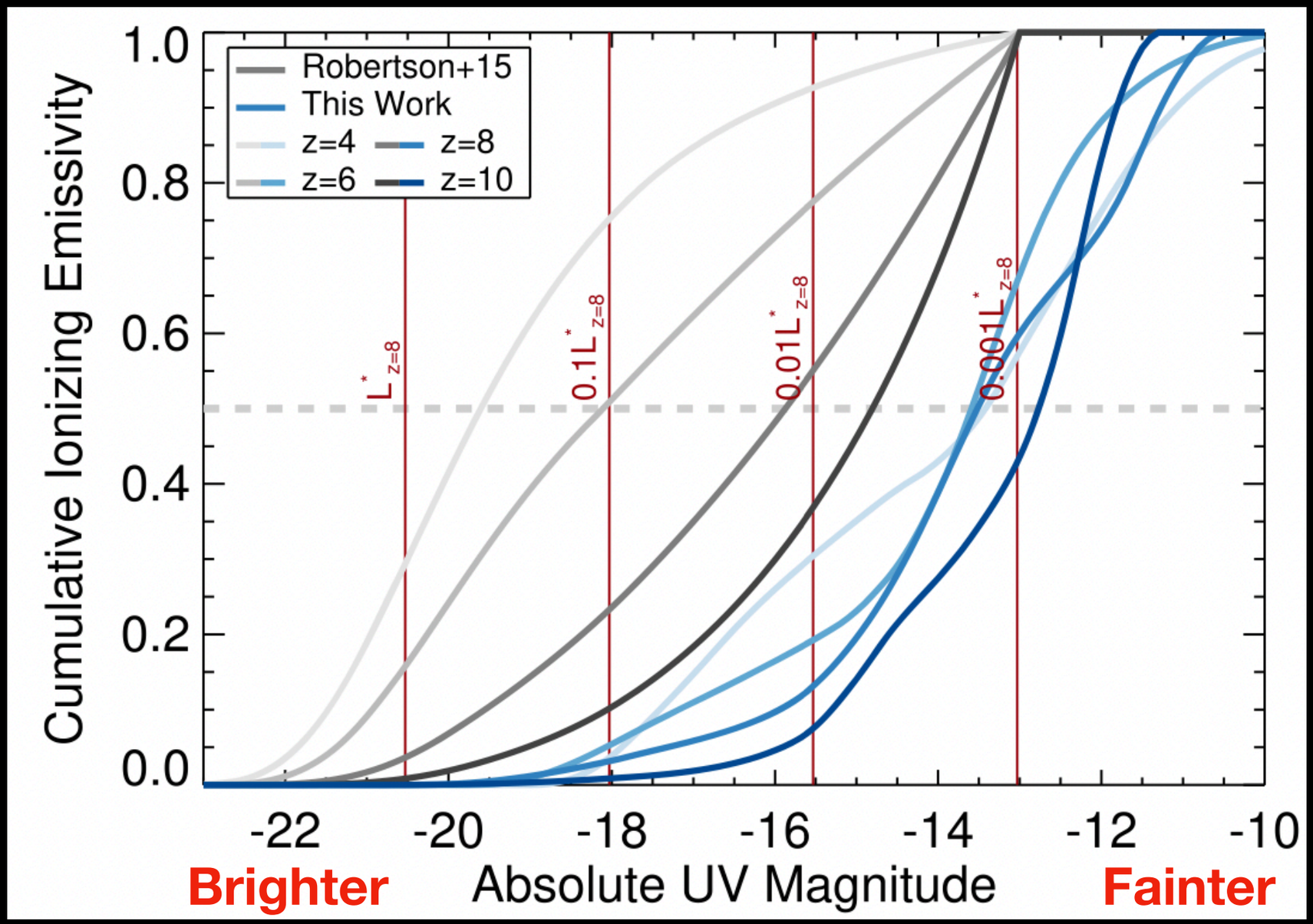
Investigating LyC Production and Escape in Local Metal-Poor Dwarf Galaxies

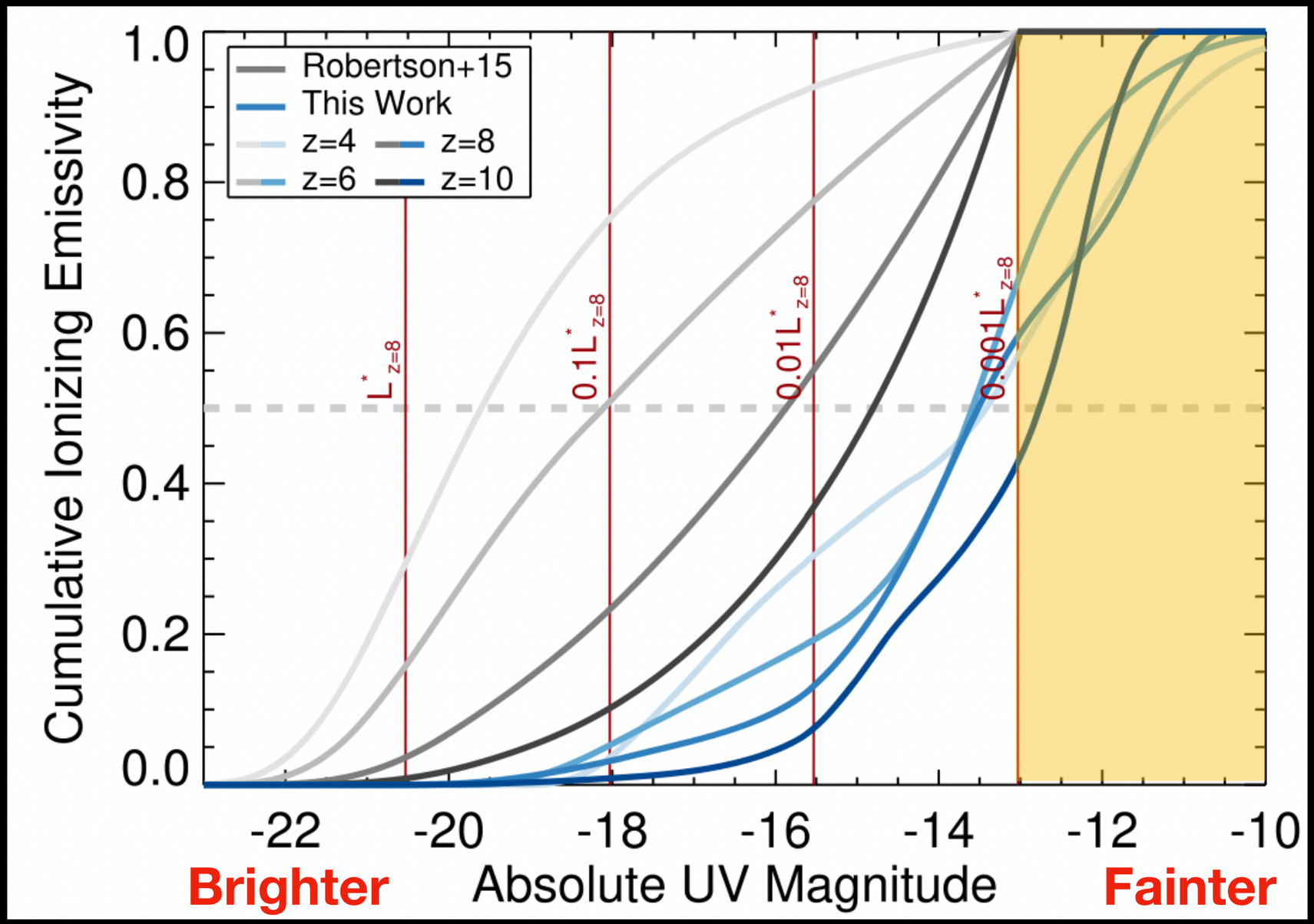
Yumi Choi (NSF NOIRLab)

