PREDICTING LUMINOSITY FUNCTION AND $[OIII]/H_\beta$ FLUX RATIO FOR THE GALAXY ISM AT HIGH-REDSHIFTS

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The University of Melbourne, Australia

In collaboration with : Prof Stuart Wyithe, Ralph Sutterland and Lisa Kewley

Beyond the age of the Universe, Sintra, 2024

ASTRO 3D

Emission line galaxies

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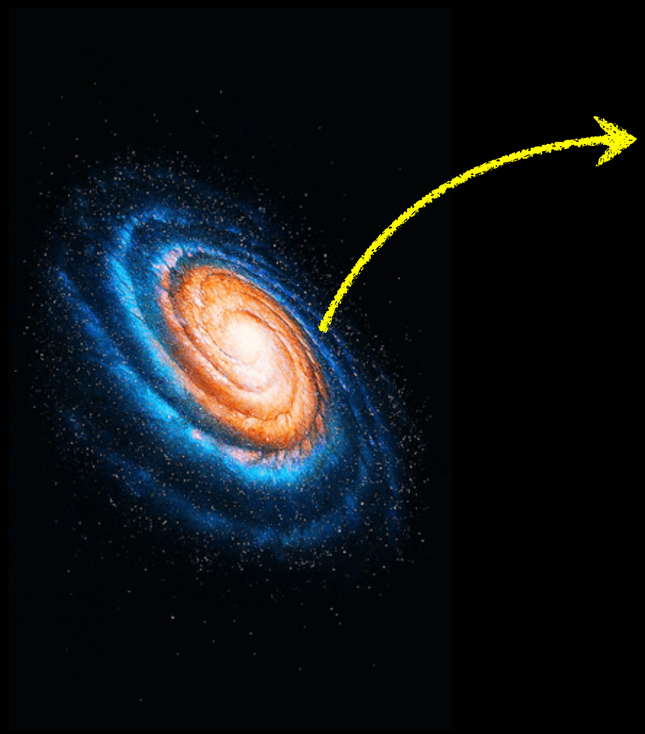

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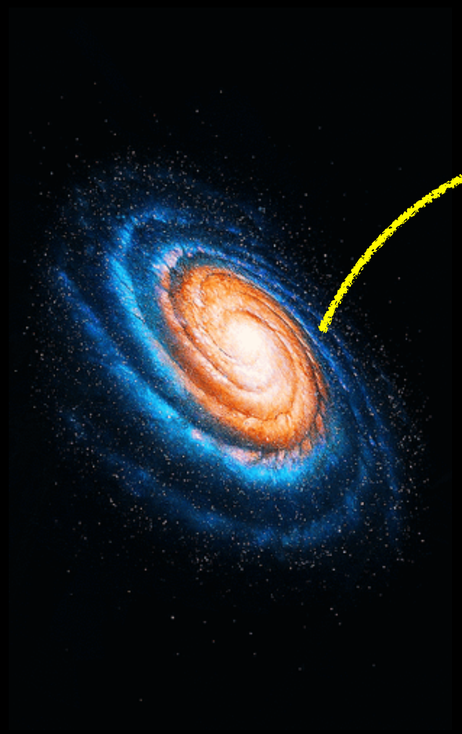

Show characteristic emission line in their spectrum.

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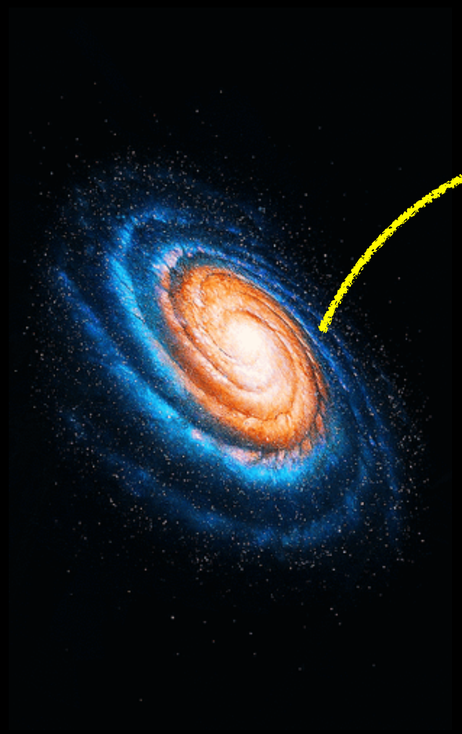

