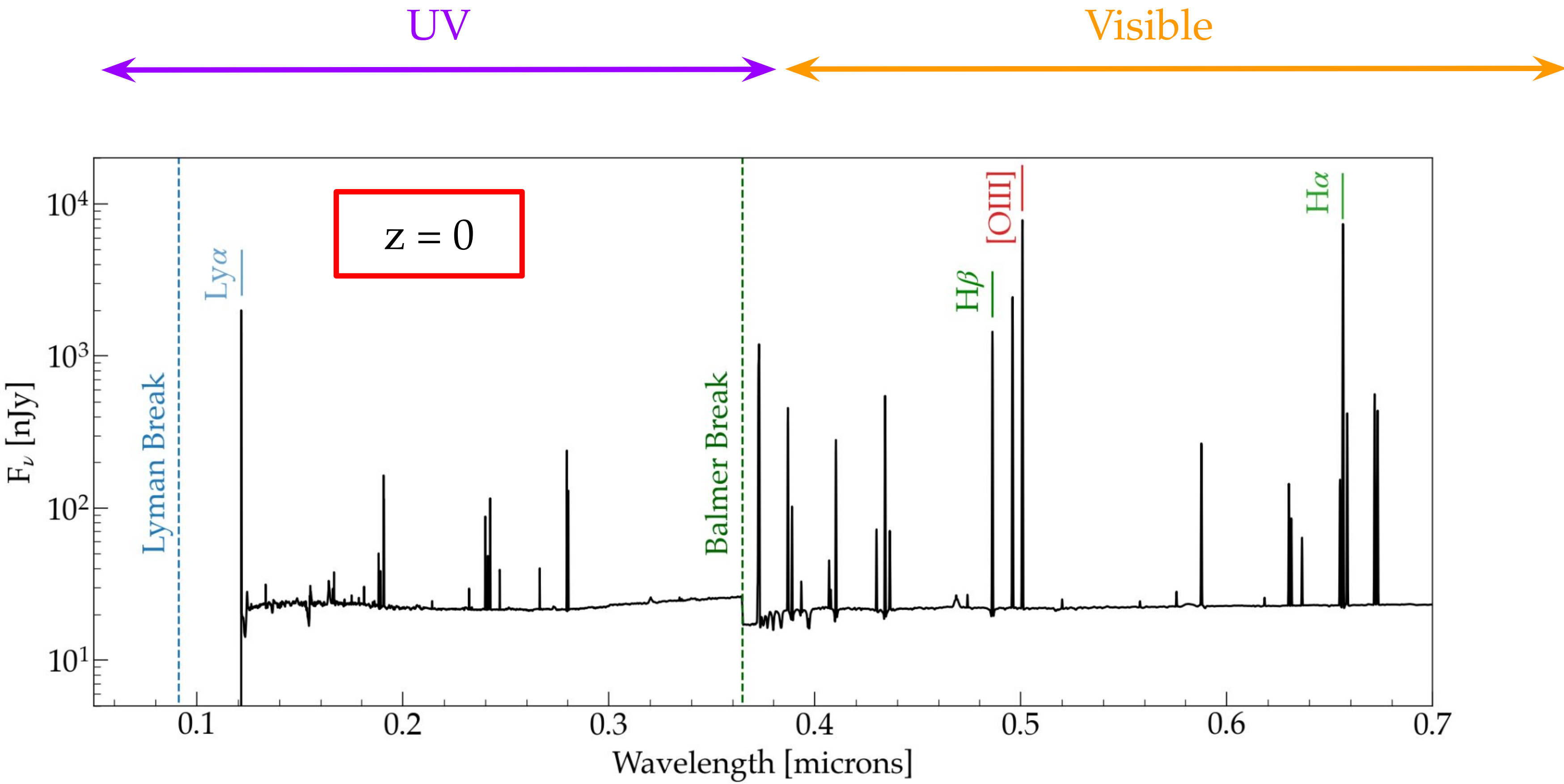
GISM3 Hand-on Project:

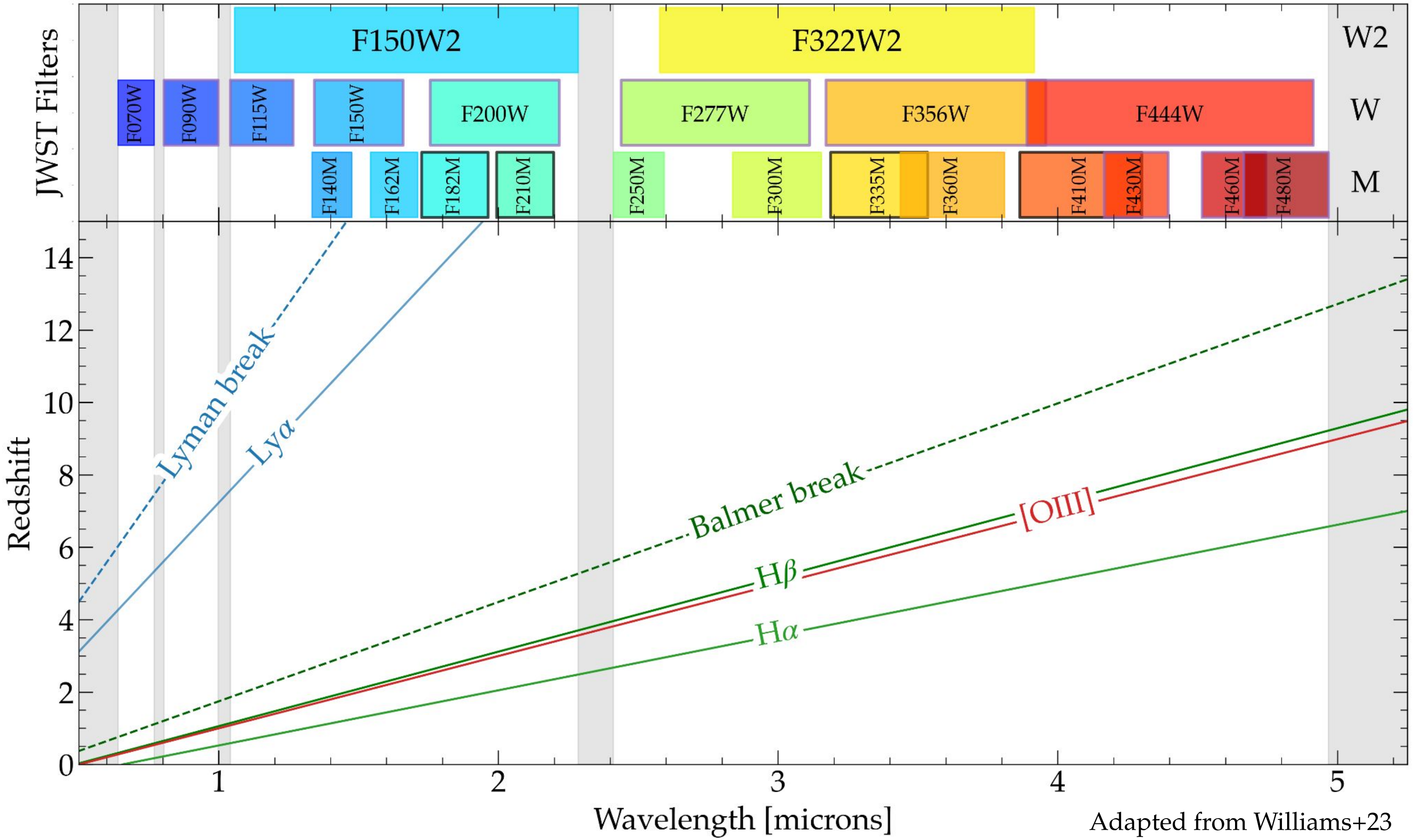
Project 8:
JWST Galactic SED fitting using Beagle