UV-faint dwarf galaxies: primary drivers of cosmic reionization



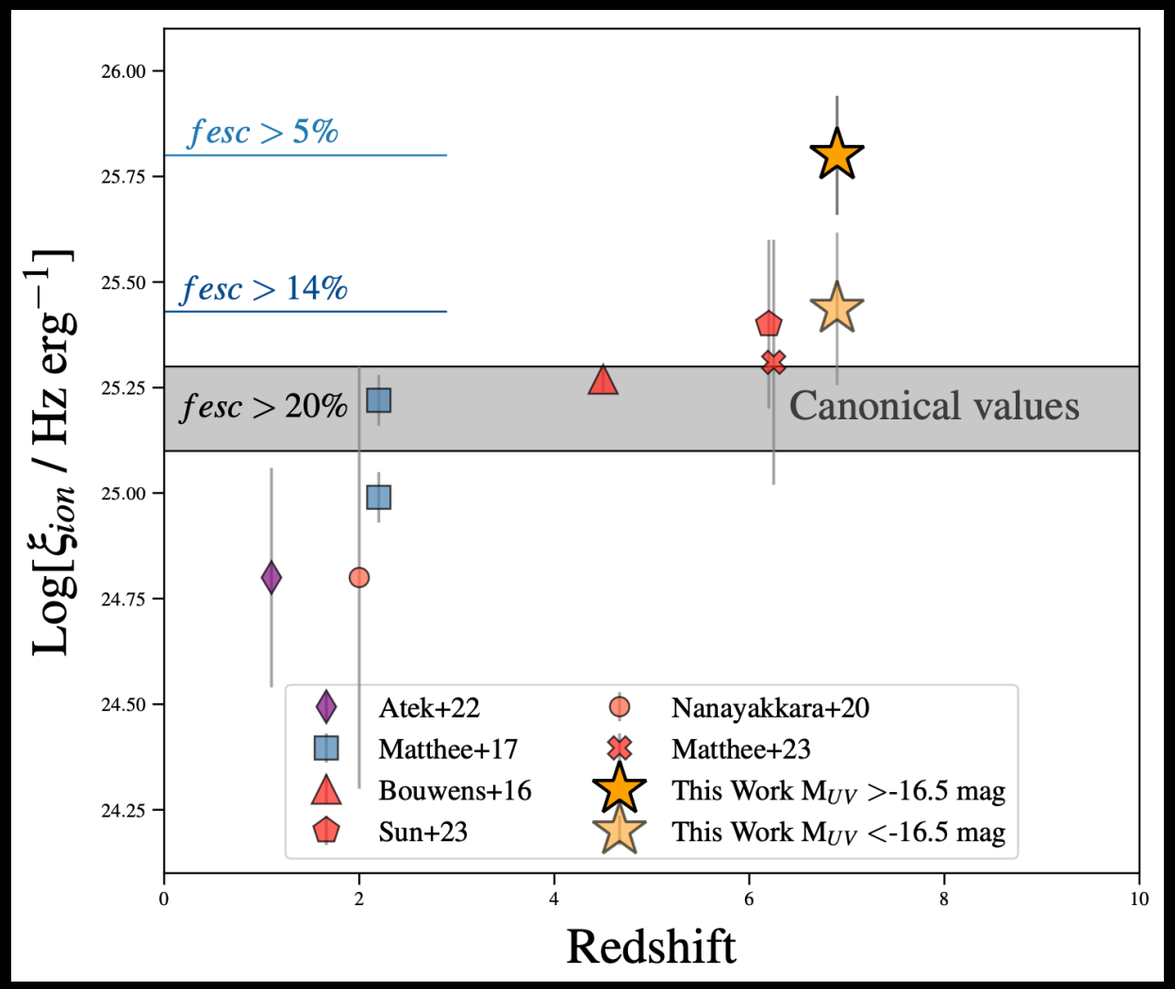
Finkelstein+19

UV-faint dwarf galaxies: primary drivers of cosmic reionization

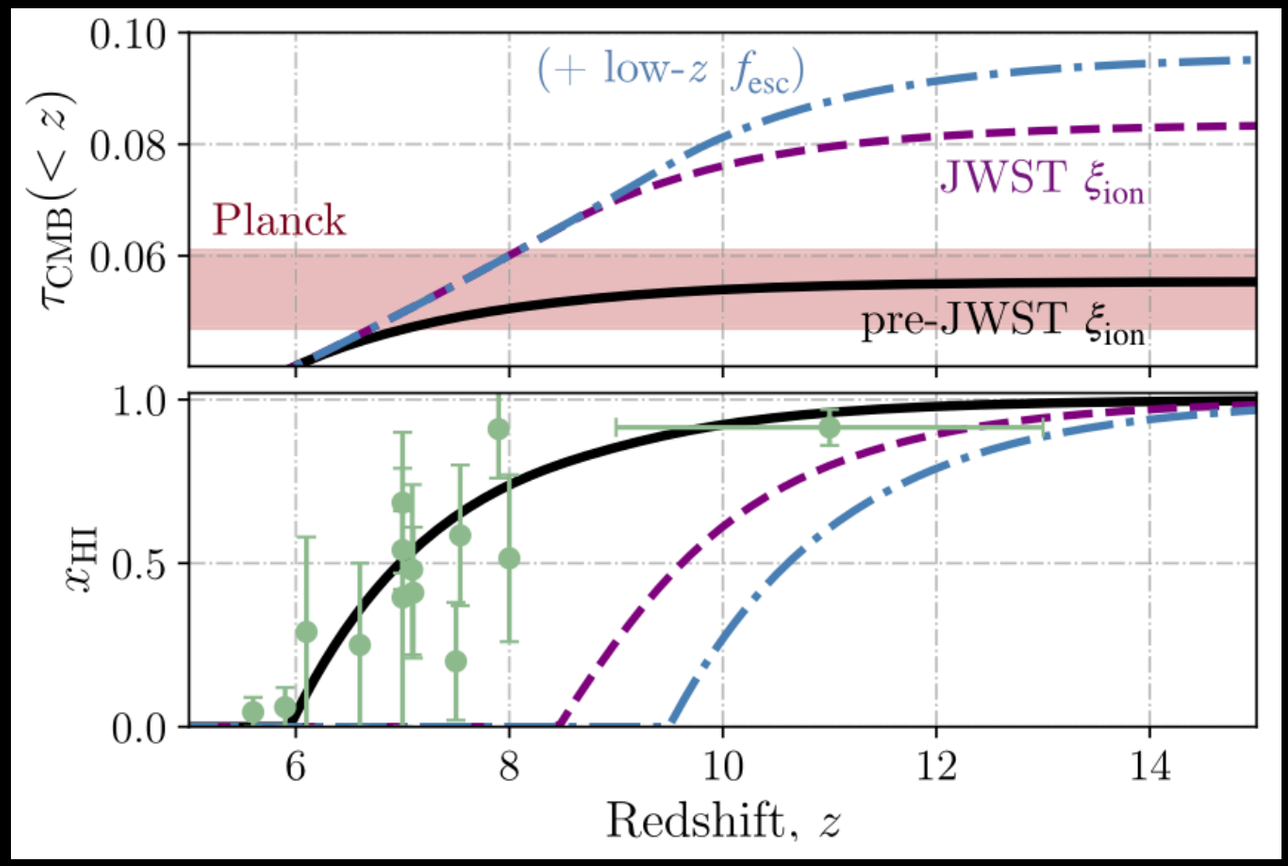


Finkelstein+19

LyC photon Inflation: high ξ_{ion}

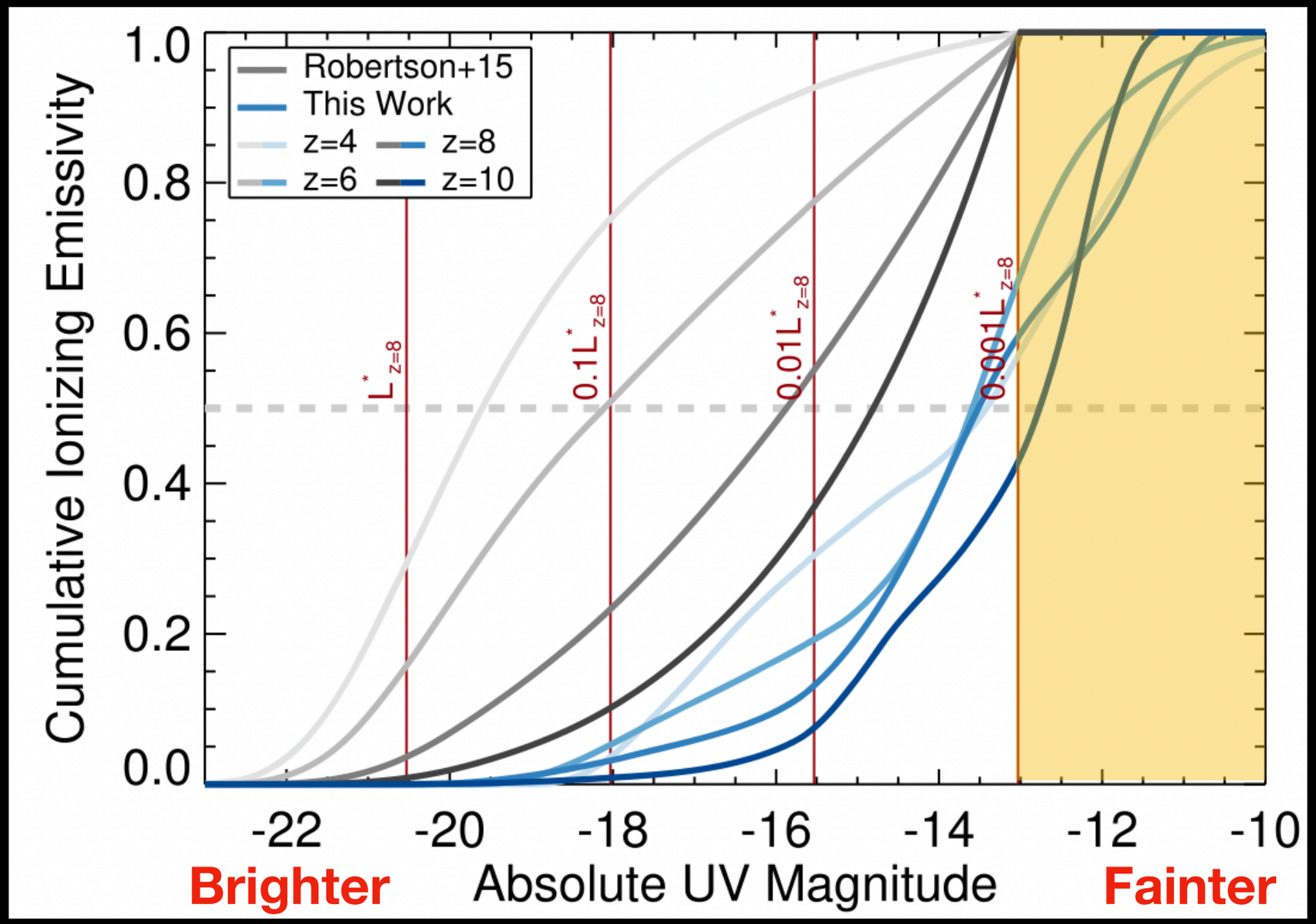


Atek+24



Muñoz+24

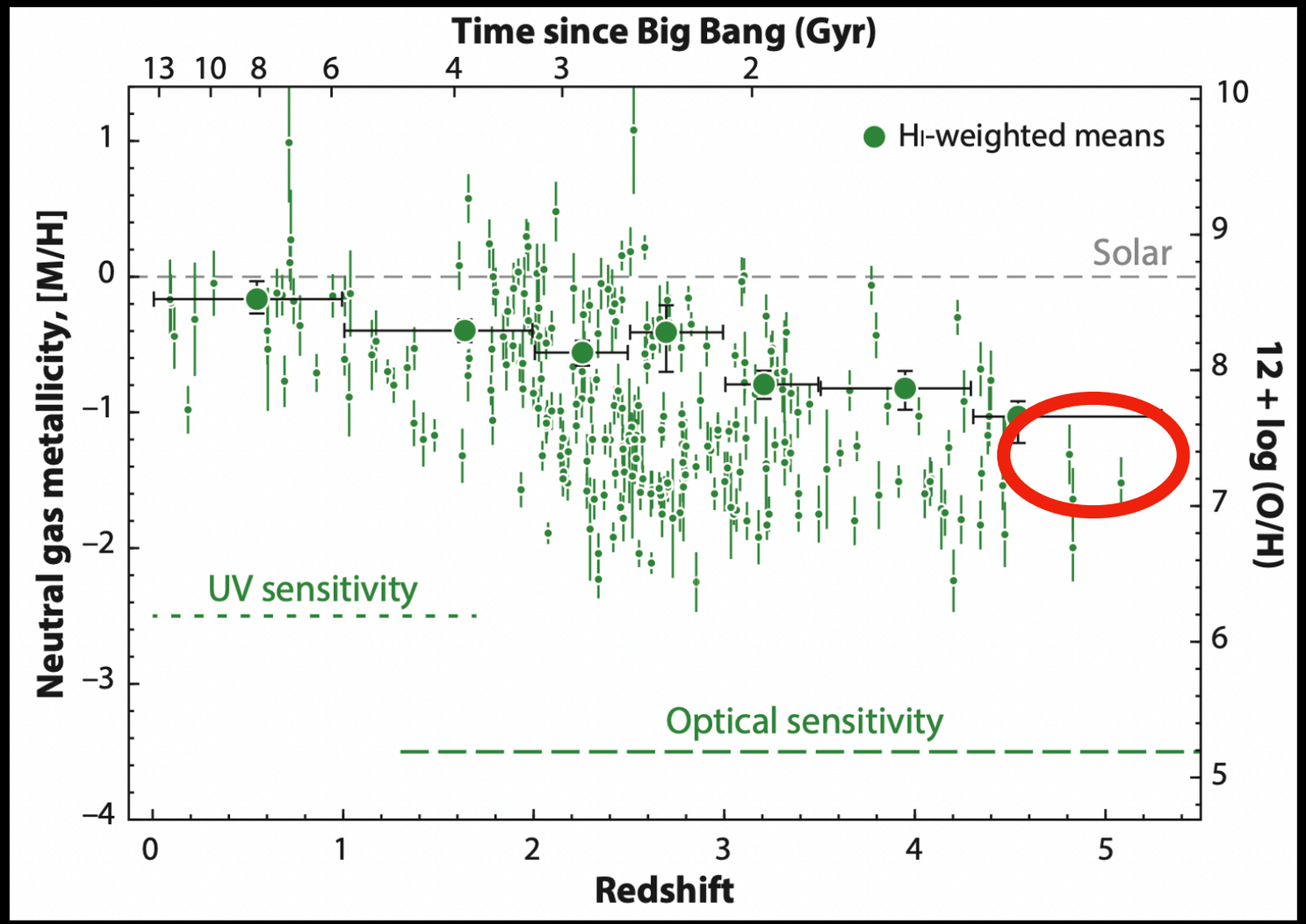
Studying galaxies at Muv=-10~-13 is crucial



Finkelstein+19

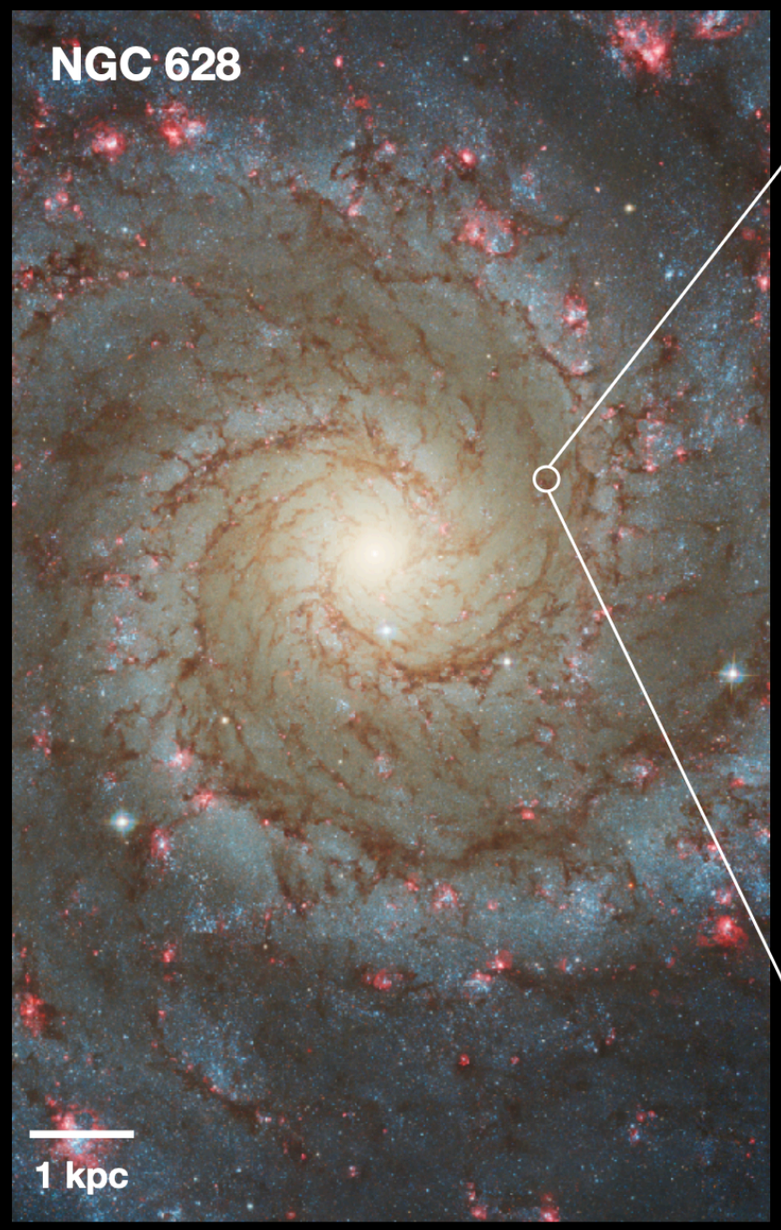
Local analogs of UV-faint galaxies in the early Universe

- Focus on the low-metallicity regime.
- Connect the small-scale processes to galactic-scale properties.
- No uncertainty due to lower-z interlopers and complex IGM transmission.

