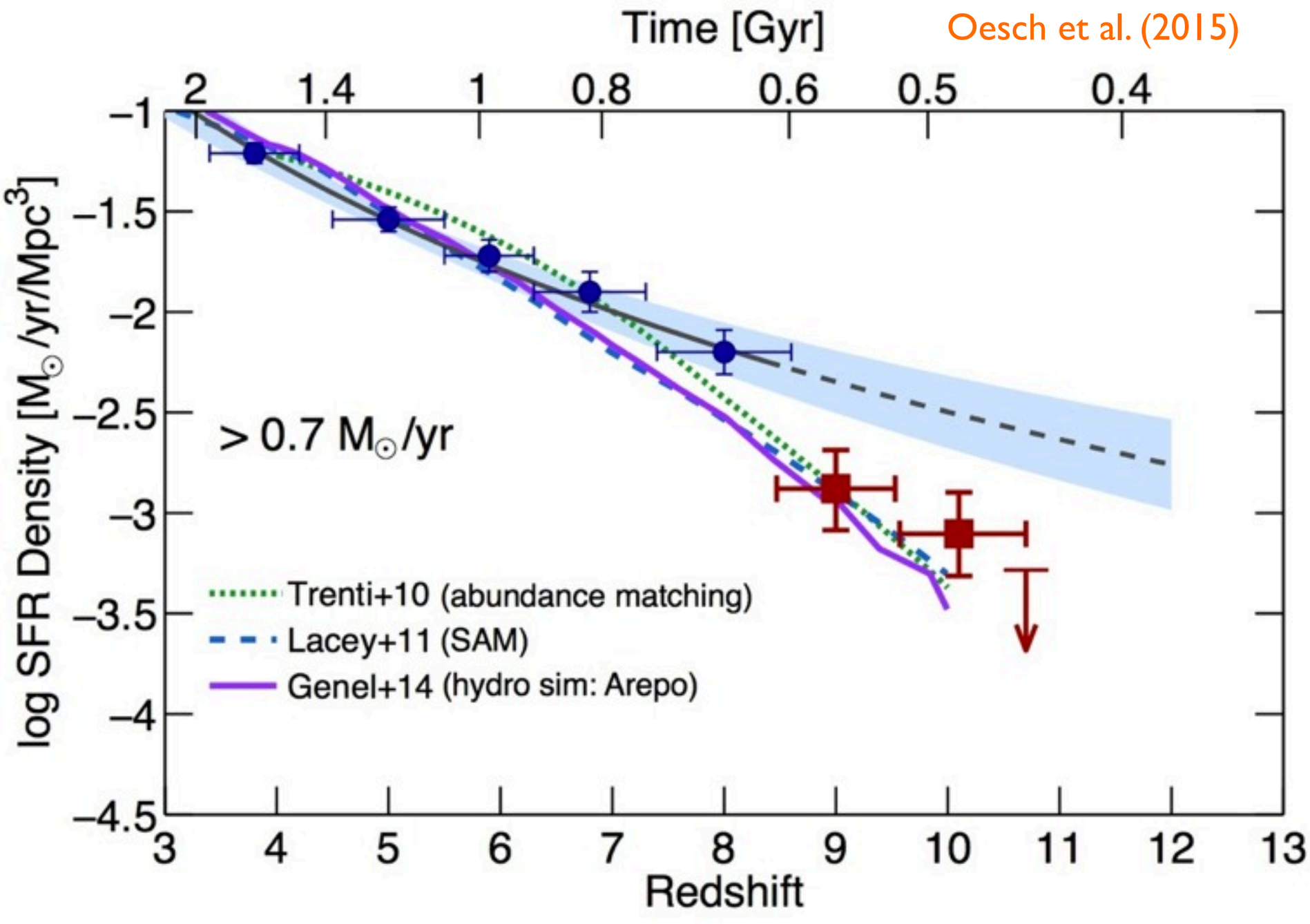


Zackrisson et al. 2013





Evolution of the SFR Density at z>8

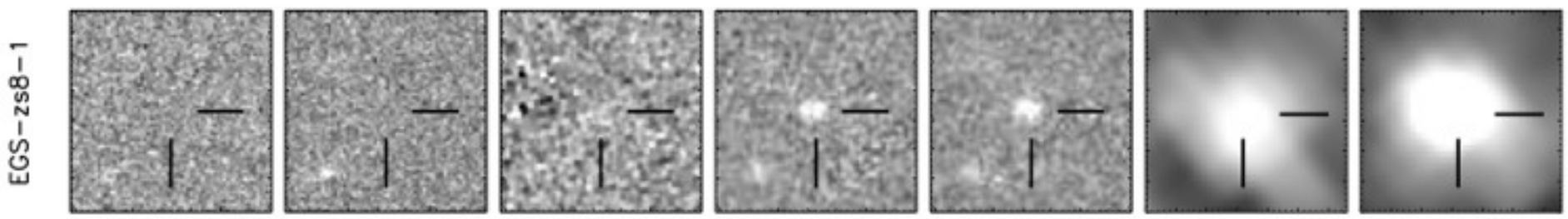


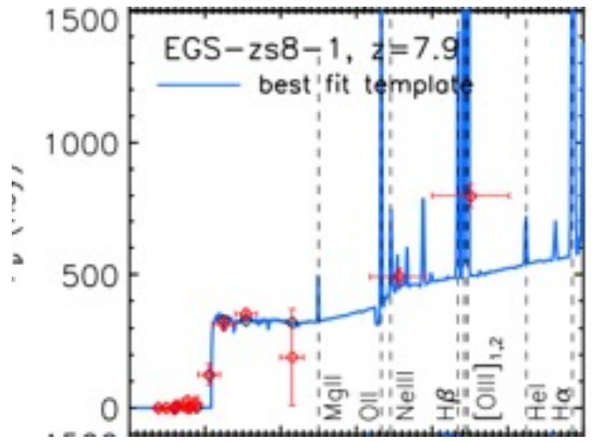
Oesch et al. (2015)

see also Zheng et al (2012), McLure et al. (2013), Coe et al. (2013), Bouwens et al. (2015), Ishigaki et al. (2015)