R. Kano, Z. Martinez, M. Mohammed, B. Moreschini, G. Vigoureux
Emma Curtis Lake

Science case : Galaxies SED spectrum



Emission line redshift with JWST



Adapted from Williams+23

JADES

JWST Advanced Deep Extragalactic Survey

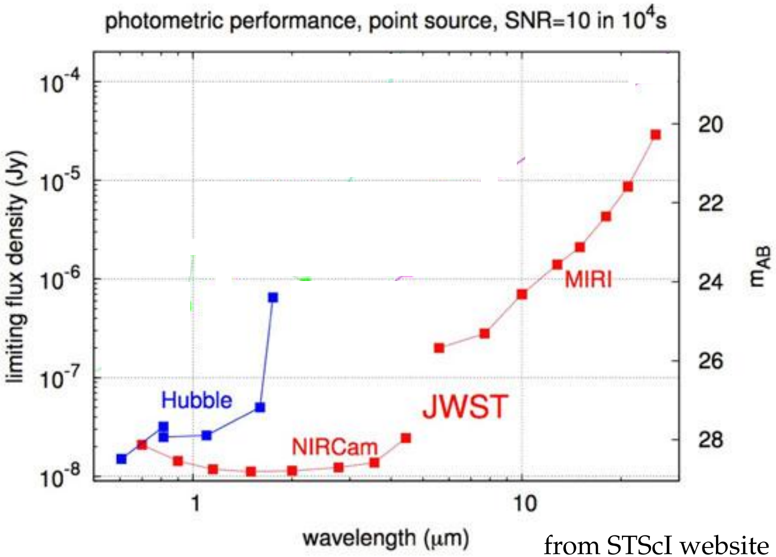
770 hours with NIRCam, NIRSpec & MIRI

10′ x 10′ from 0.7 to 5 μm   3′ x 3′ at 7.7 μm

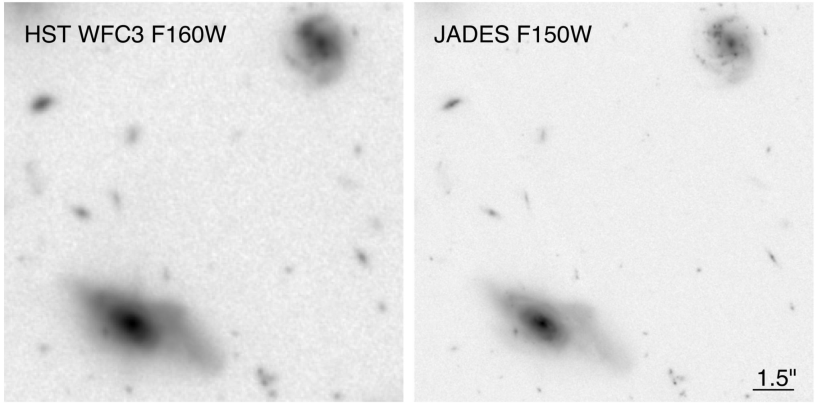
\+ 1000 galaxy spectra

Combined with **CANDELS** (Deep survey from HST)

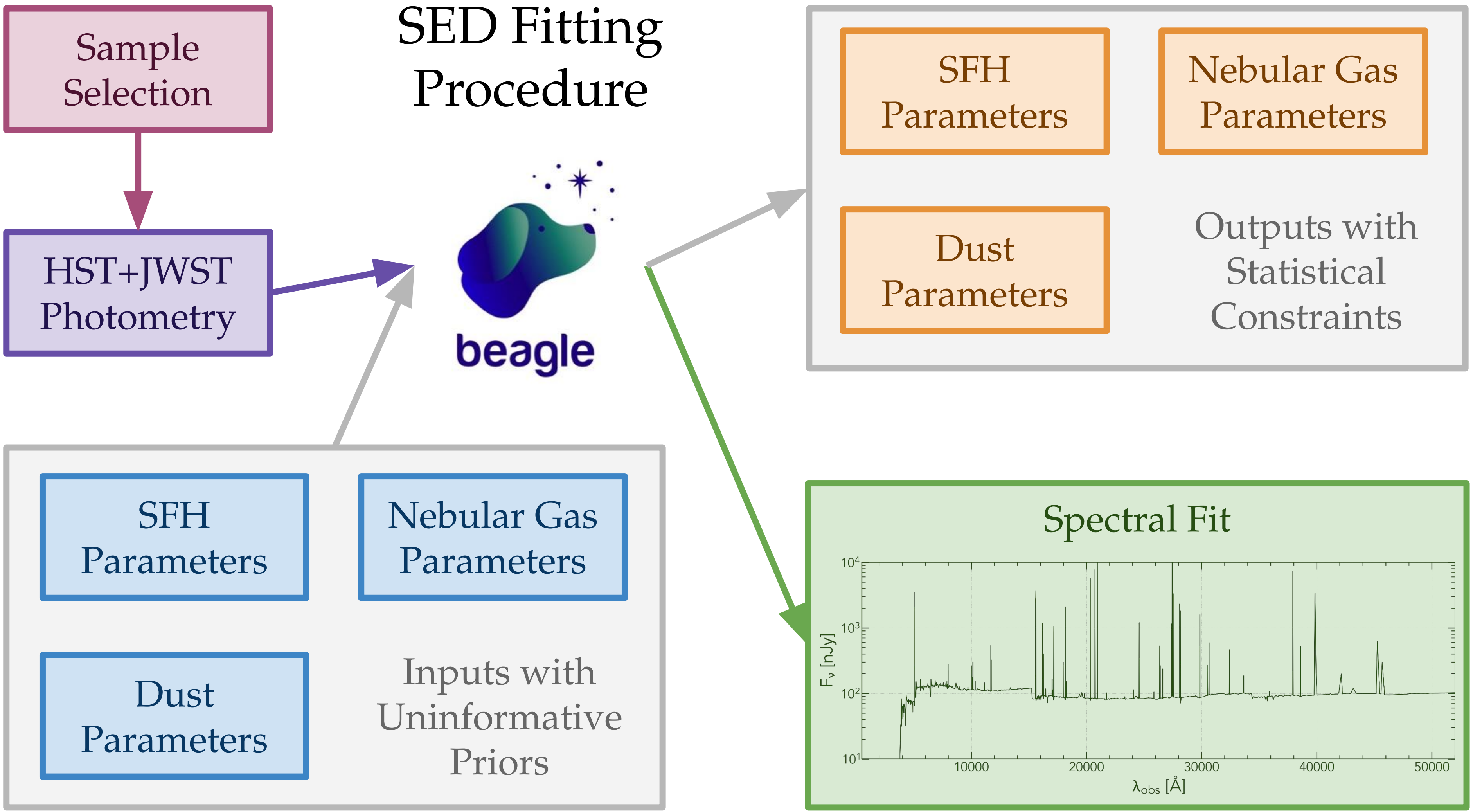
- worse resolution but lower wavelength
- allow wider range