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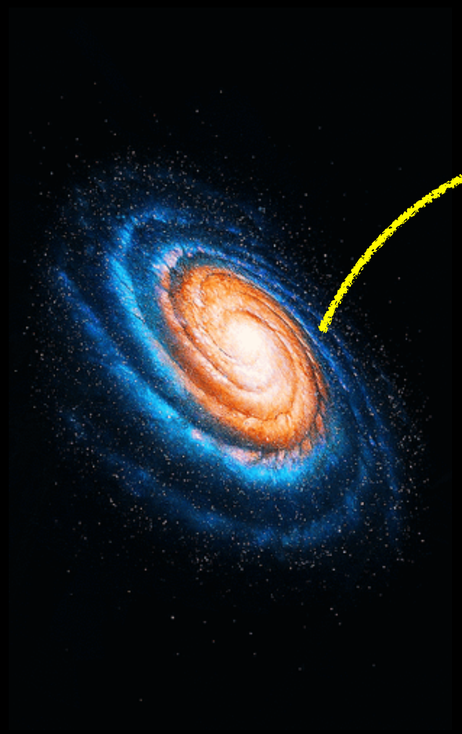

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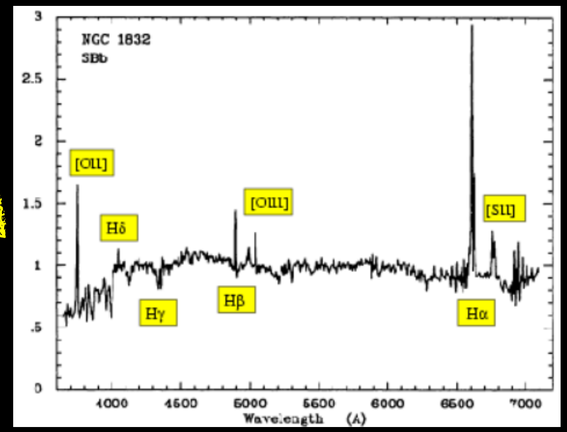

Steward Observatory, R. Kennicutt

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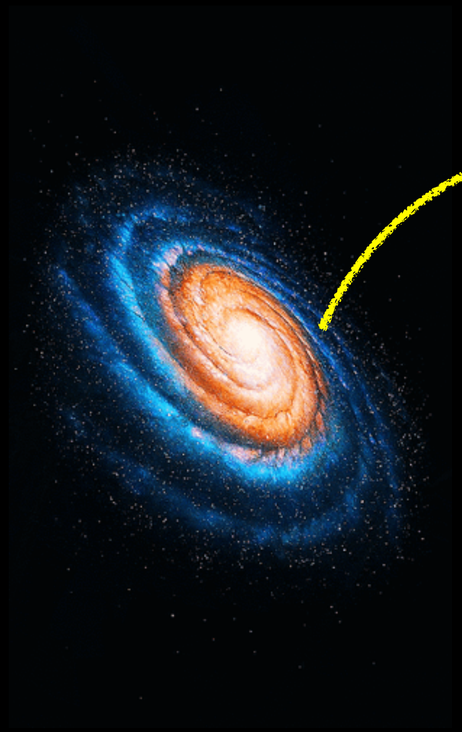

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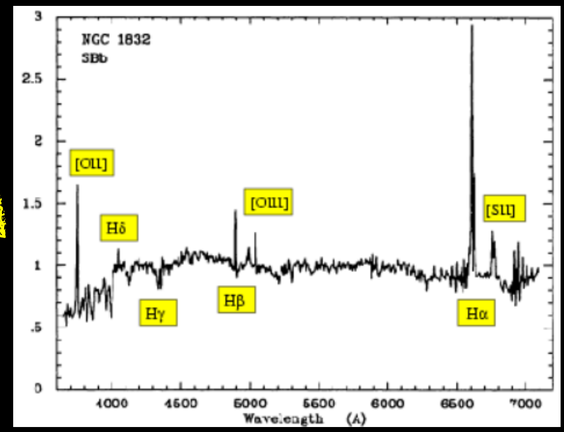