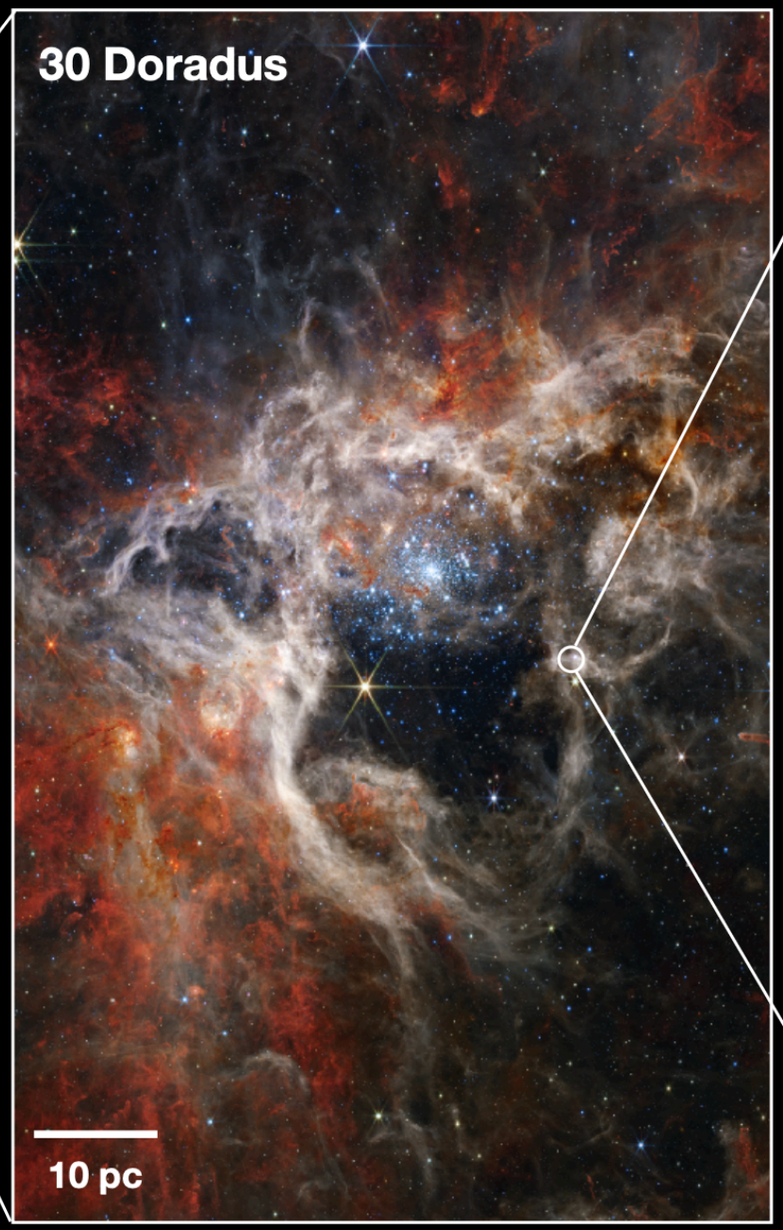


Péroux & How (2020)

Stars interact with the ISM at sub-pc scales



Meidt+2023

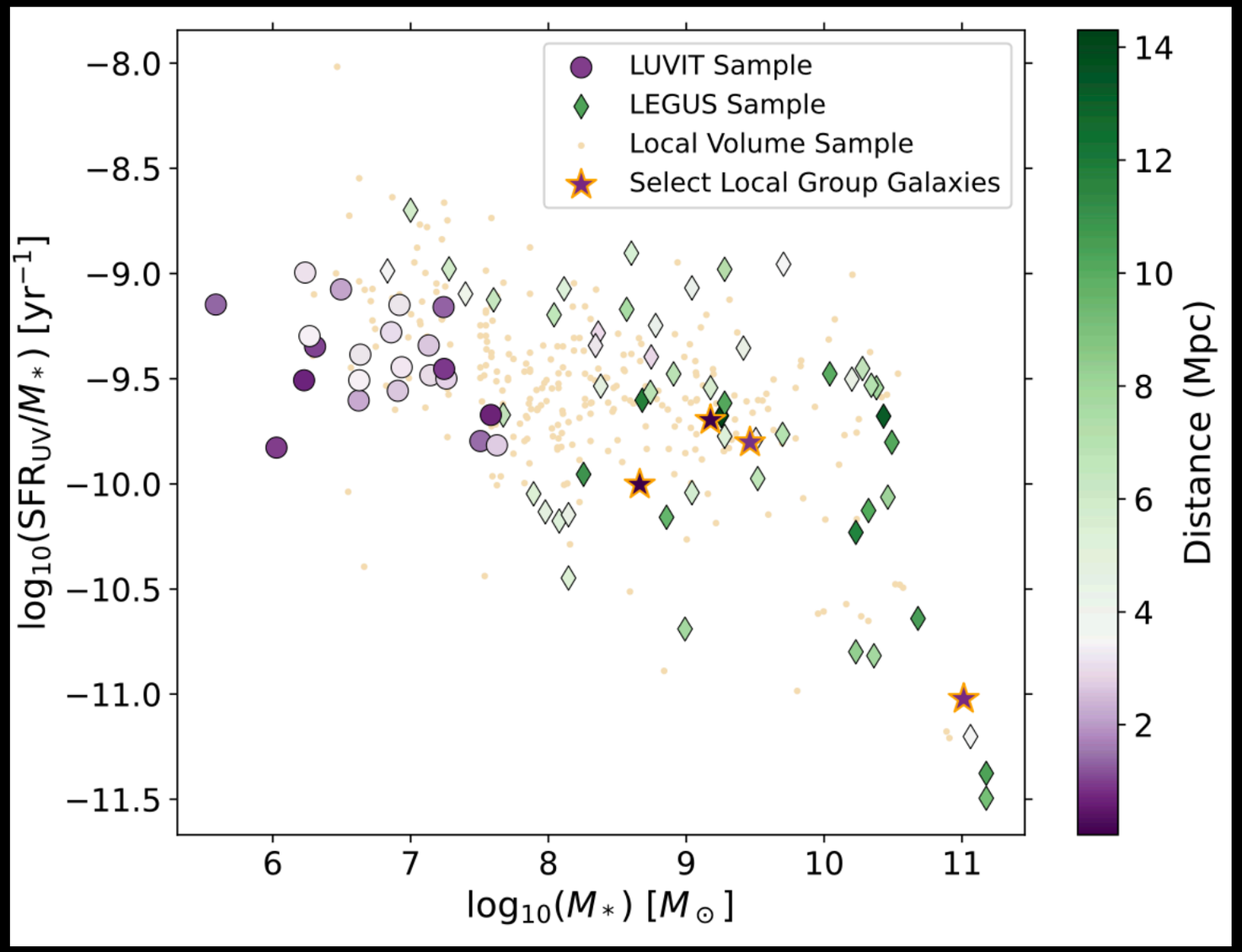


Fahrion+2024

NASA Heritage Team

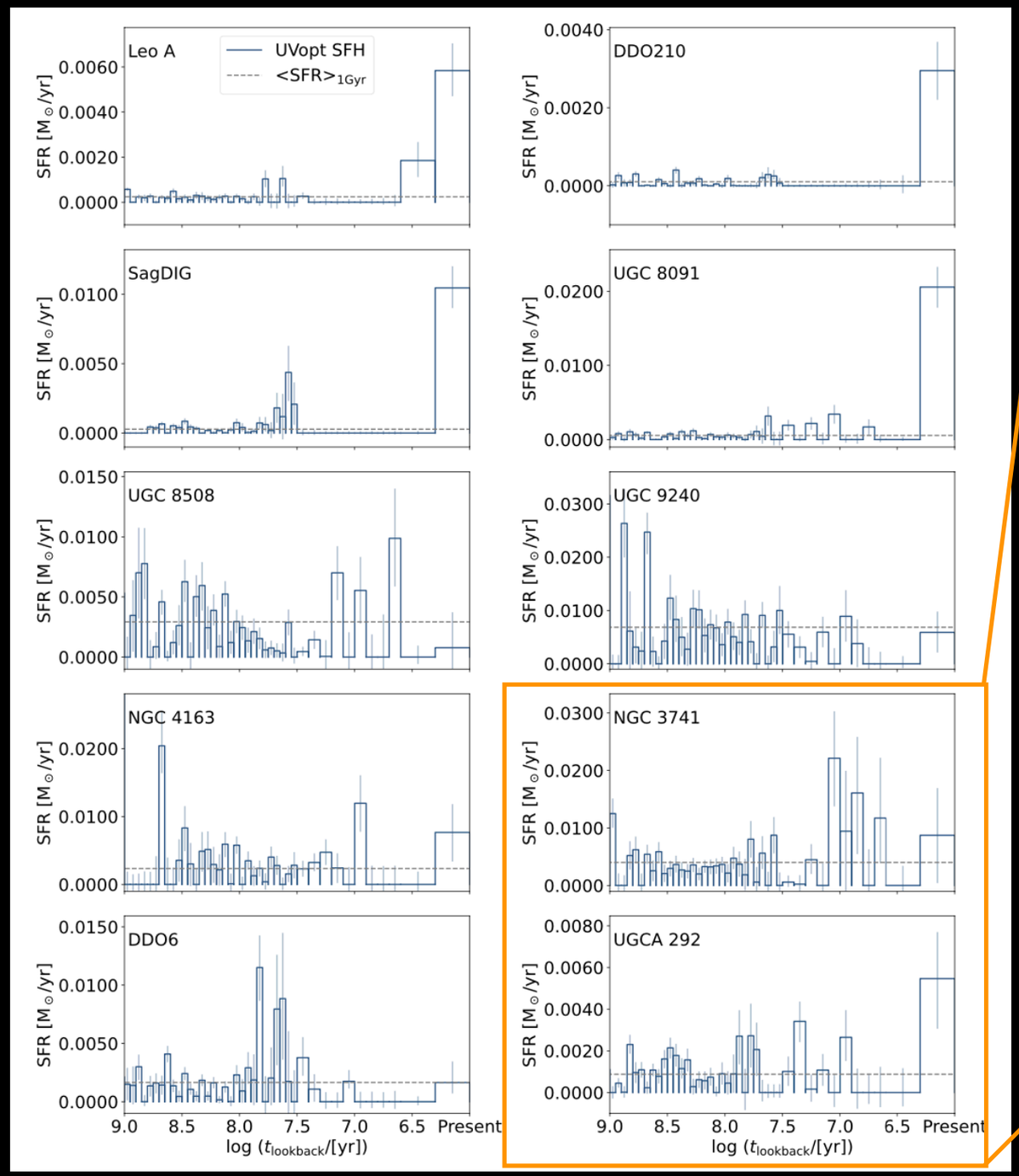
The Local Ultraviolet to Infrared Treasury (LUVIT)

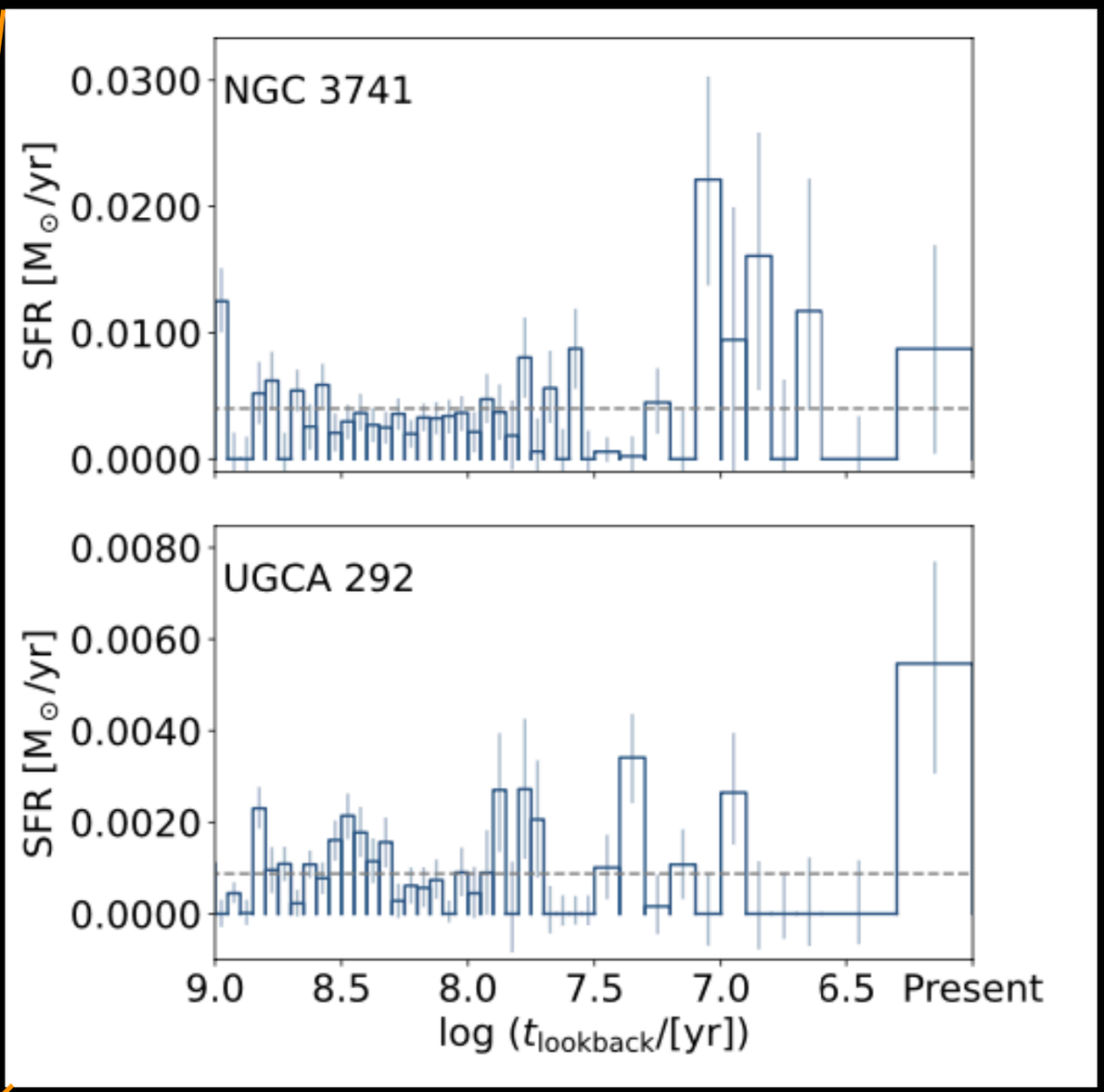
- LUVIT targets represent the lowest stellar mass, lowest metallicity star-forming galaxies in the local Universe.