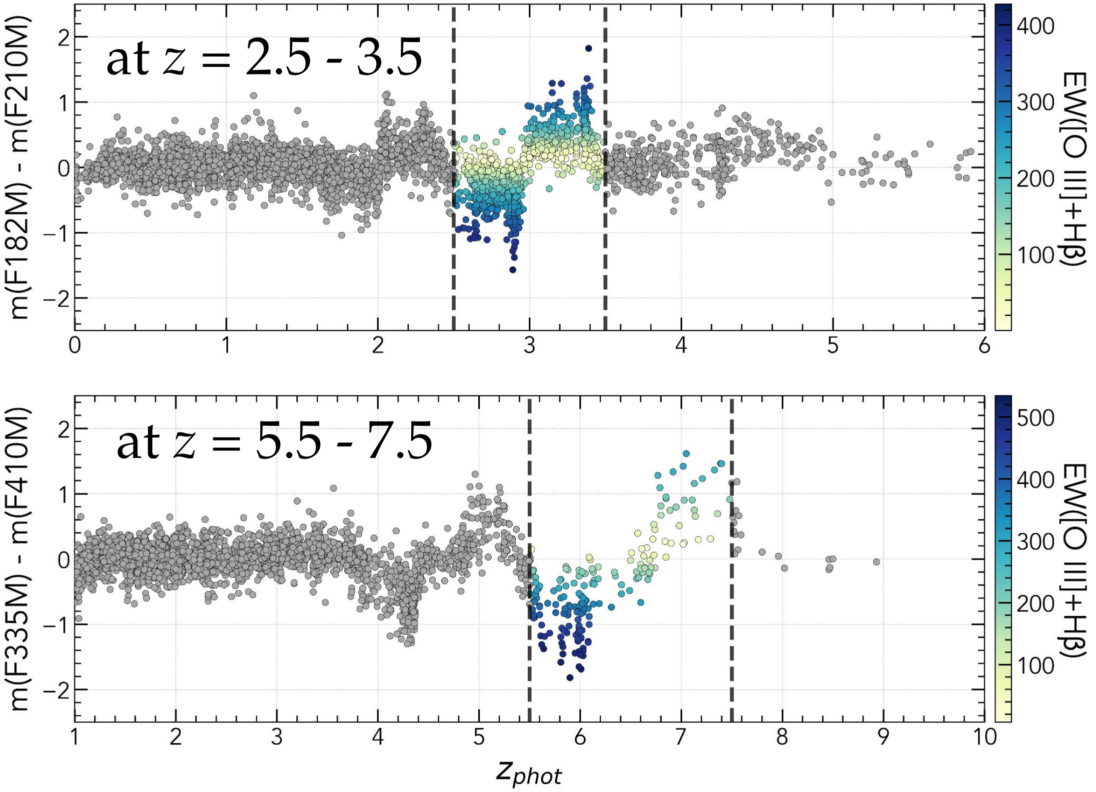
from STScI website



from Eisenstein+23


SED Fitting Procedure
Sample Selection
HST+JWST Photometry
beagle
SFH Parameters
Nebular Gas Parameters
Dust Parameters
Inputs with Uninformative Priors
SFH Parameters
Nebular Gas Parameters
Dust Parameters
Outputs with Statistical Constraints
Spectral Fit
F_ν [nJy]
λ_{obs} [Å]
10000
20000
30000
40000
50000
10^1
10^2
10^3
10^4

We select for 30 extreme [O III]+Hβ emitters with EW([O III]+Hβ) $\gtrsim$ 200 Å in two redshift bins.