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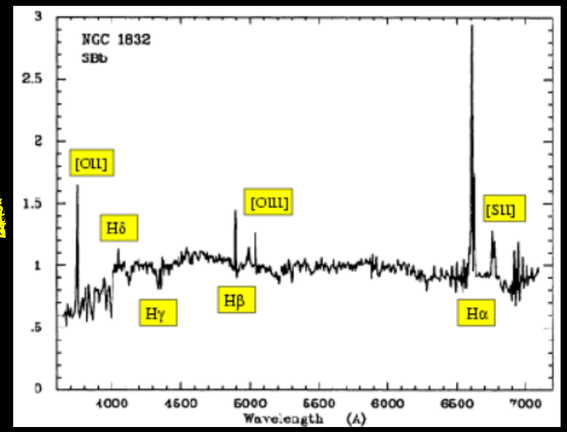

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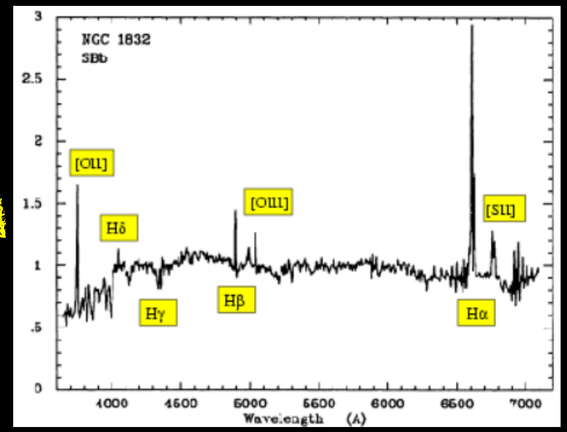

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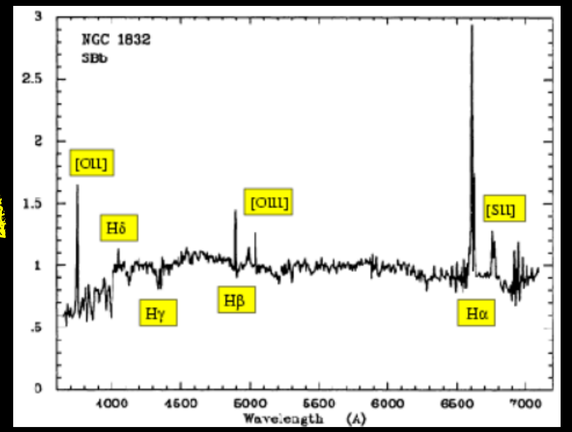

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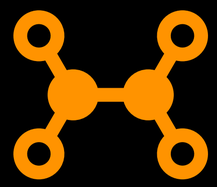

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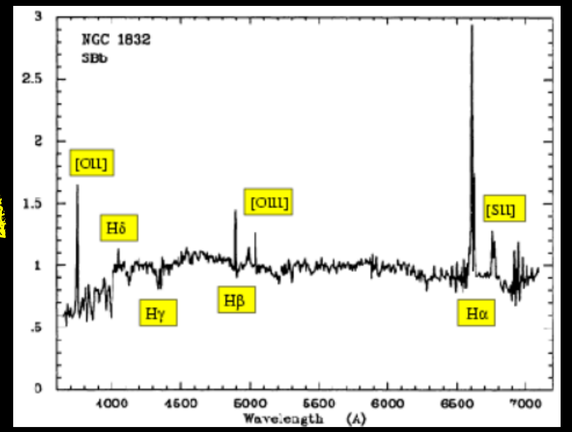

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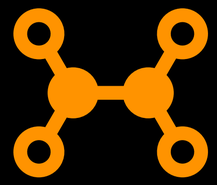