Gilbert, Choi, et al. (2025)

Bursty Nature of Dwarf Galaxies





Choi+2025

UGC 8091 at ~2.2 Mpc

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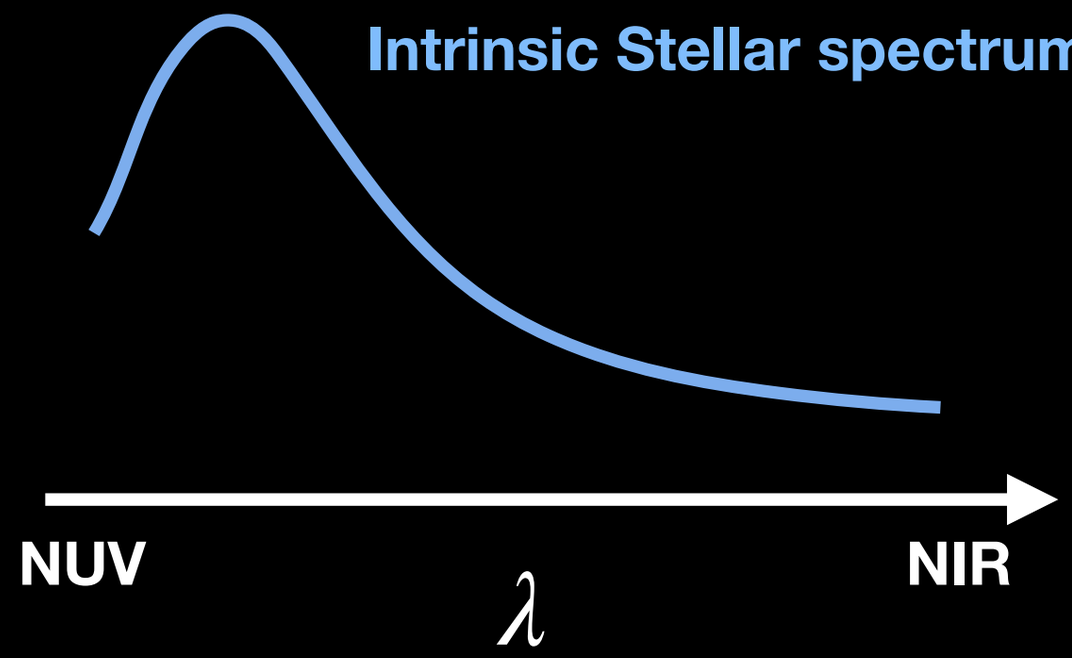
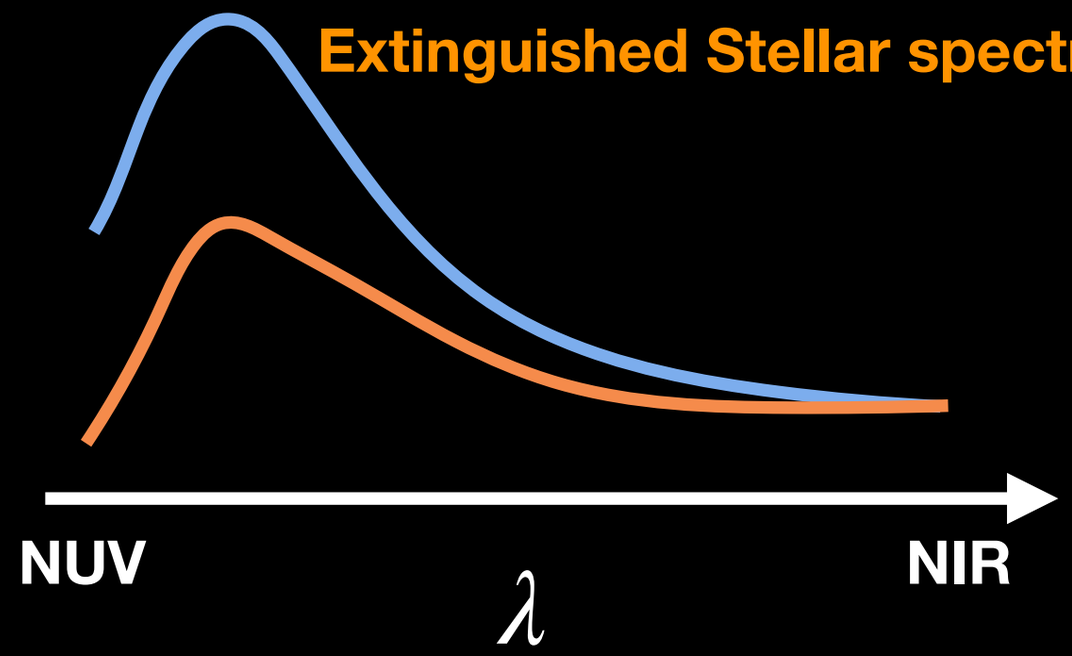
Characterizing Individual Stars



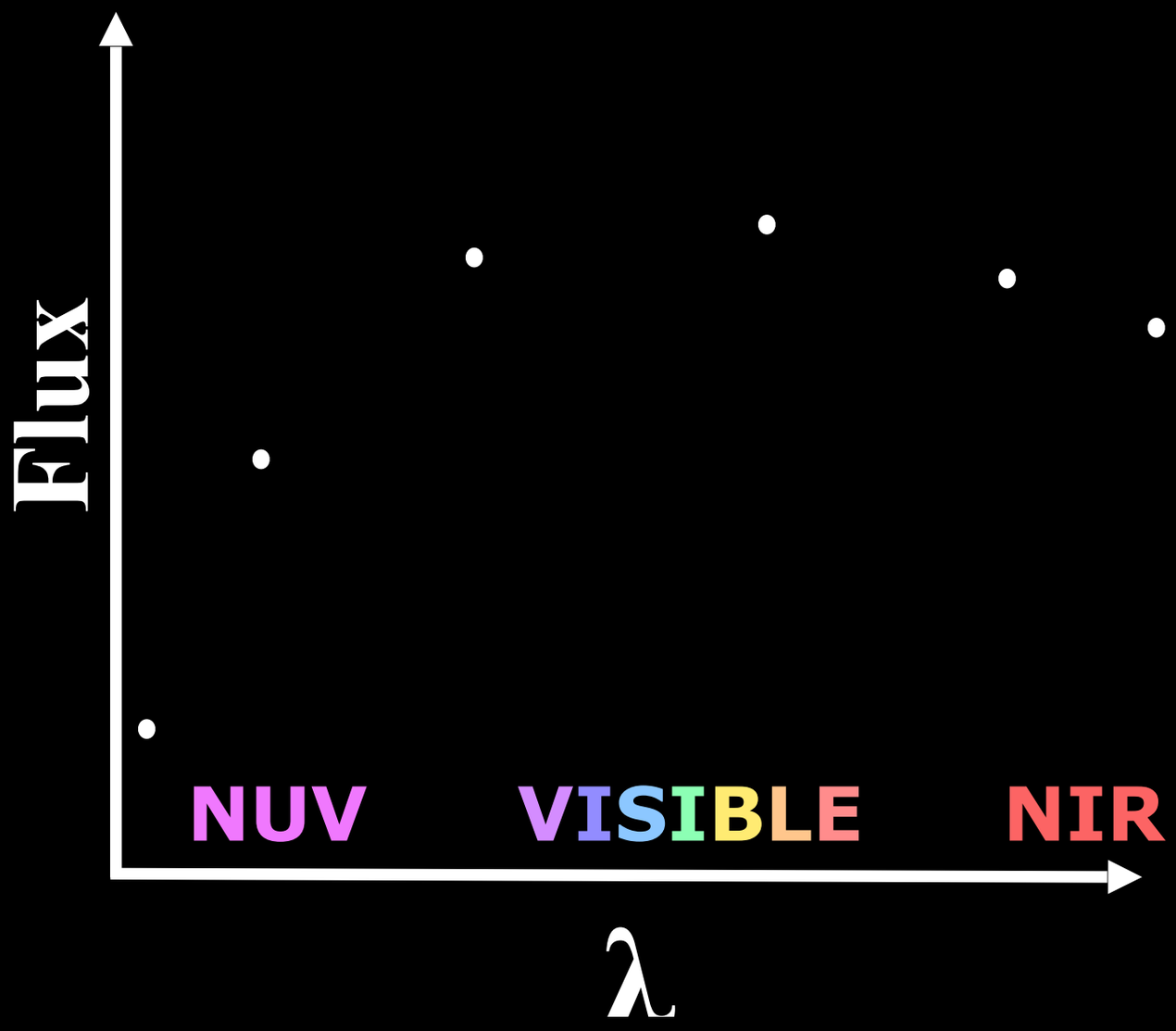
Credit: Christina Lindberg

Characterizing Individual Stars



Credit: Christina Lindberg

The Brief Overview of the Bayesian Extinction and Stellar Tool (BEAST; Gordon+16)



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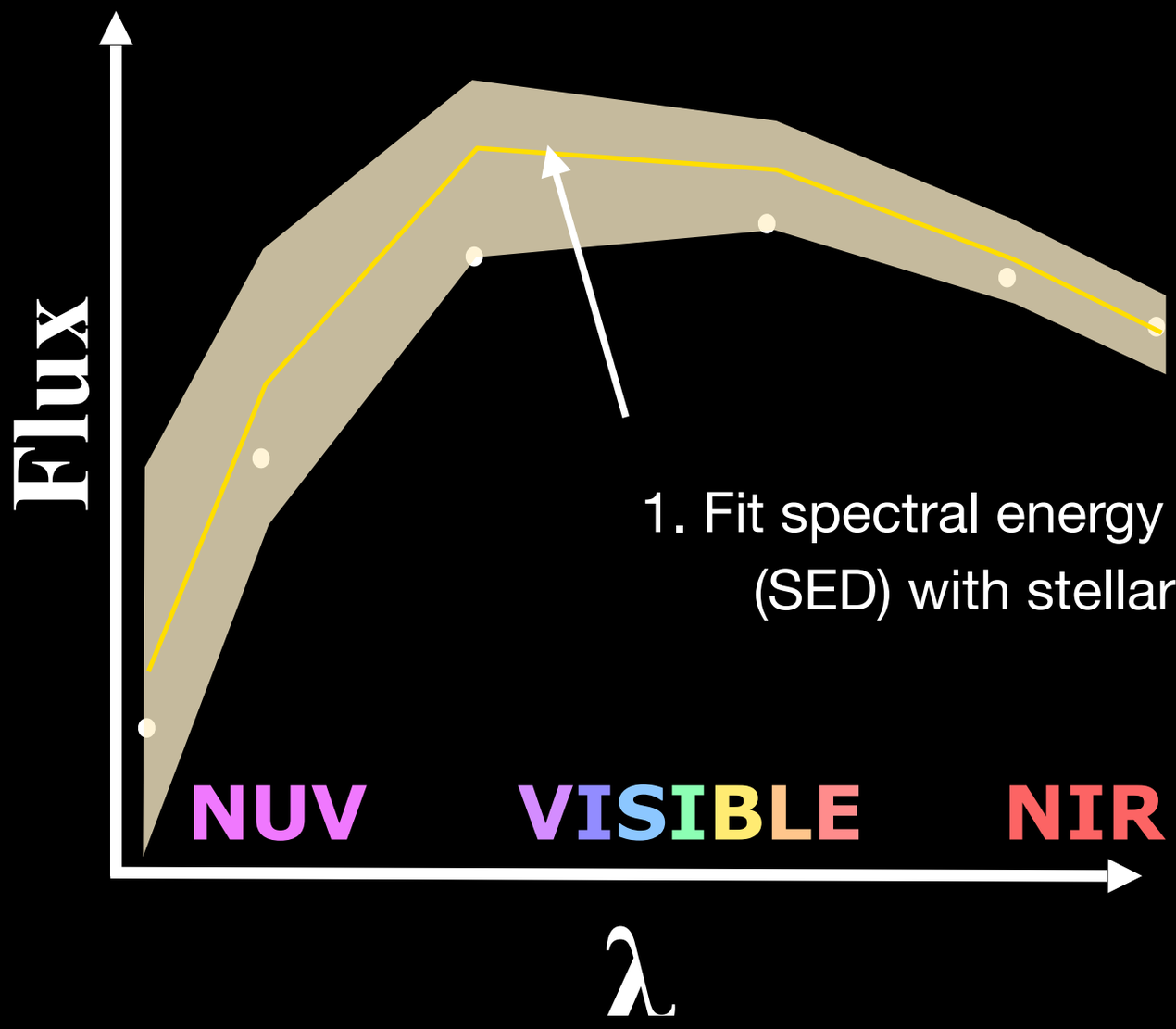

STELLAR MODEL
[initial mass, age, Z]