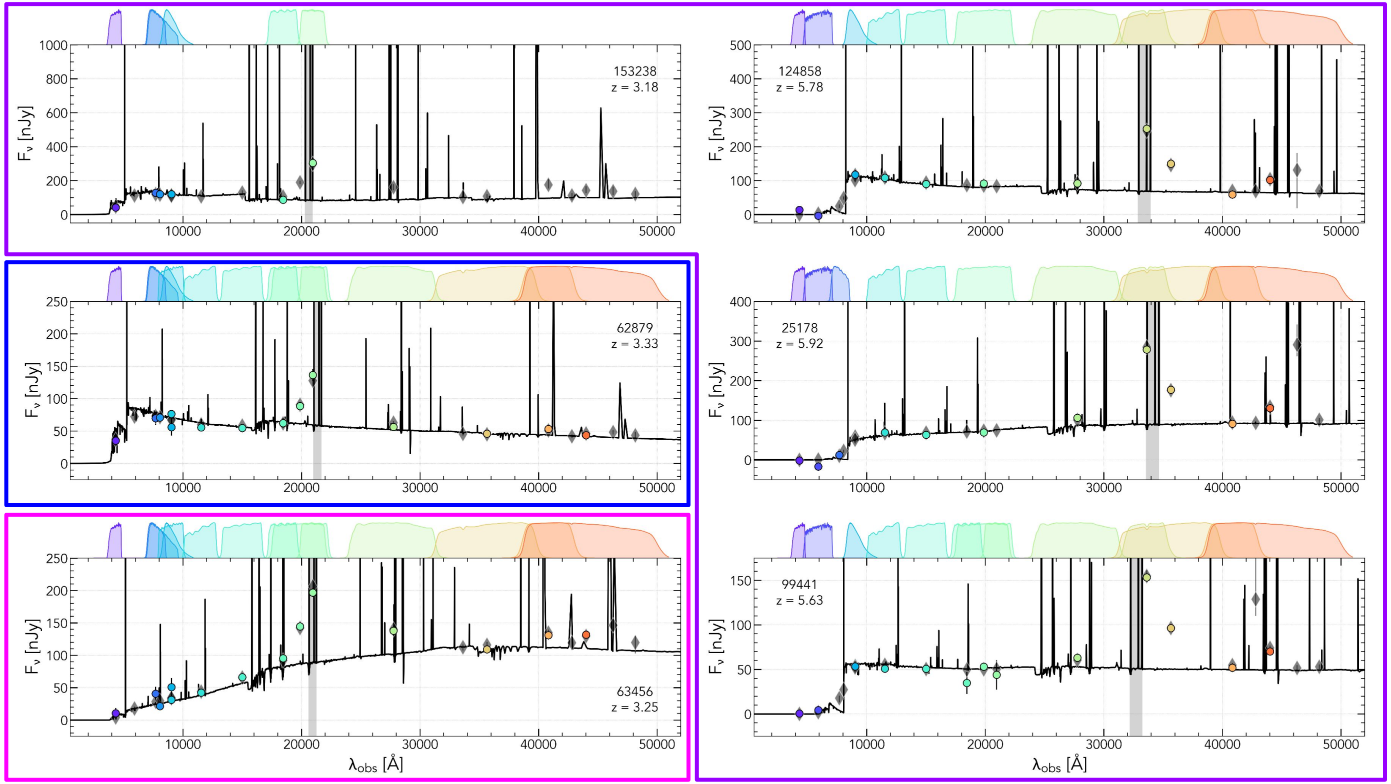
14 galaxies with EW([O III]+Hβ)$_{MED}$ = 310 Å

16 galaxies with EW([O III]+Hβ)$_{MED}$ = 470 Å

On average the higher-z bin has larger EW([O III]+Hβ) than the lower-z bin.

Overall, we find that there is less variety in the fits to the higher-z bin when compared to the lower-z bin.

at z = 2.5 - 3.5 | at z = 5.5 - 7.5



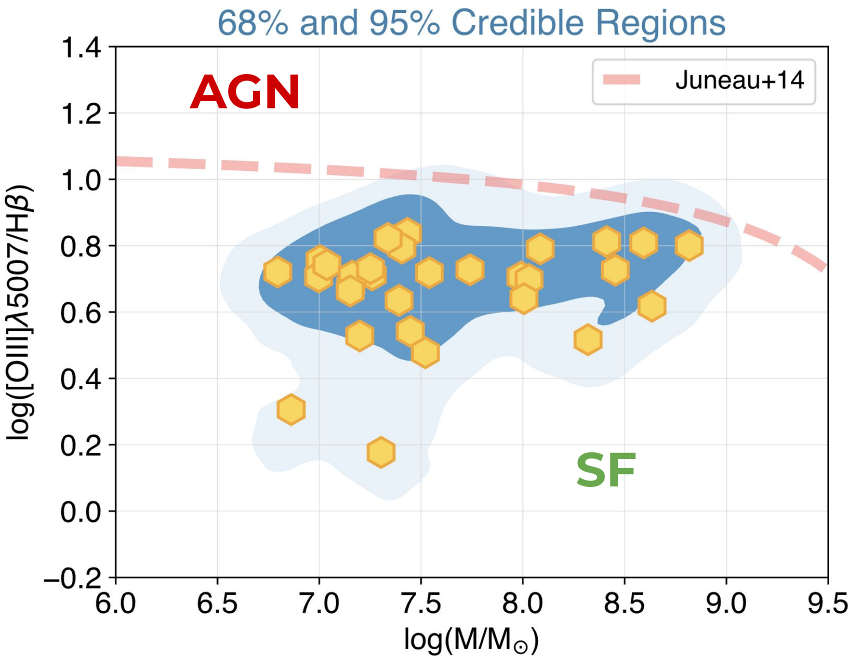
Balmer Break

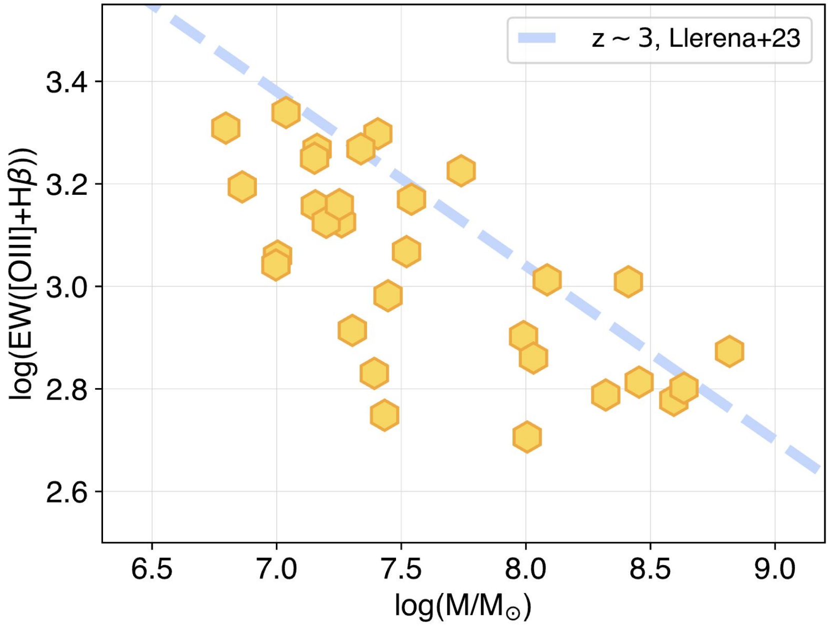
Dusty

Potential Balmer Jumps

(in the most extreme [O III]+Hβ emitters)