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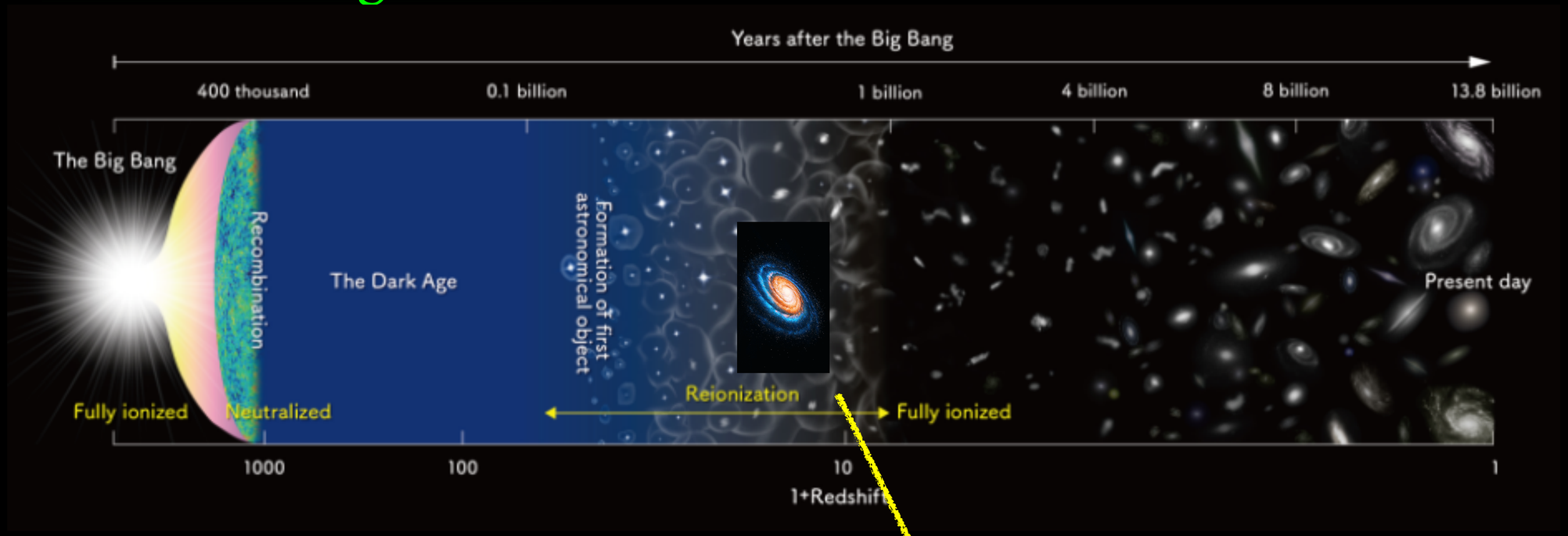

Credit : NAOJ

Galaxies residing in the Epoch of Reionization era.

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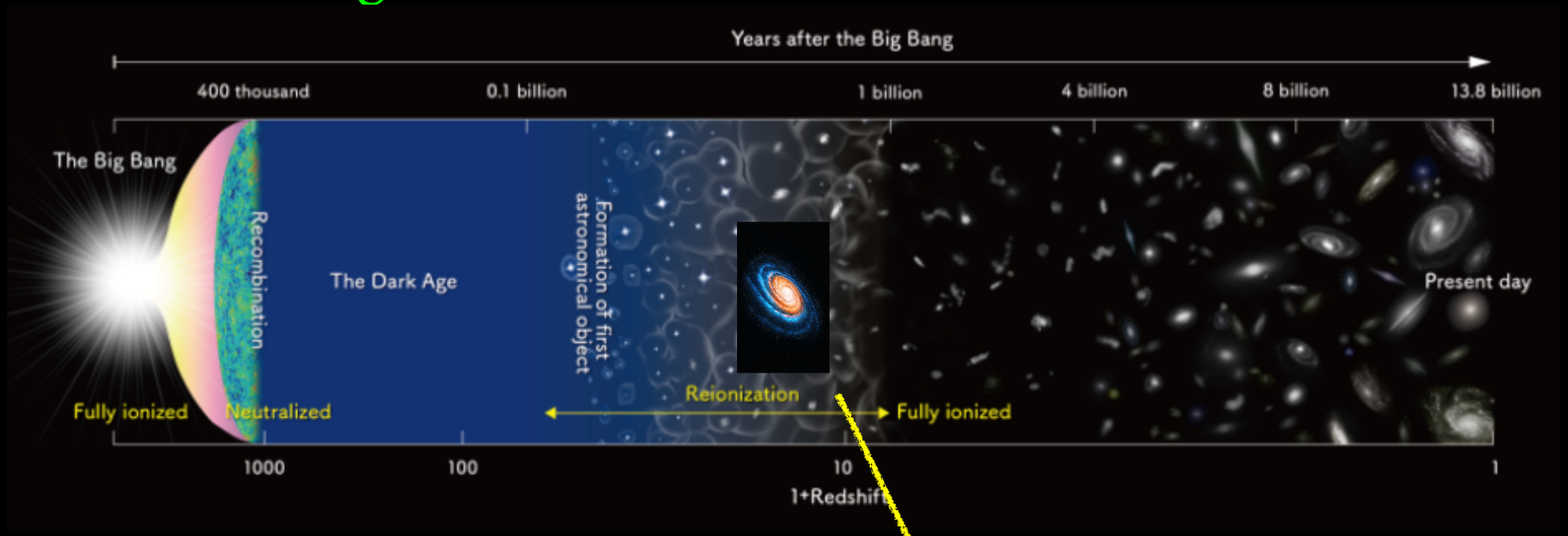