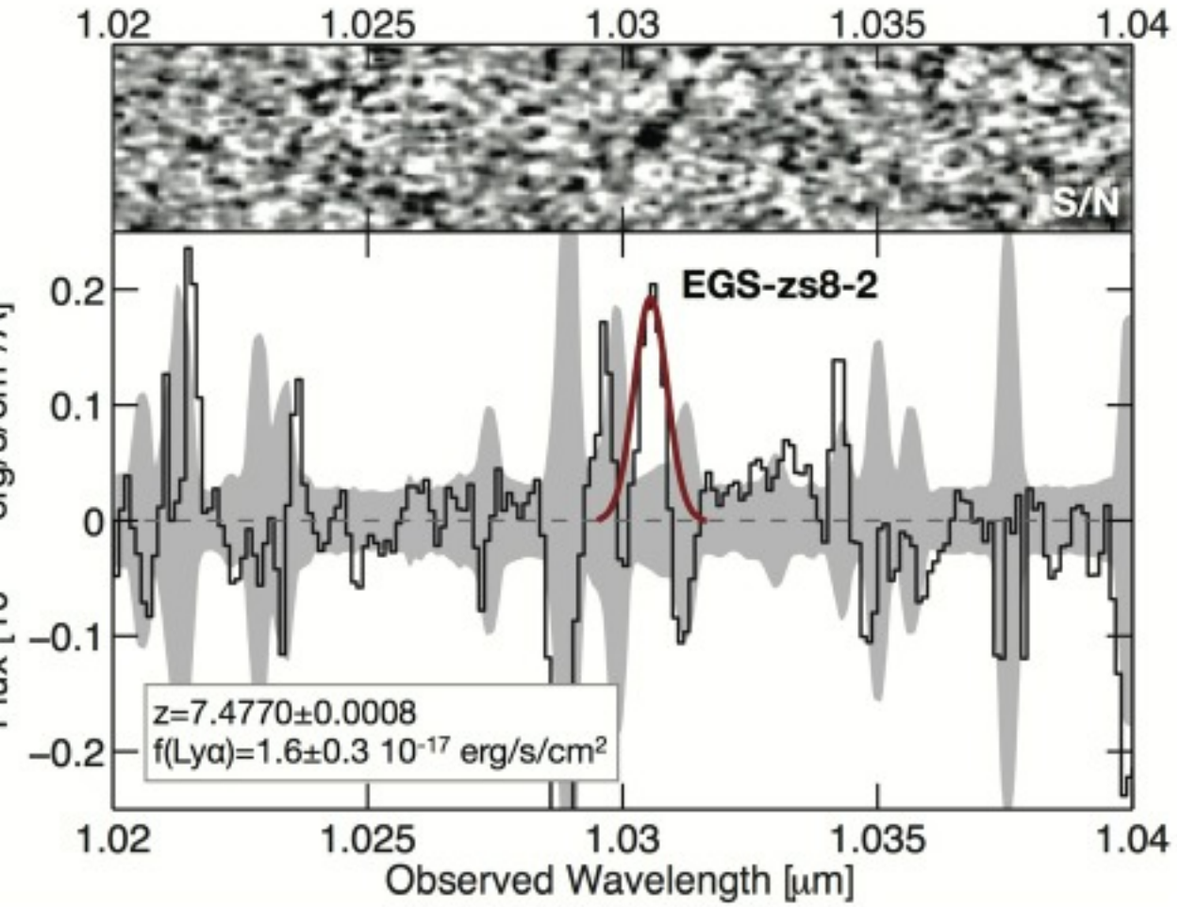
The brightest high-z galaxies