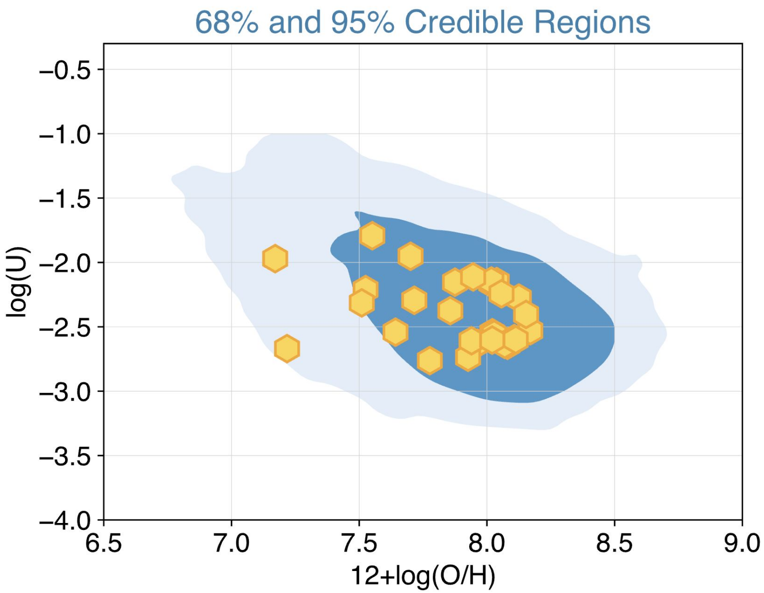
BEAGLE results: extreme [OIII]-emitters properties



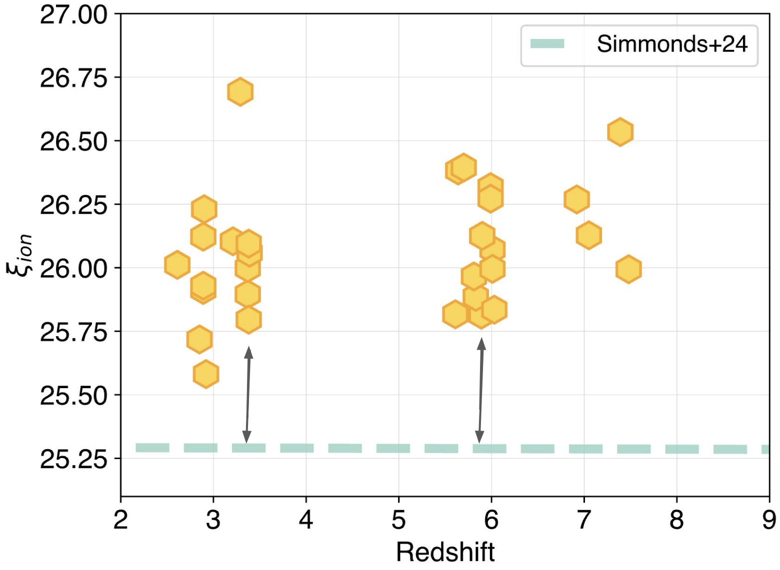


Extreme galaxies but consistent with **ionisation by star formation**

BEAGLE results: extreme [OIII]-emitters properties



Slight **anti-correlation** between metallicity and ionisation parameter

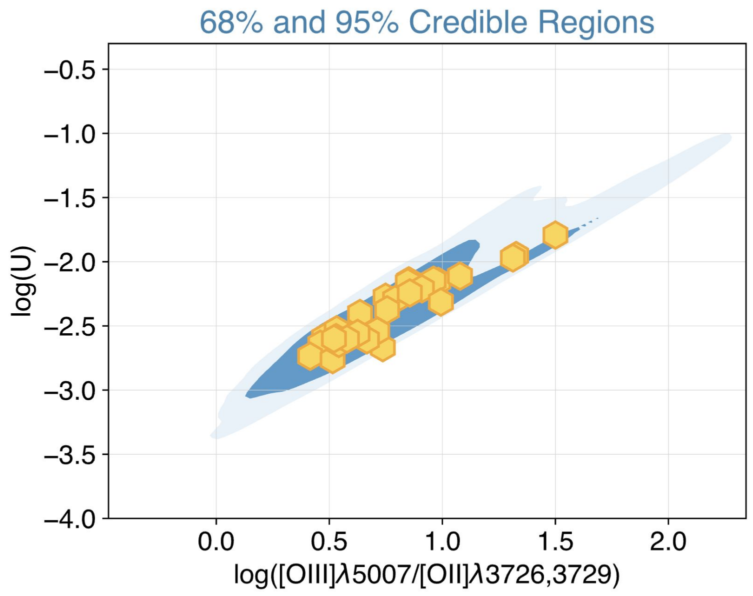


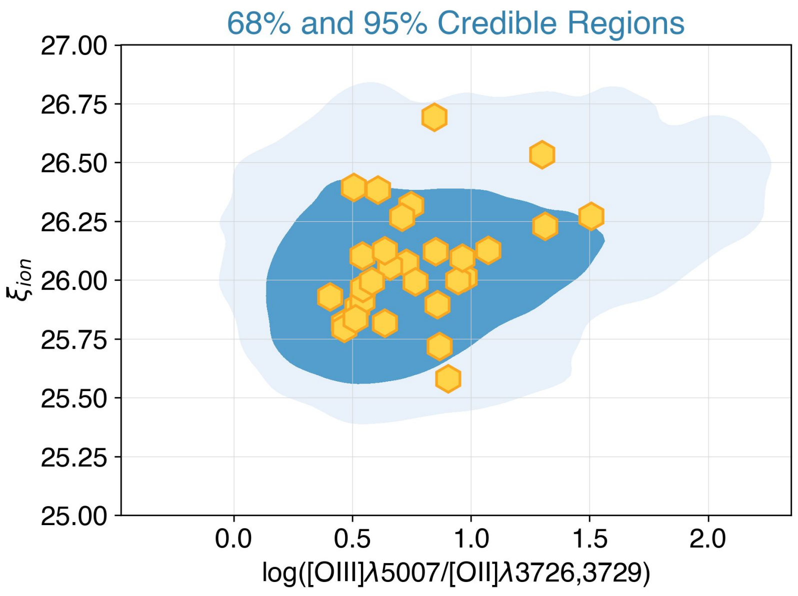
Efficient **ionising photons** production!