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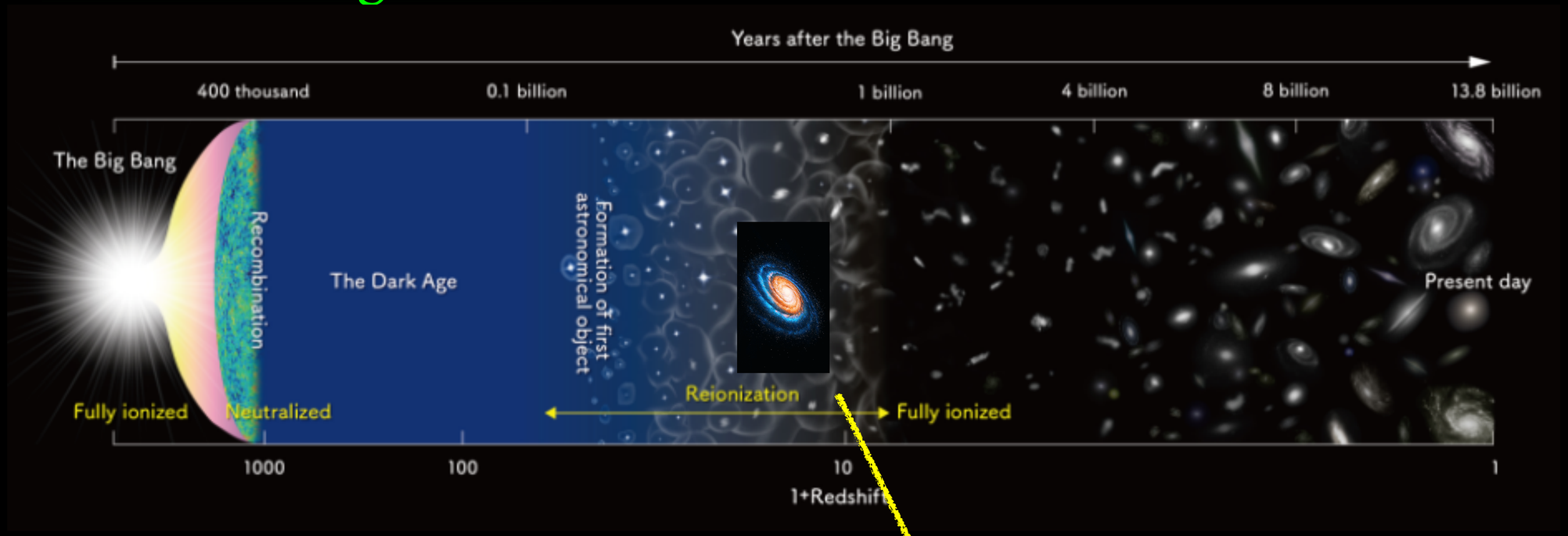

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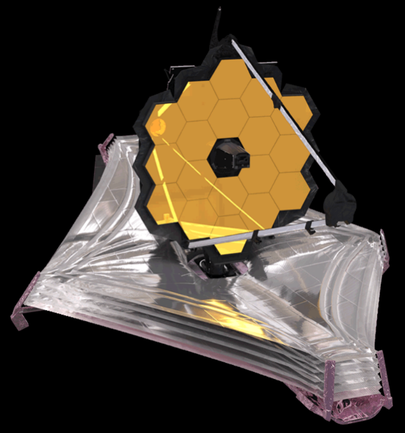