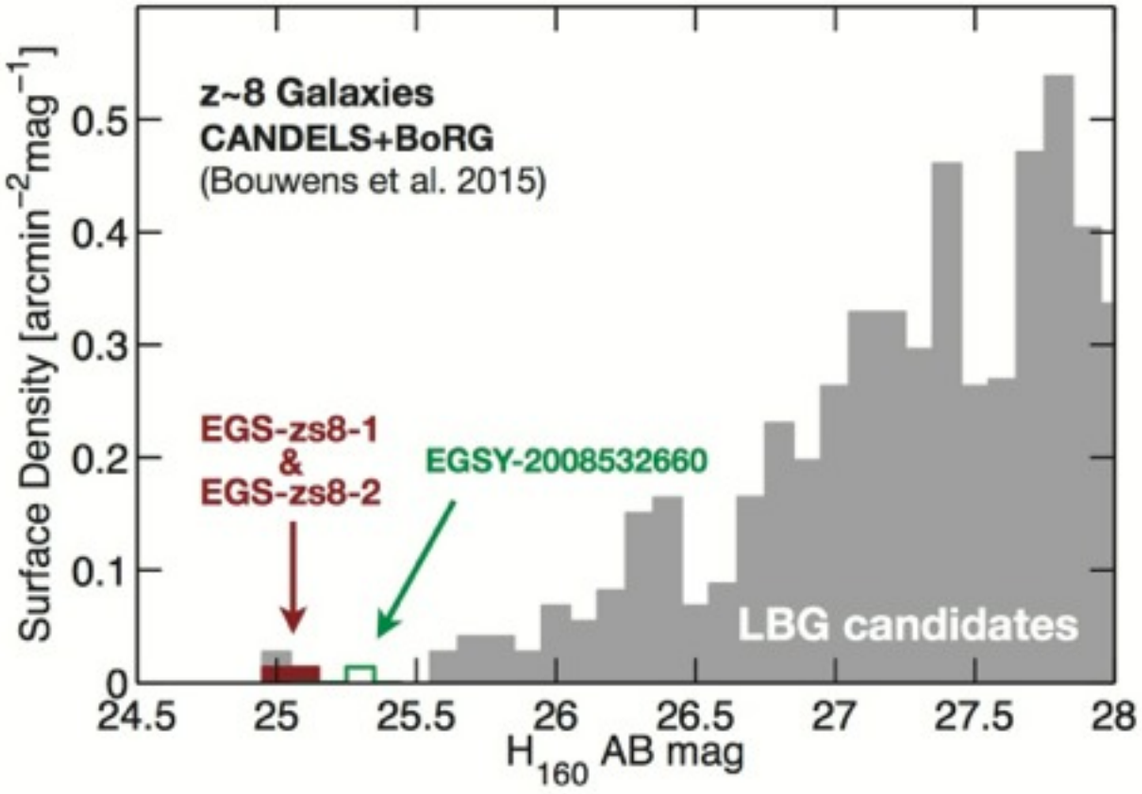
IRAC-selected candidates





Roberts-Borsani et al. (2016)