Connecting ionisation properties with line ratios

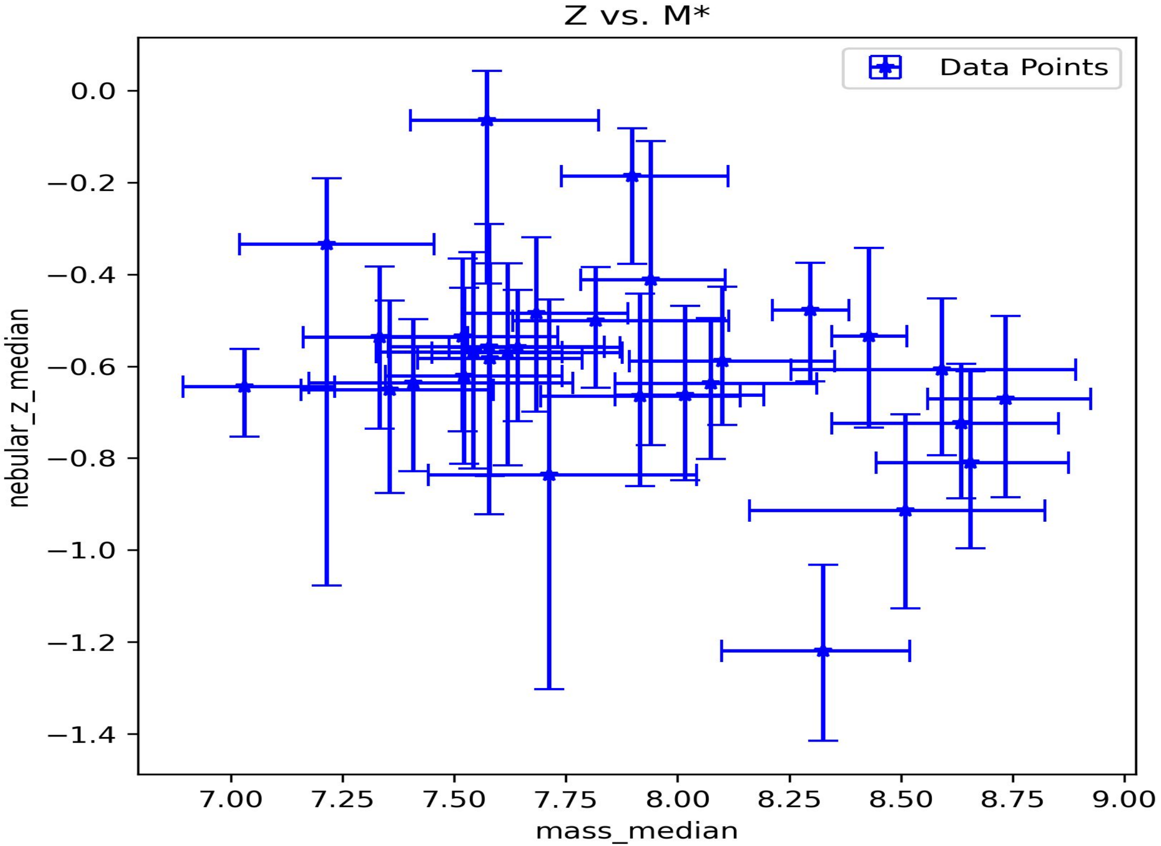
log(U)