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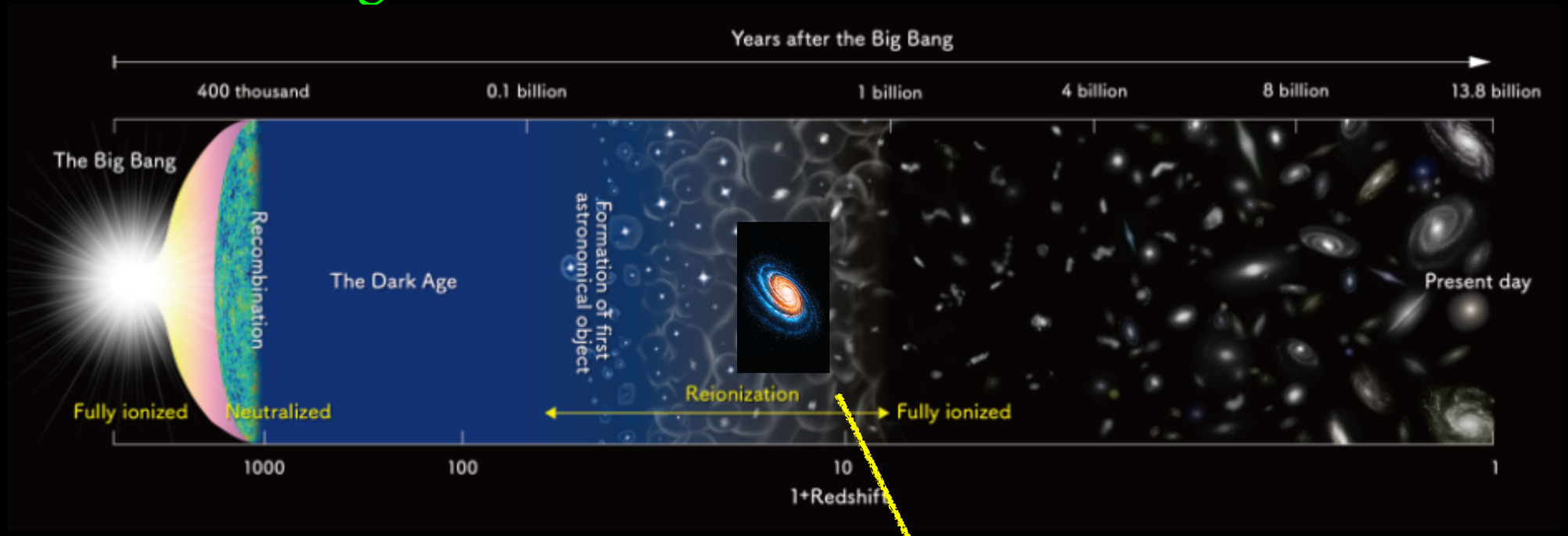

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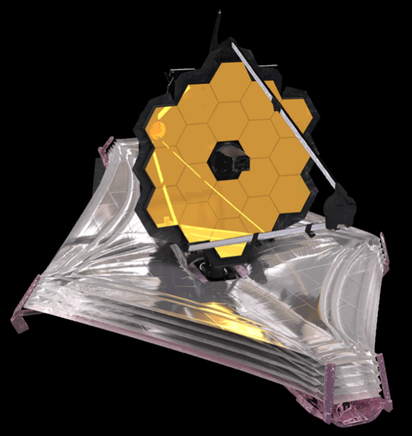