1. Fit spectral energy distribution (SED) with stellar model

Credit: Christina Lindberg

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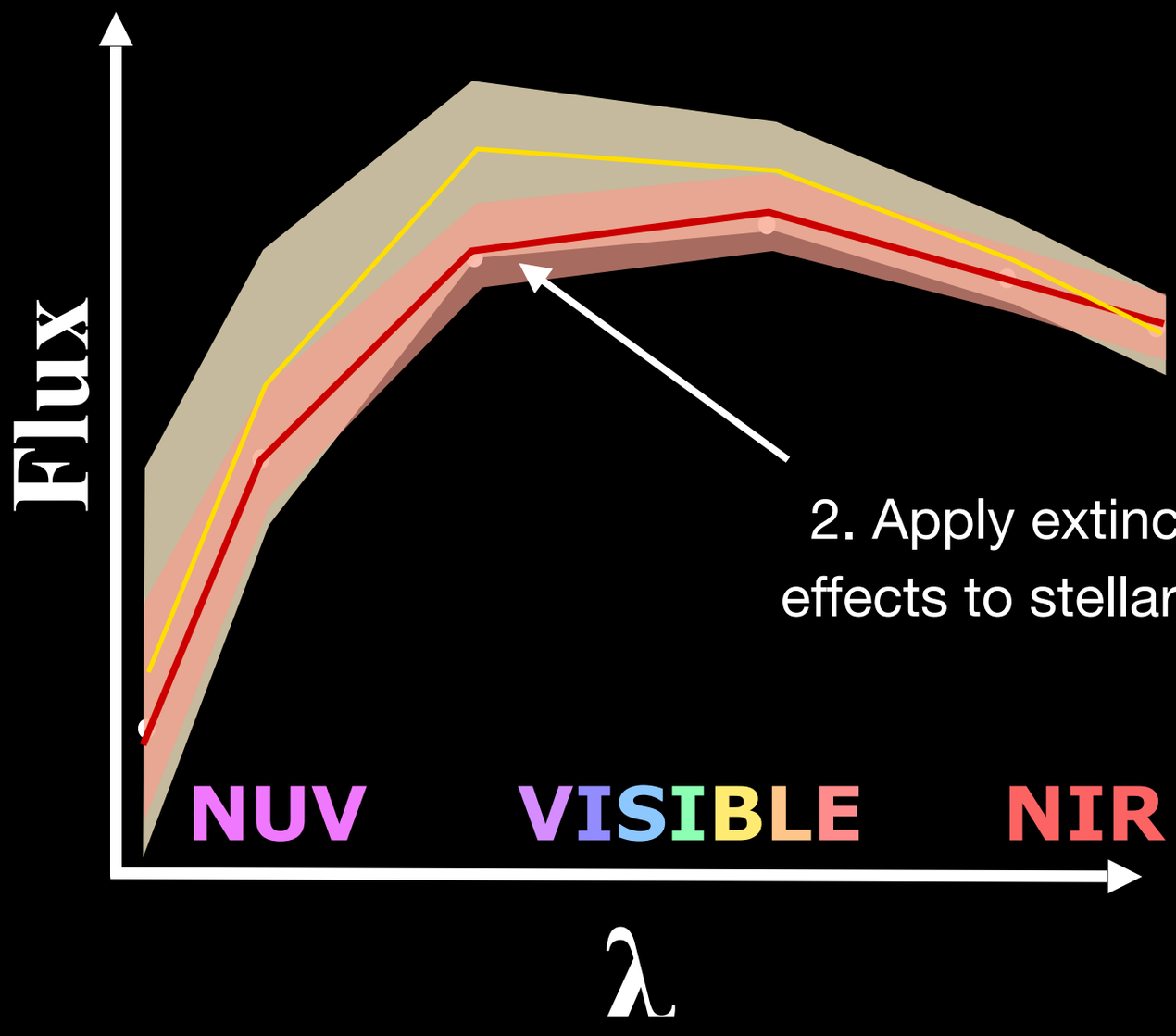

STELLAR MODEL
[initial mass, age, Z]
+
DUST MODEL
[A_V, R_V, bump strength]

Credit: Christina Lindberg

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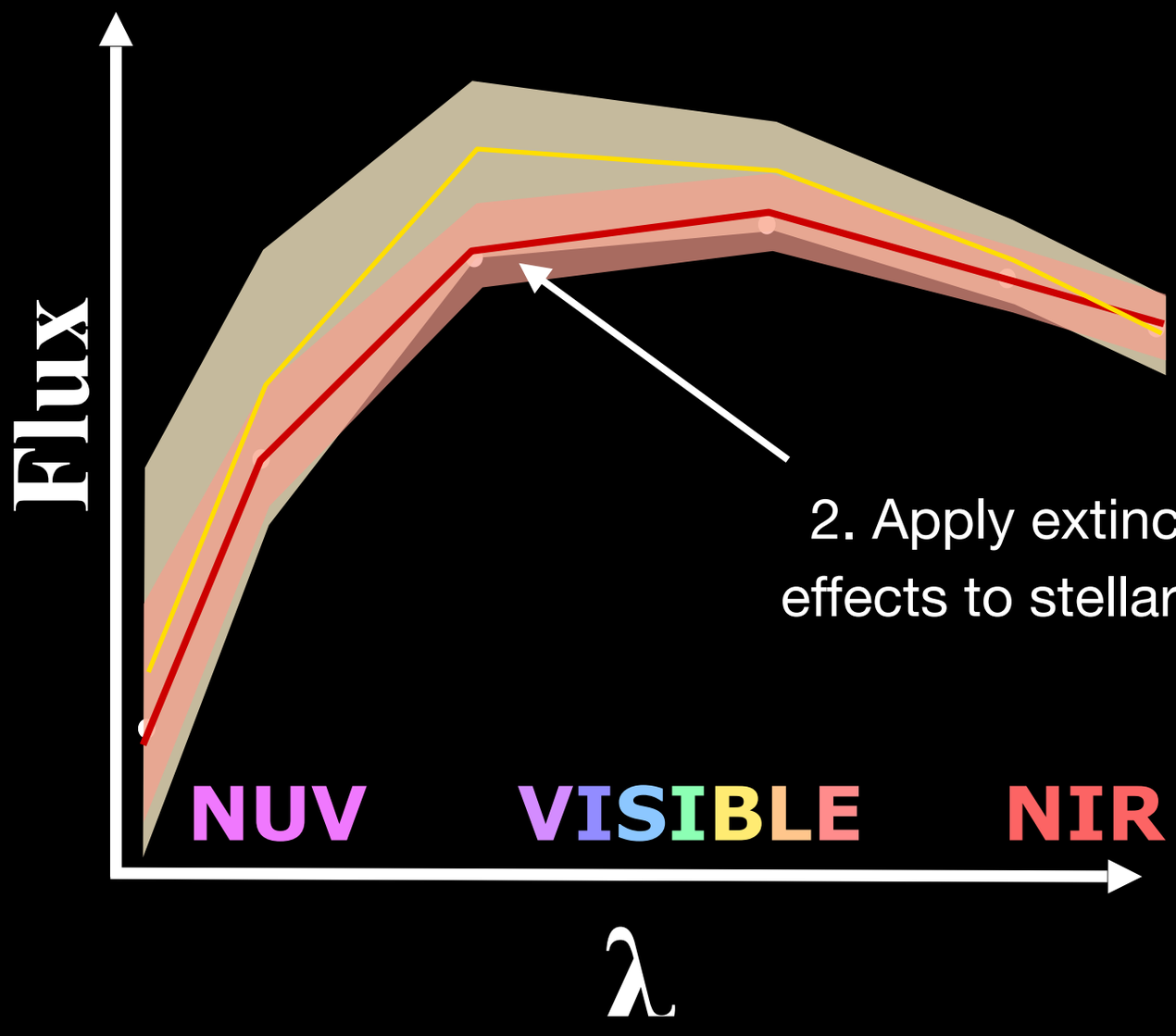

Priors

STELLAR MODEL
[initial mass, age, Z]
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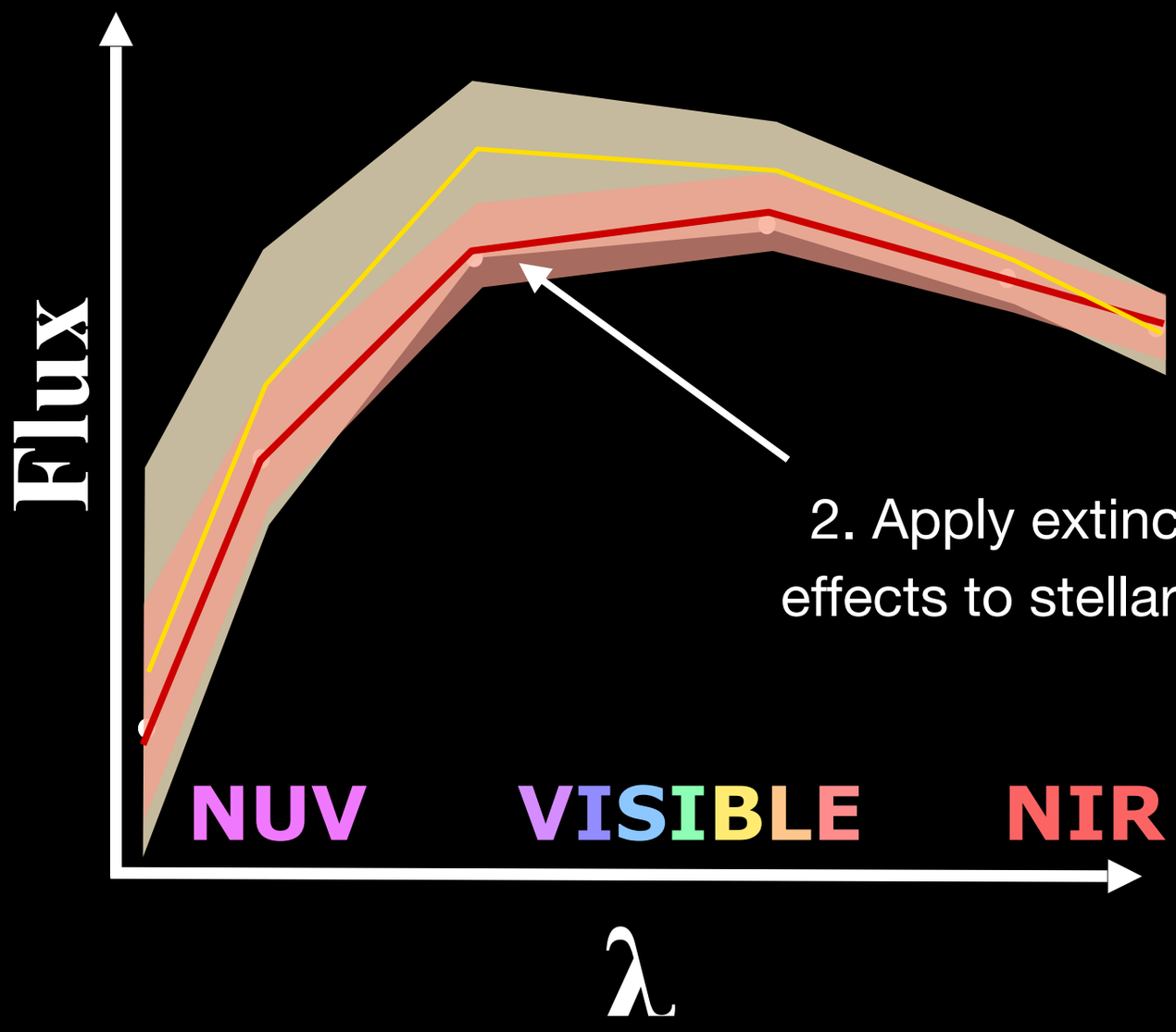
Credit: Christina Lindberg

The Brief Overview of the Bayesian Extinction and Stellar Tool (BEAST; Gordon+16)