ξ_{ion}

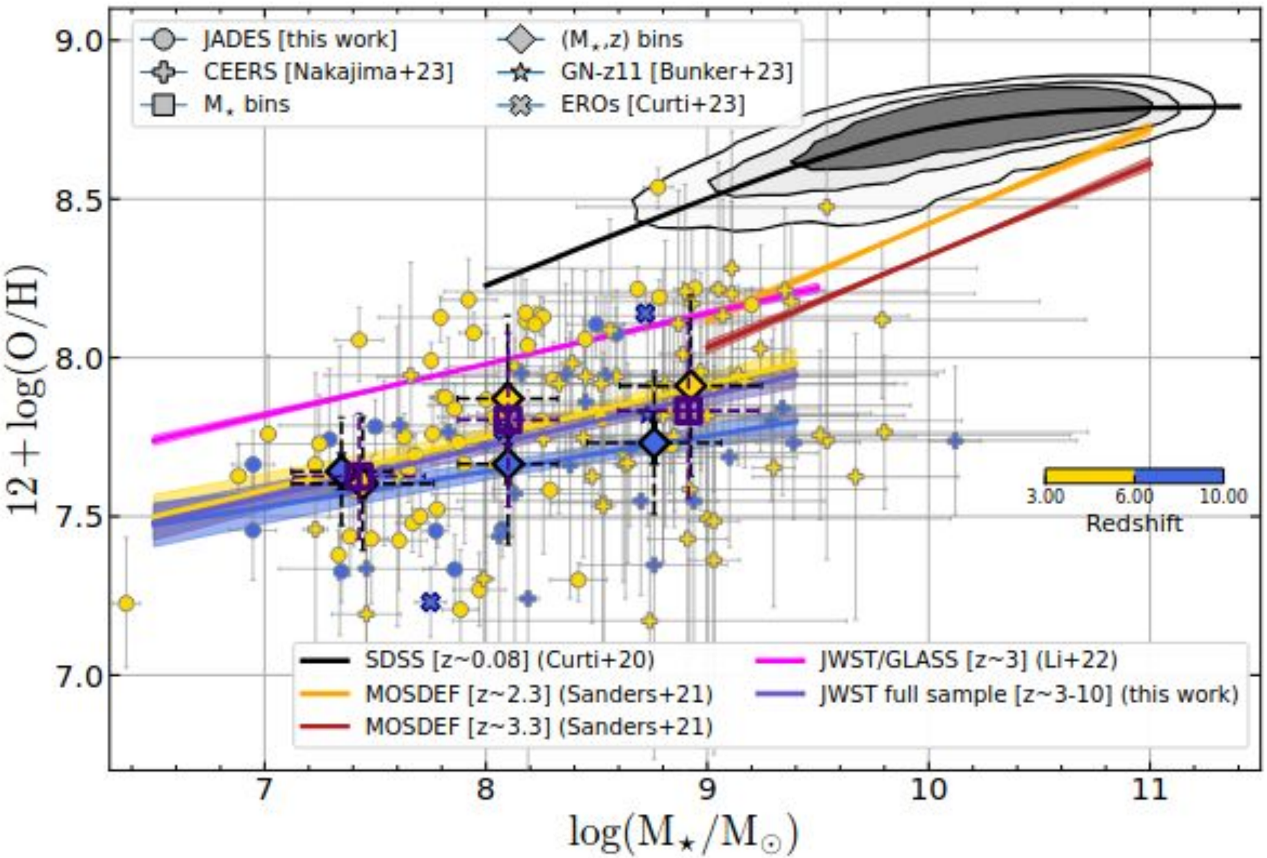




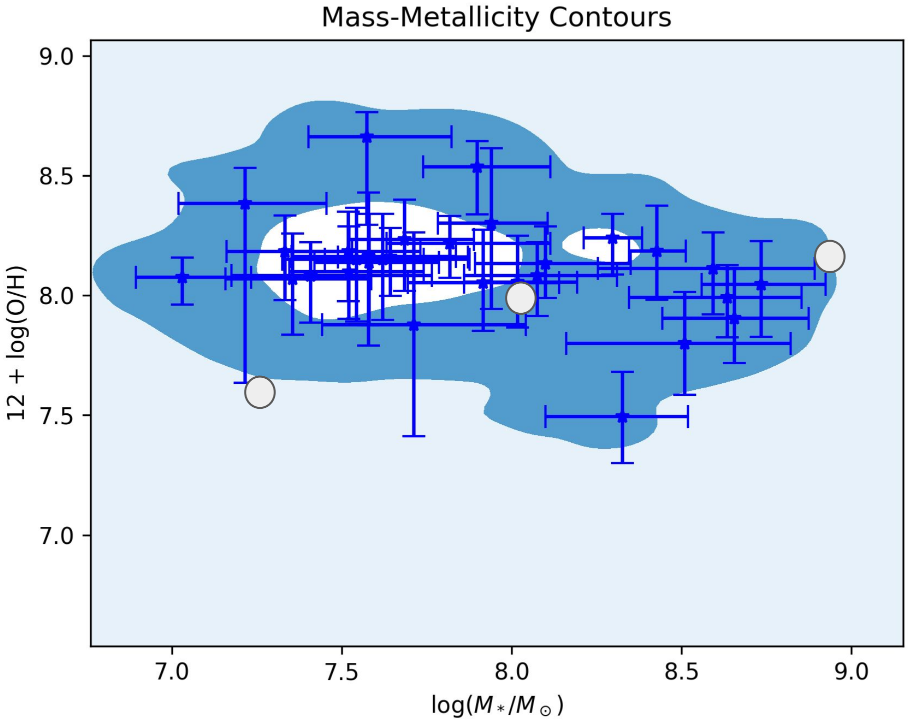
Mass Metallicity Relation (MZR)



Comparison with other sample of galaxies with similar z



Mass-Metallicity Contours

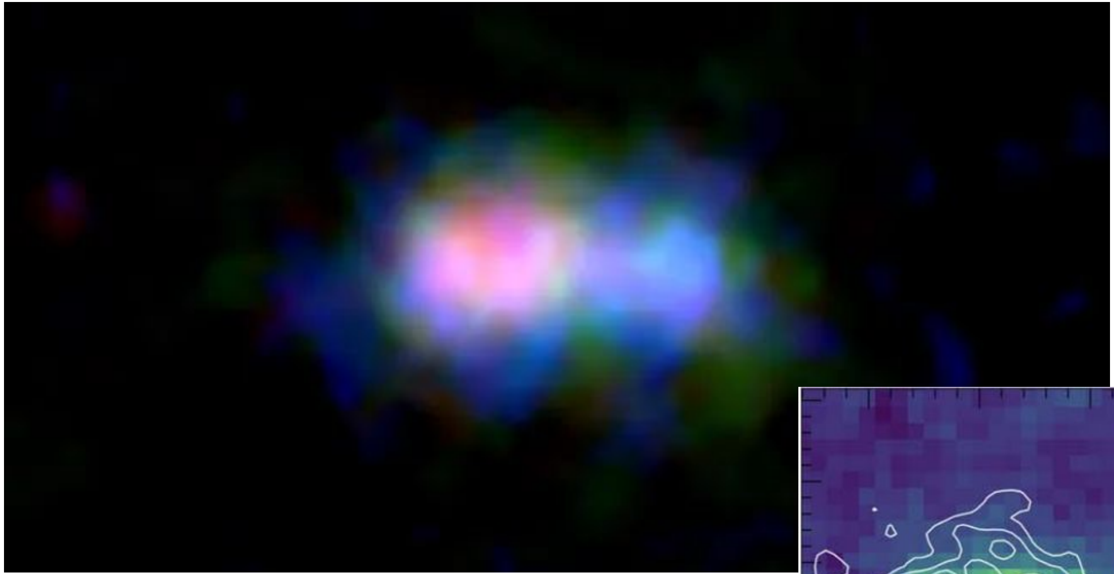


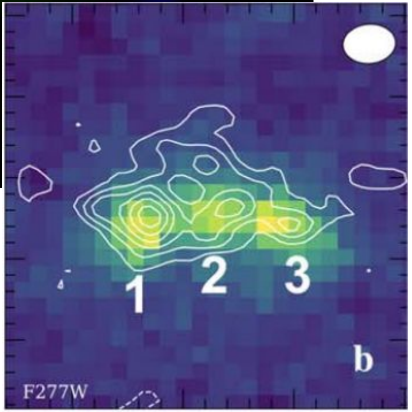
Case II: BEAGLE result for high-z galaxy (z=8.3)

	Y1
R.A. (deg)	64.0391682
Decl. (deg)	−24.0931764
R.A.^{s} (deg)	64.036045
Decl.^{s} (deg)	−24.084671
F090W	>28.64
F105W	>29.48
F115W	26.94 ± 0.11
F125W	26.55 ± 0.06
F140W	26.24 ± 0.04
F150W	26.16 ± 0.06
F160W	26.12 ± 0.03
F200W	26.09 ± 0.05
F277W	25.98 ± 0.03
F356W	25.60 ± 0.02
F410M	25.92 ± 0.04
F444W	24.85 ± 0.01