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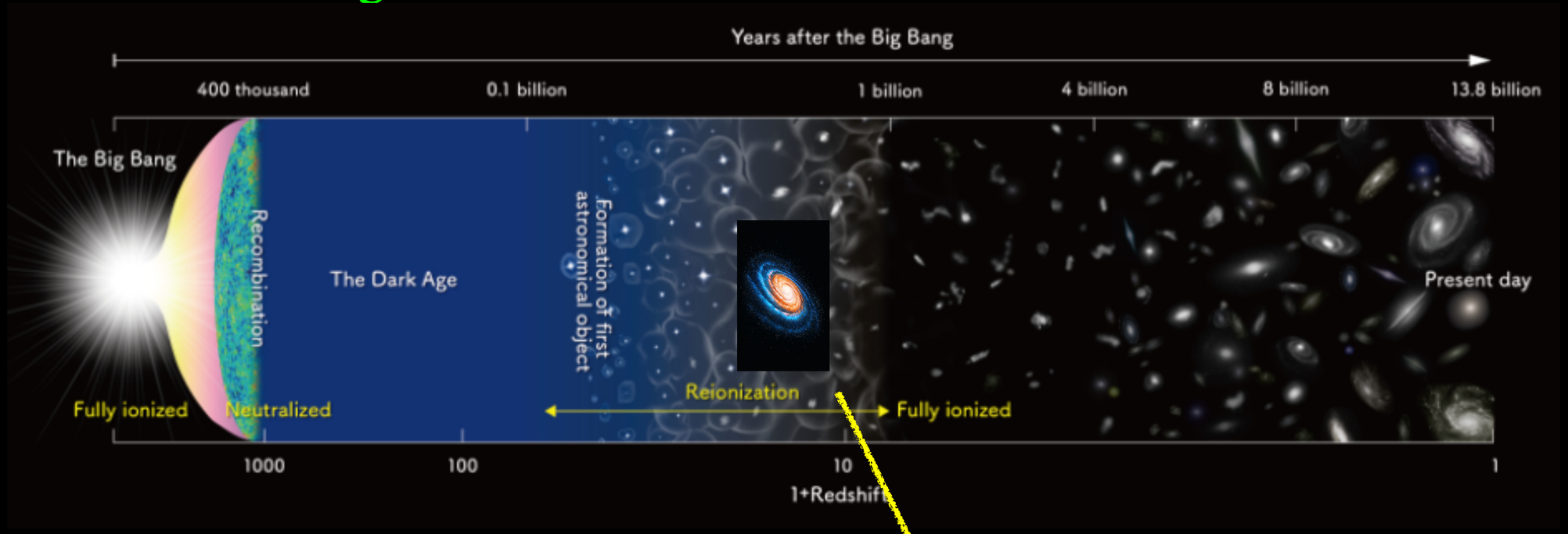

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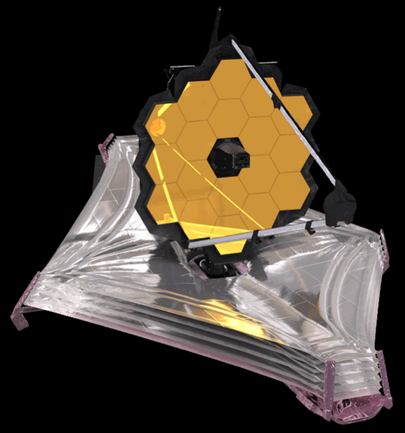

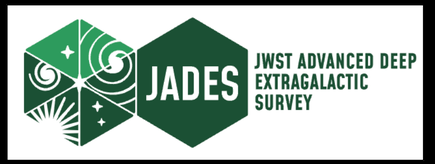

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- *Effect of turbulence on disc properties*
- *Modelled luminosity function*
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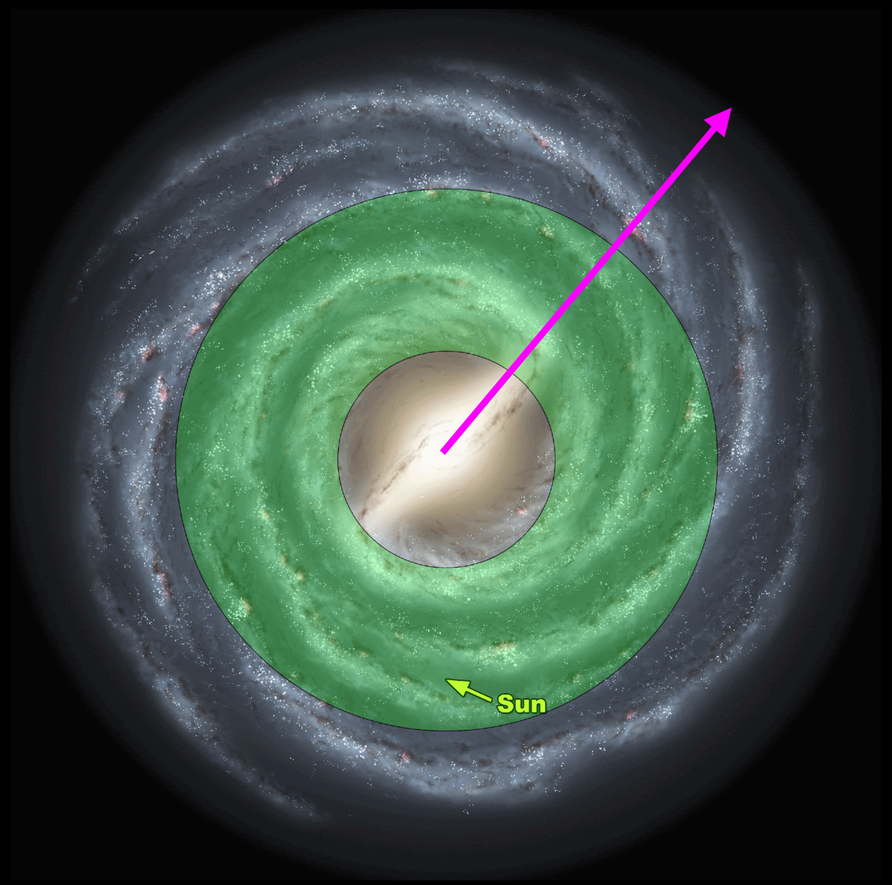