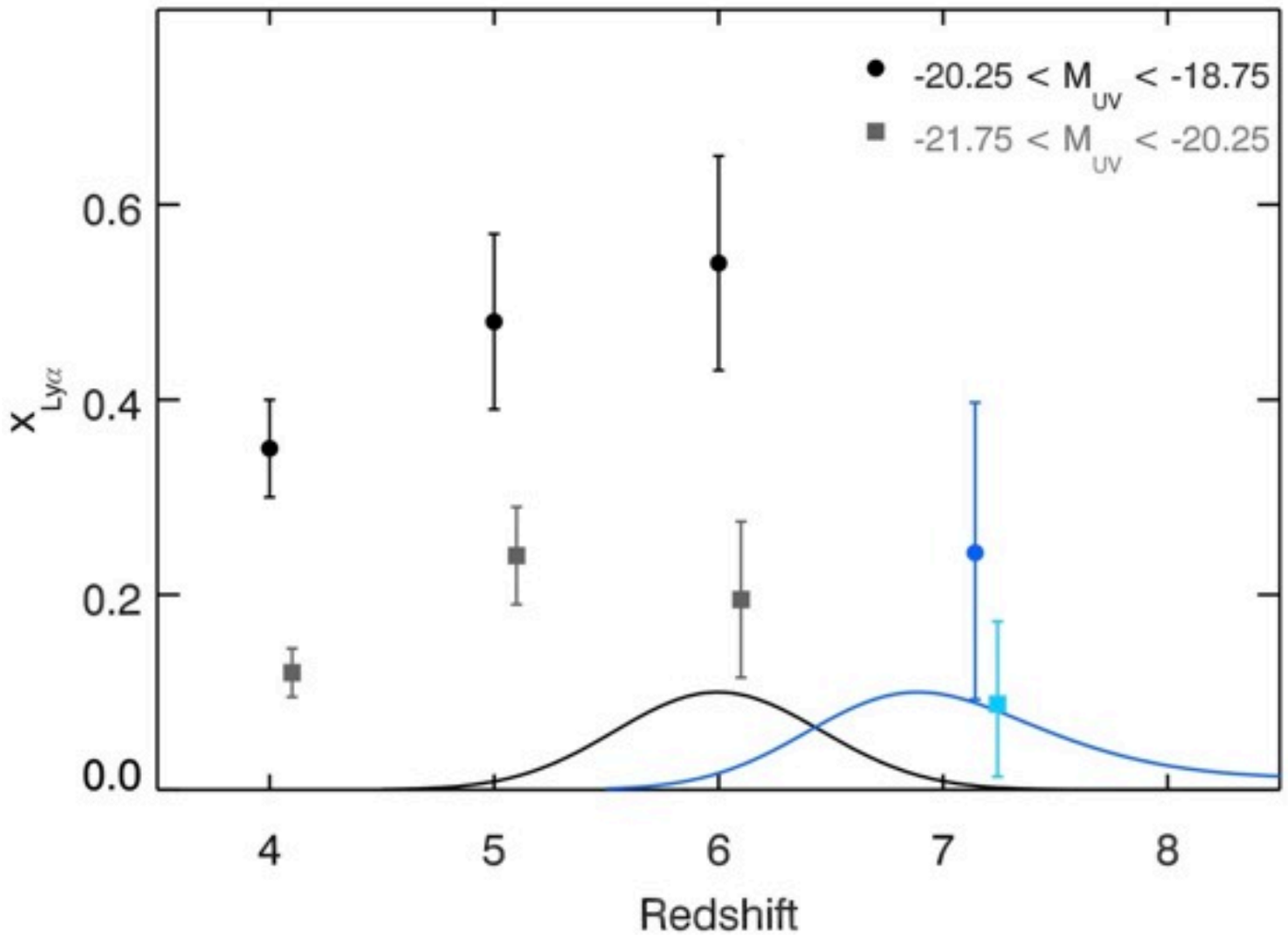


WIDE MOONS survey, ultra-vista field ?

The prevalence of Lya Emitters

Disentangle the effects of the ISM from those in the IGM:
--> The need for high-resolution spectra

Stark et al. (2012)



Verhamme et al. (2008)