No ALMA data

MACS0416_Y1

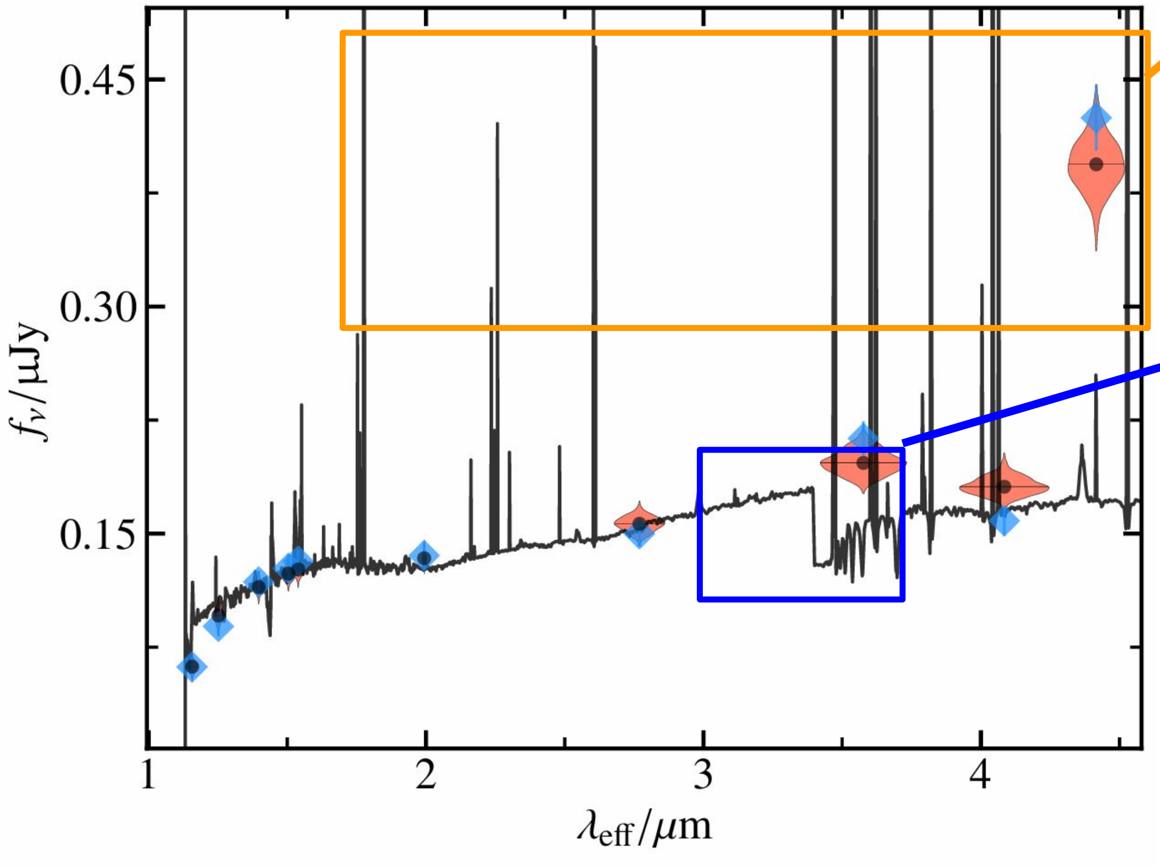




credit:Tamura et al (2019)

BEAGLE result for high-z galaxy (z=8.3)

Best Fitting



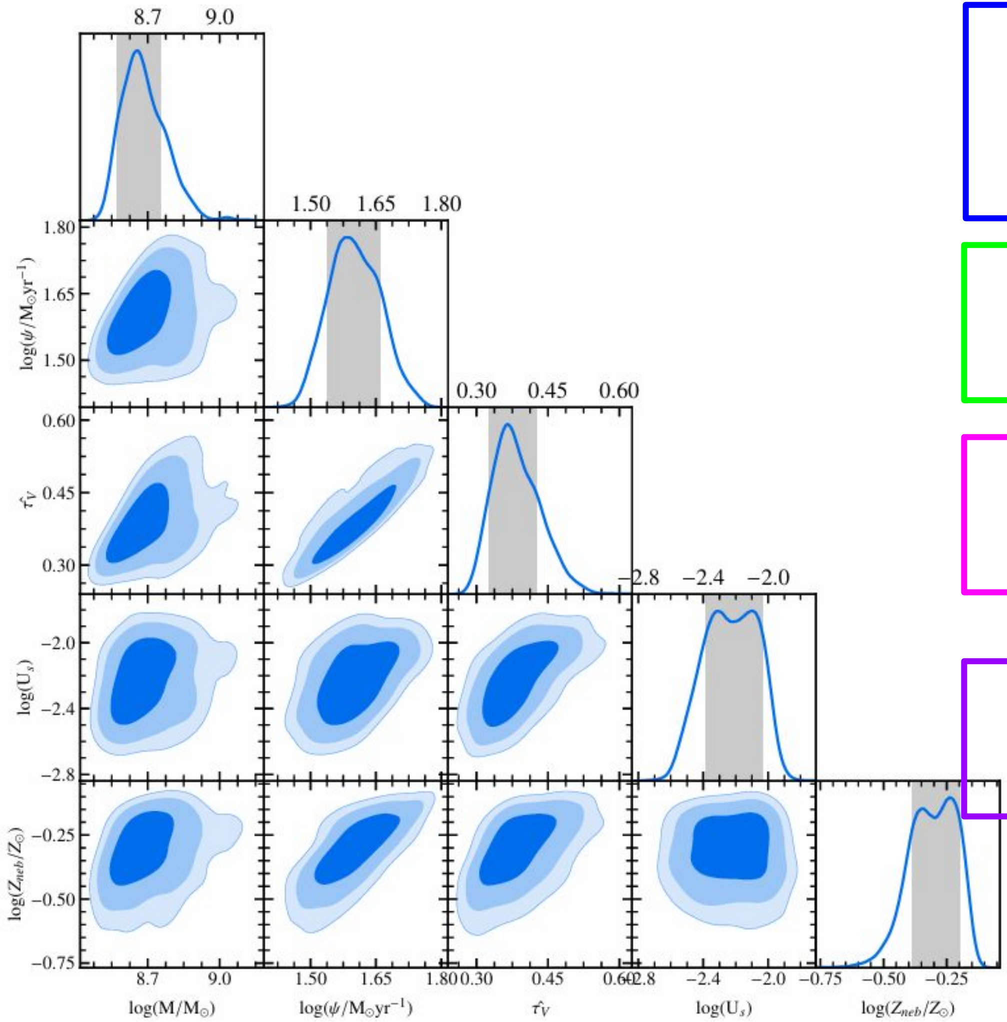
Strong emission

High SFR

Highly ionized?

Strong Free-bound continuum emission

Hot stars emit enough ionizing photons?



Stellar Mass: log(M/Msun) ~ 8.7
Small mass galaxy?
We did not use ALMA data…

SFR: log(Φ/Msun/yr) ~ 1.6 = 40M/yr
Relatively high SFR

Optical depth: τv ~ 0.4
Moderate dust attenuation

Dust obscured star formation region

Ionized parameter: log(Uz) ~ -2.2
Relatively high ionized