Priors

STELLAR MODEL
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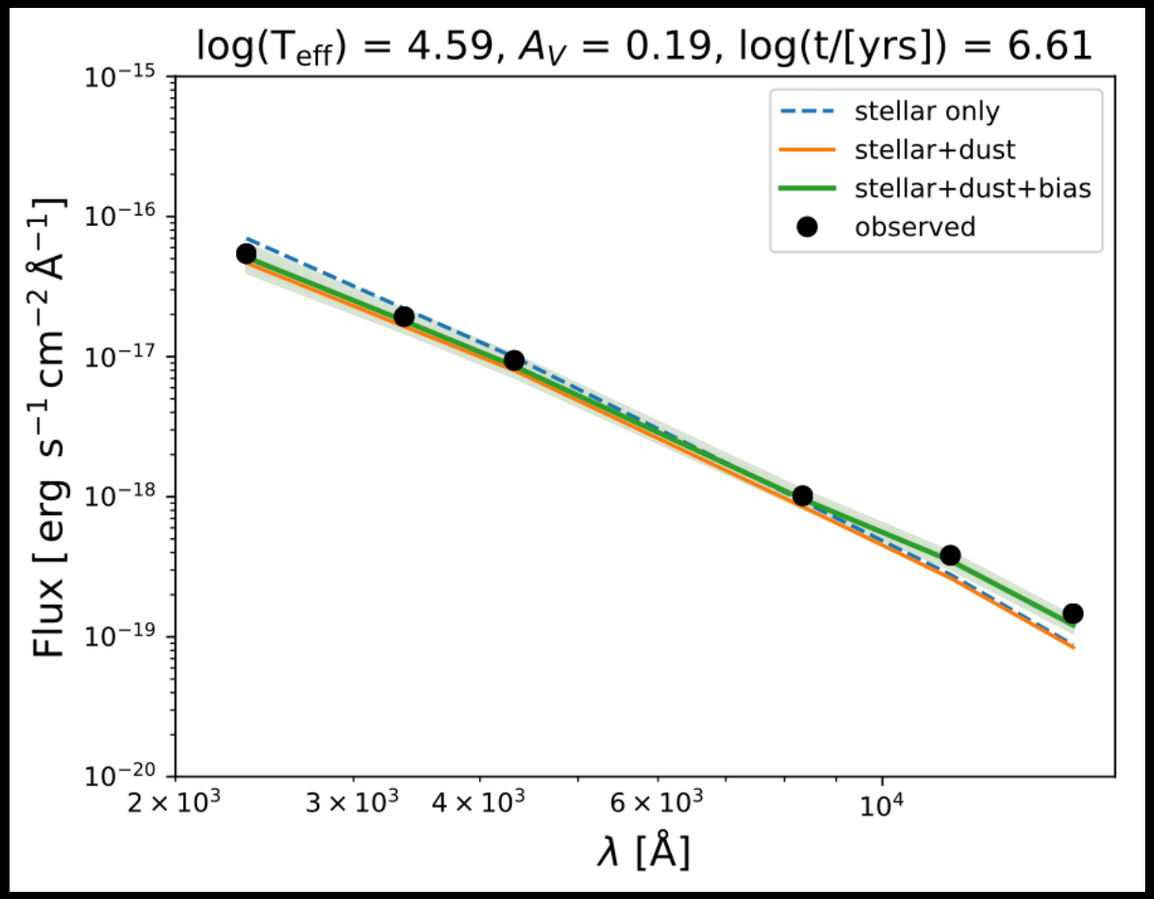
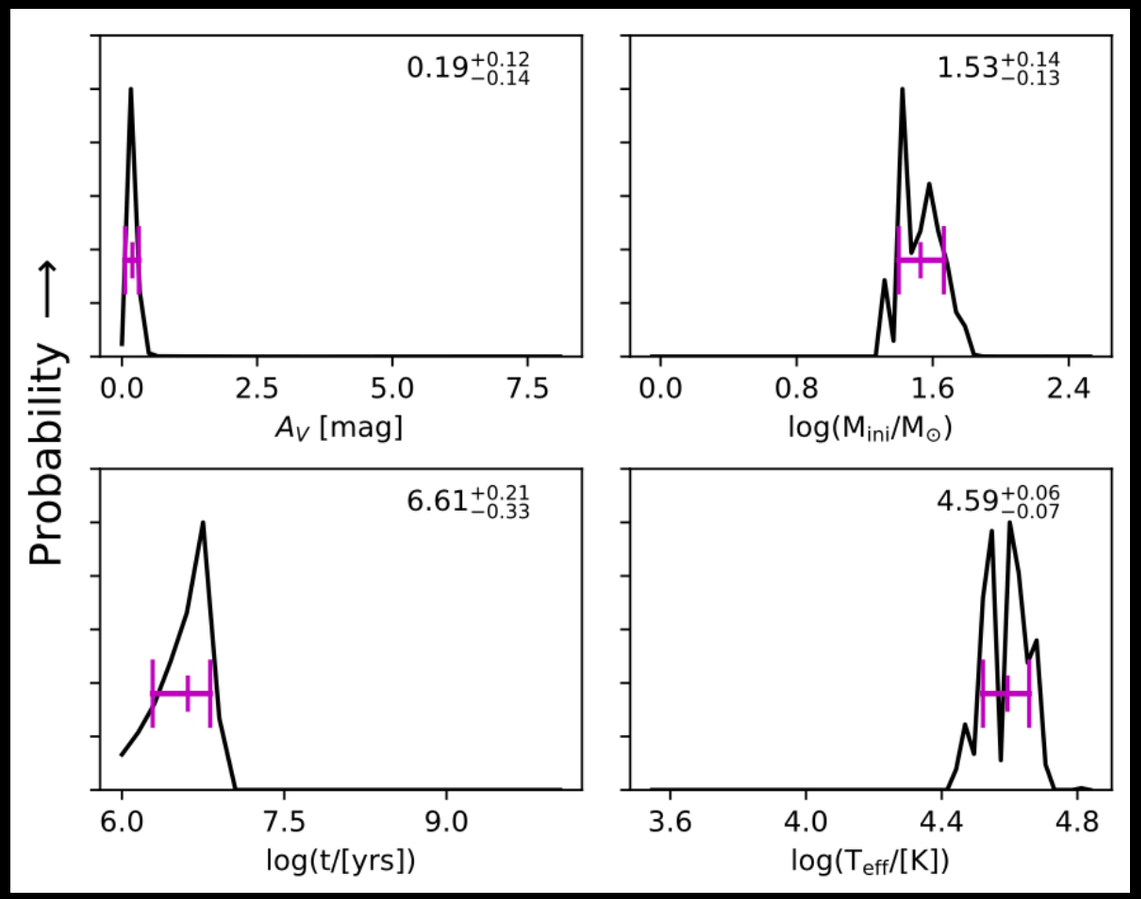
Marginalize 6D posterior to get 1D posteriors for each model parameter

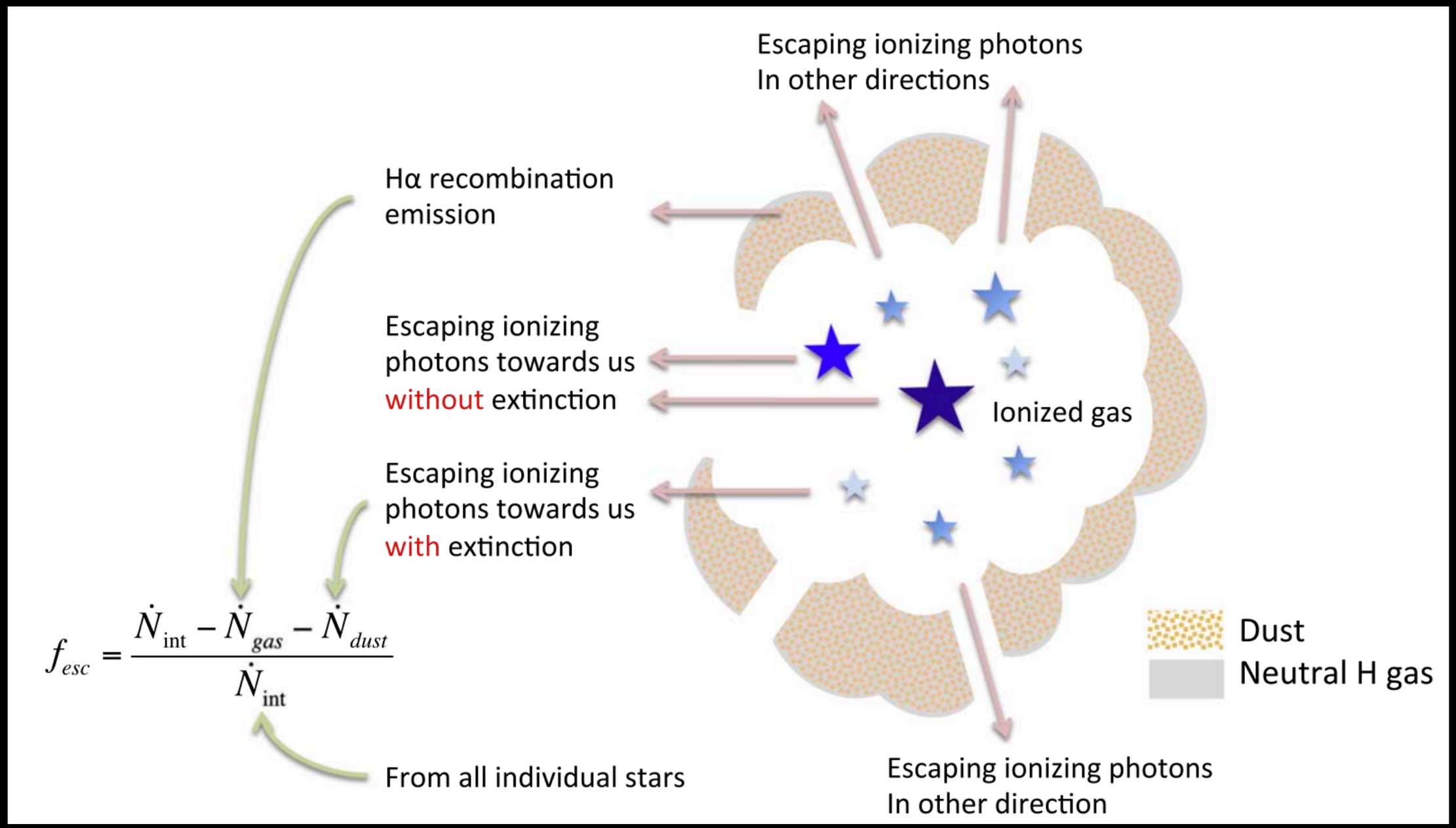
Example BEAST SED Fit





Choi+20

Measuring f_{esc} using individual stars in a galaxy



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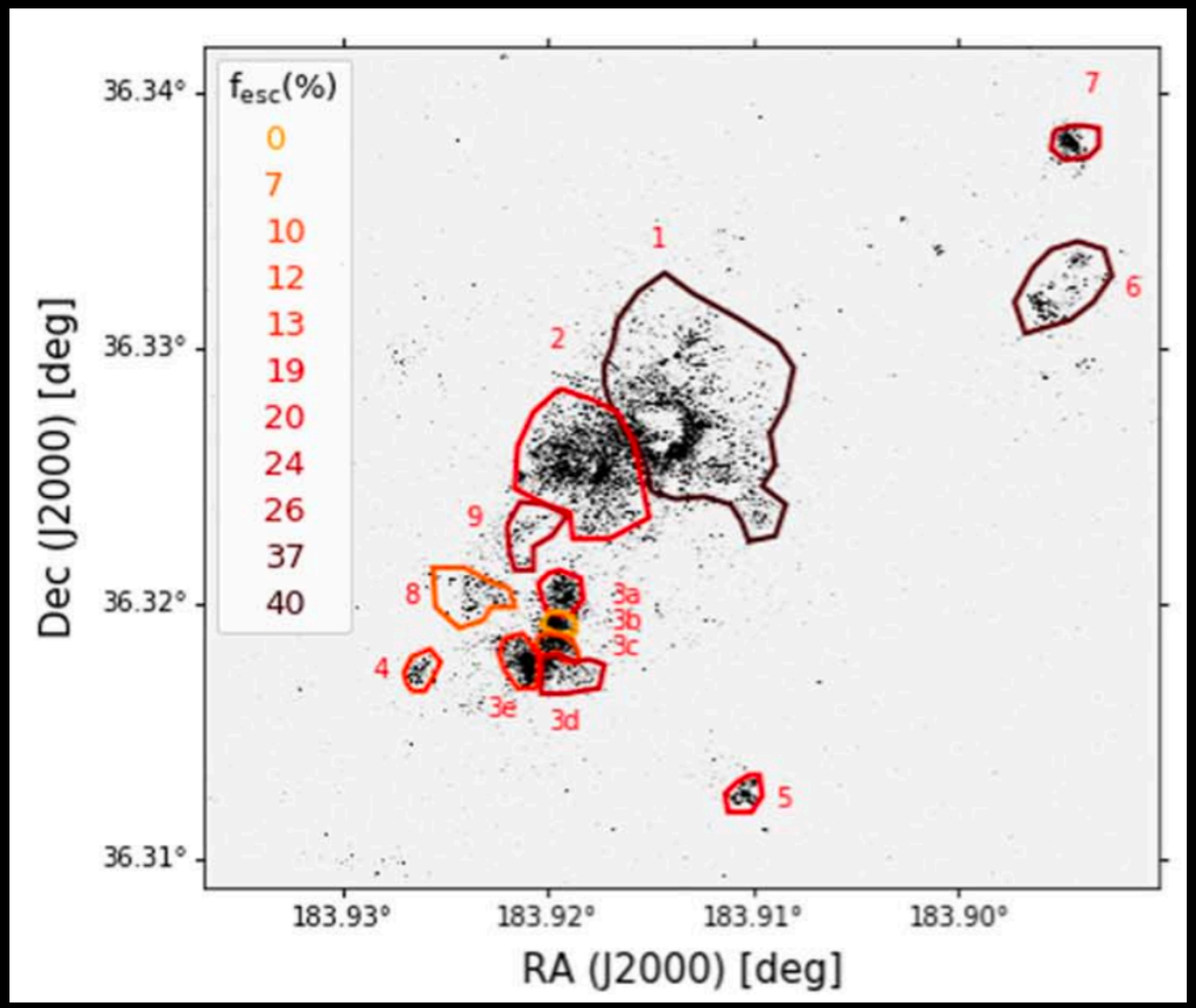
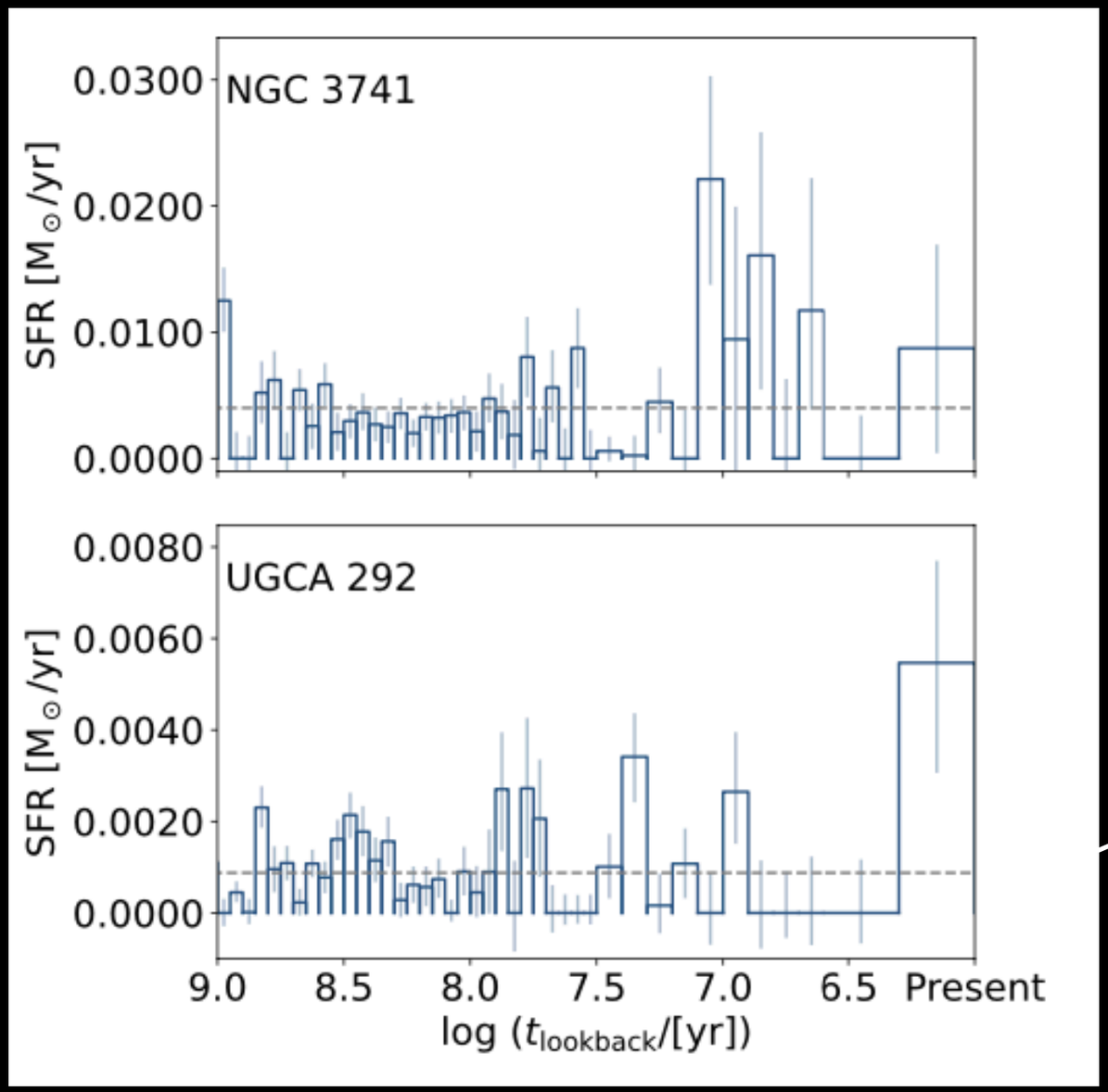


Choi+20

- NGC 4214 has M_{UV} = -15.9.
- Spatial variation in f_{esc} (0-40%).
- The global $f_{esc} \simeq 25\,\%$, suggesting that it releases ~10e52 ionizing photons/sec to the surrounding IGM.

Measuring ξ_{ion} directly from resolved stellar populations!

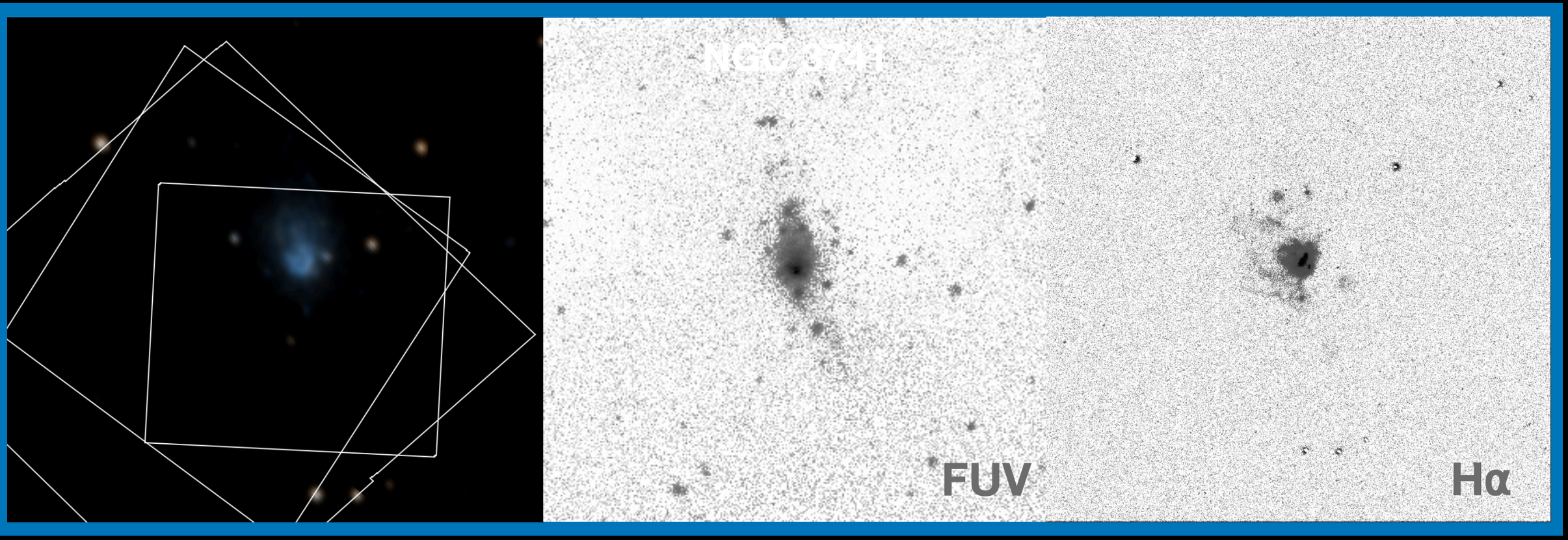


SED fits

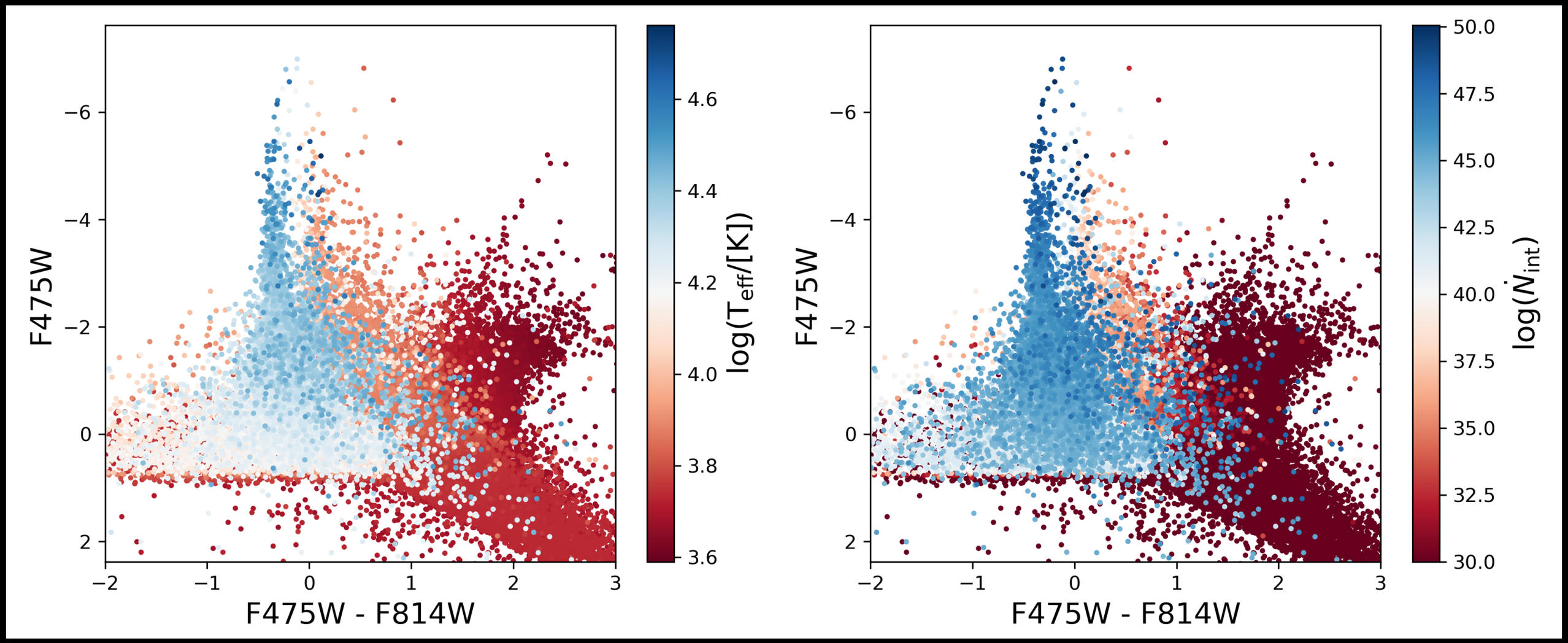
$$\xi_{ion} = \frac{Q(H^0)}{L_{UV}}$$

NGC 3741 with M_{UV} = -12.4

- $M_\star$ = 3.7e7 $M_\odot$
- 12 + log(O/H) = 7.68



Preliminary results for NGC 3741



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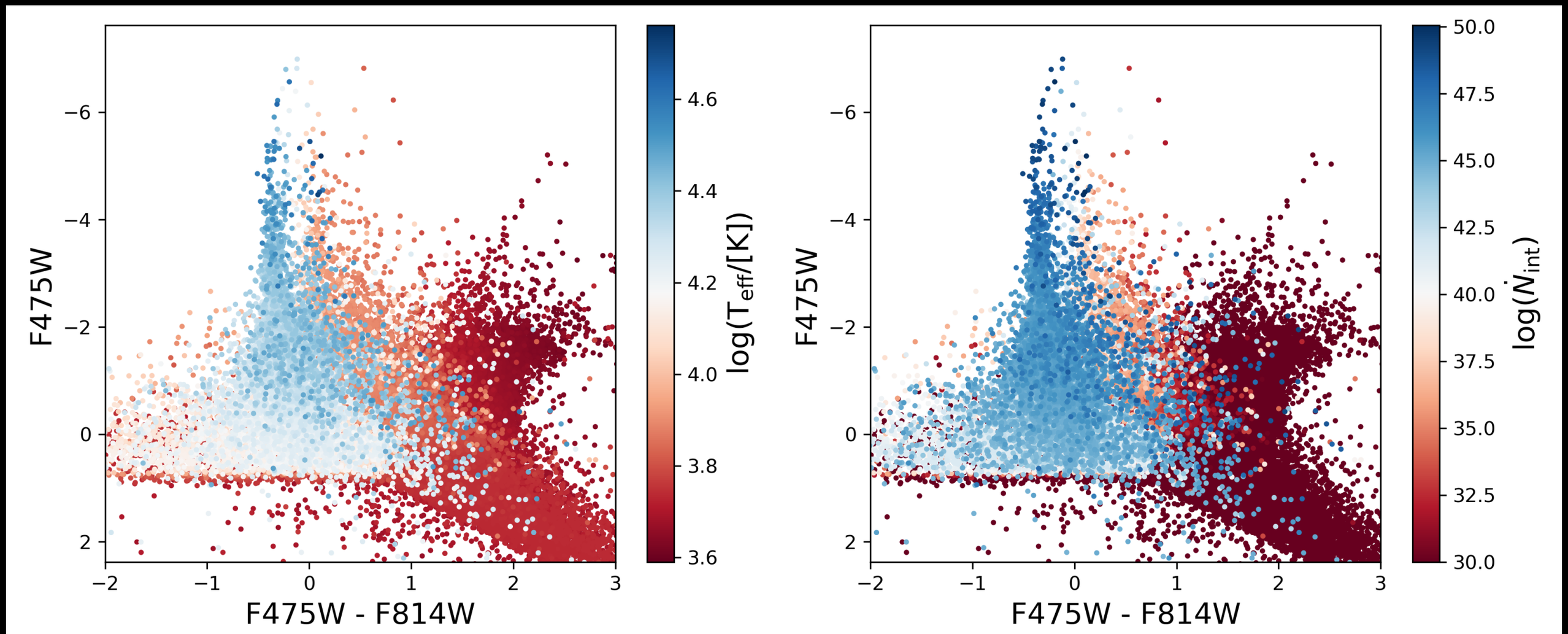
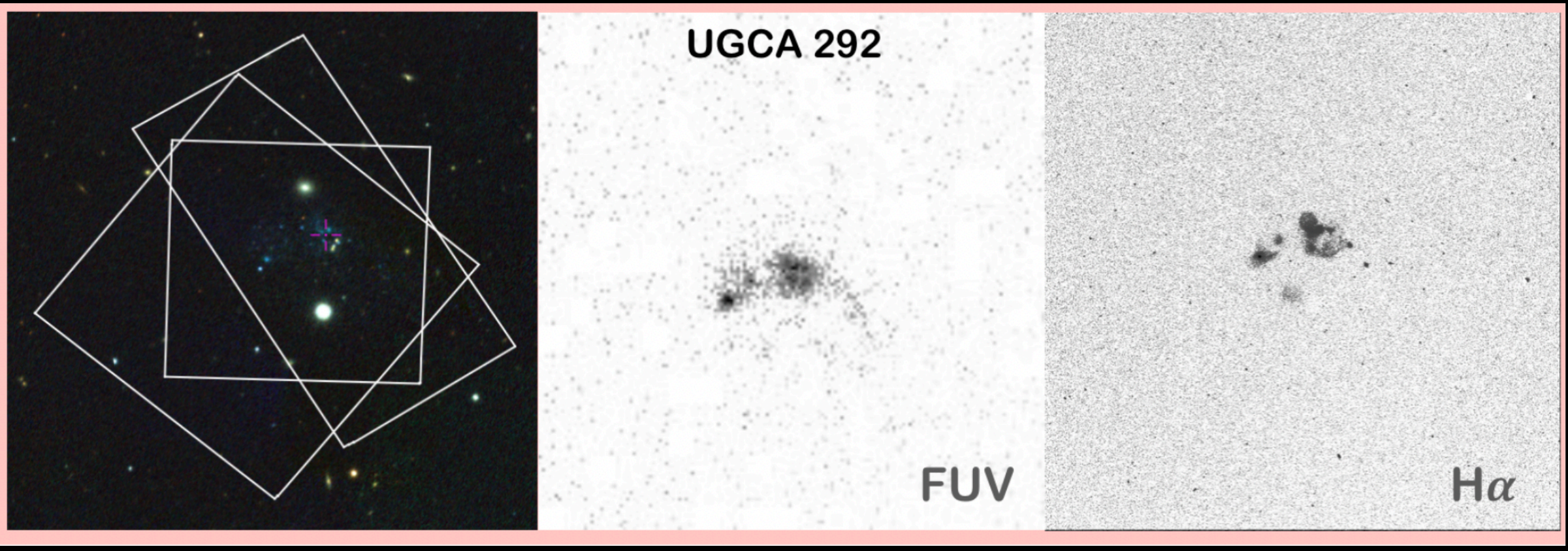


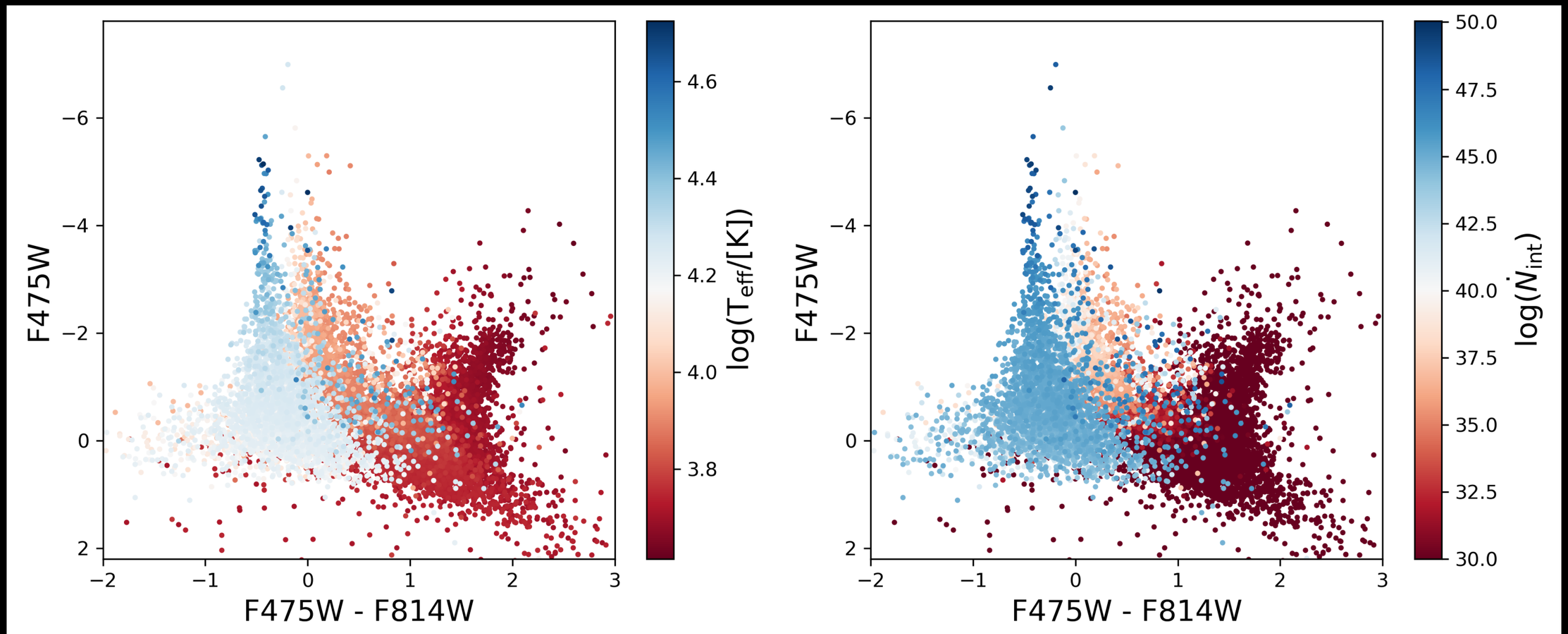
- $\dot{N}_{ion} \simeq 1.9 \times 10^{51} [s^{-1}]$, $f_{esc} = 0\% - 80\,\%$, $\xi_{ion} = 25.39$

UGCA 292 with M_{uv} = -11.7

- $M_\star$ = 5e6 $M_\odot$
- 12 + log(O/H) = 7.32

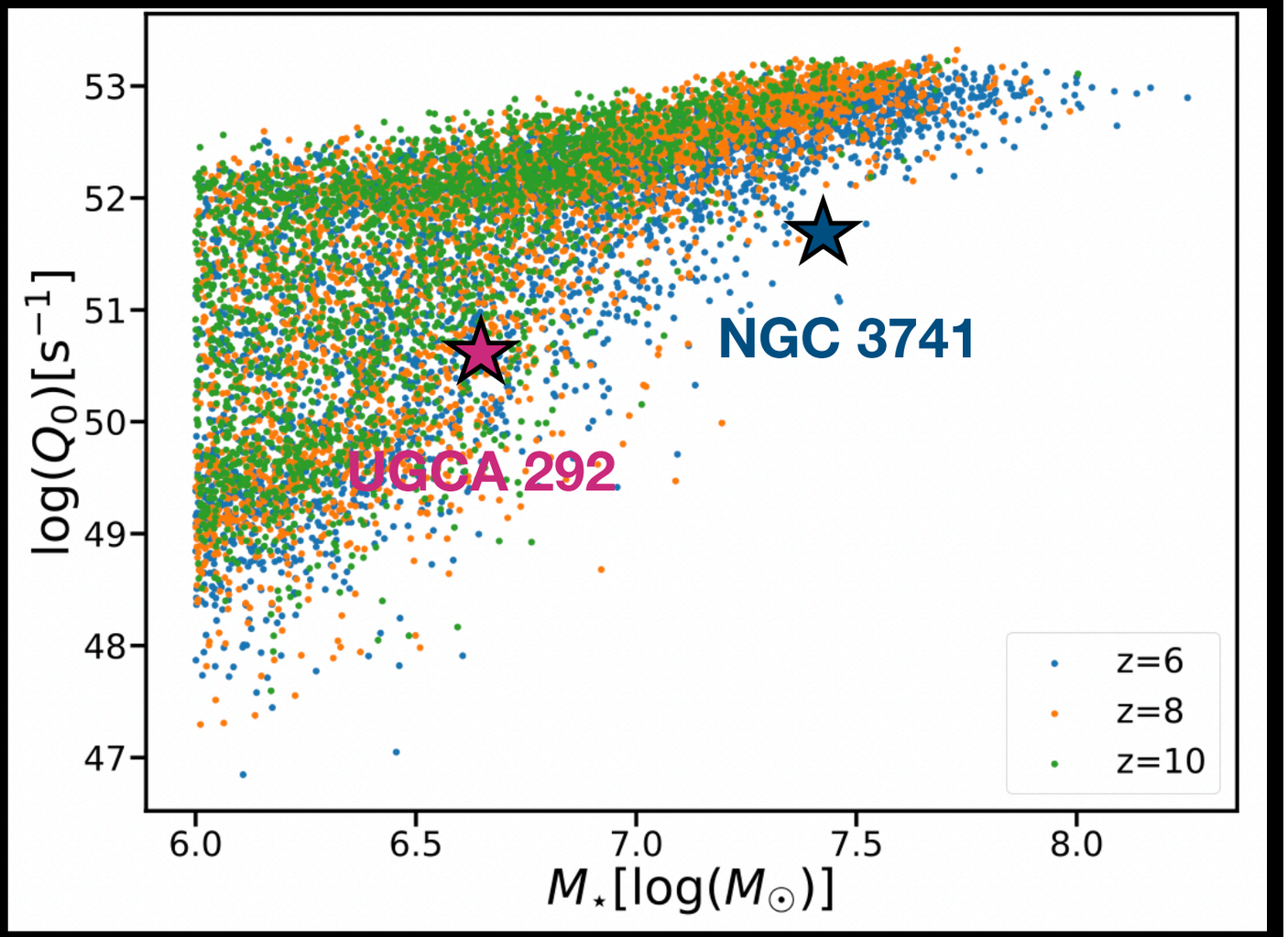


Preliminary results for UGCA 292

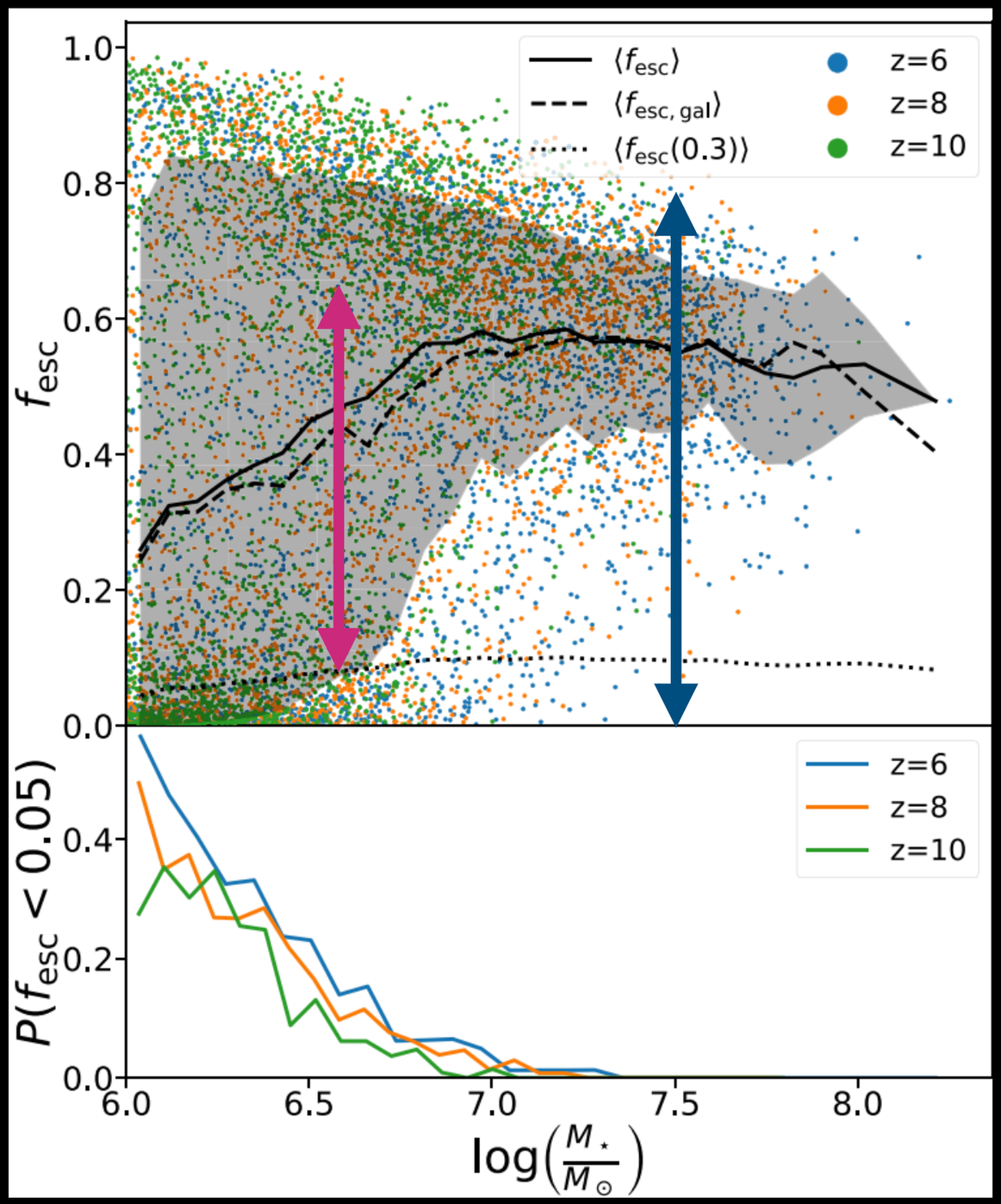


$$\dot{N}_{ion} \simeq 4.4 \times 10^{50} [s^{-1}],\ f_{esc} = 6\% - 63\,\%\,,\ \xi_{ion} = 25.00$$

Comparison with theoretical models



Kostyuk+23



Thank you!