Wyithe and Loeb 2012

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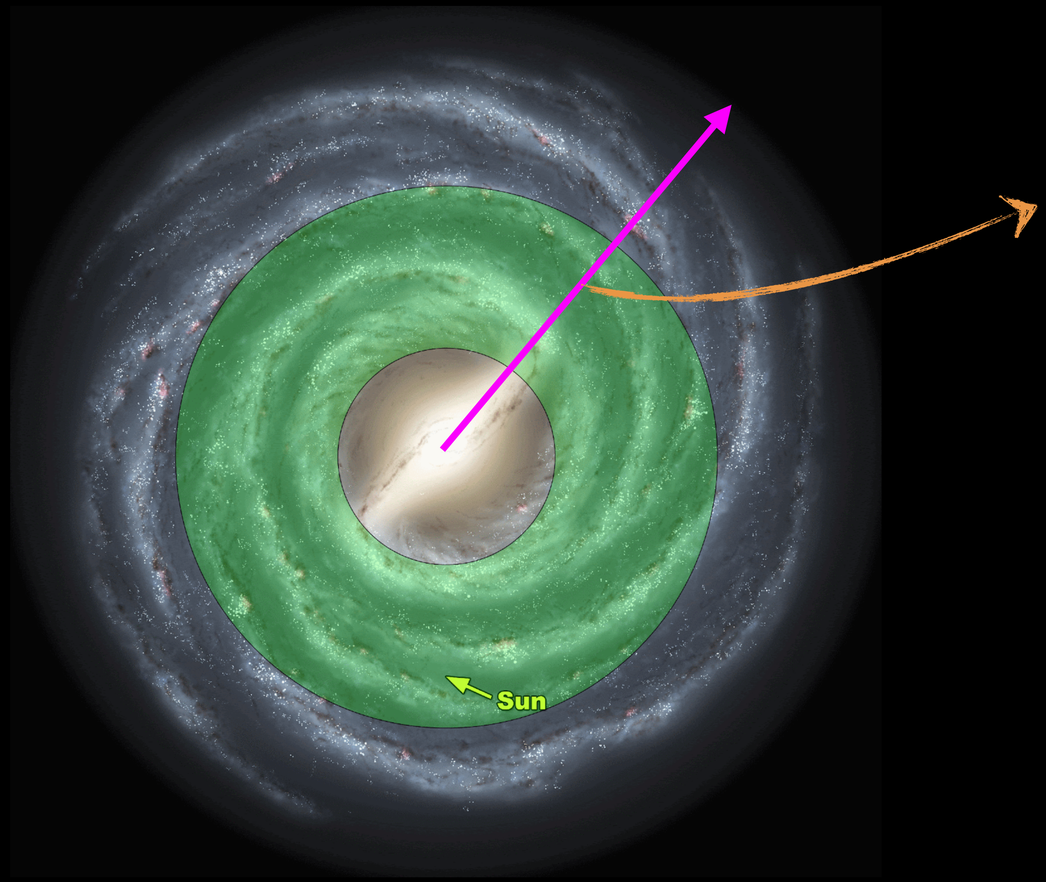

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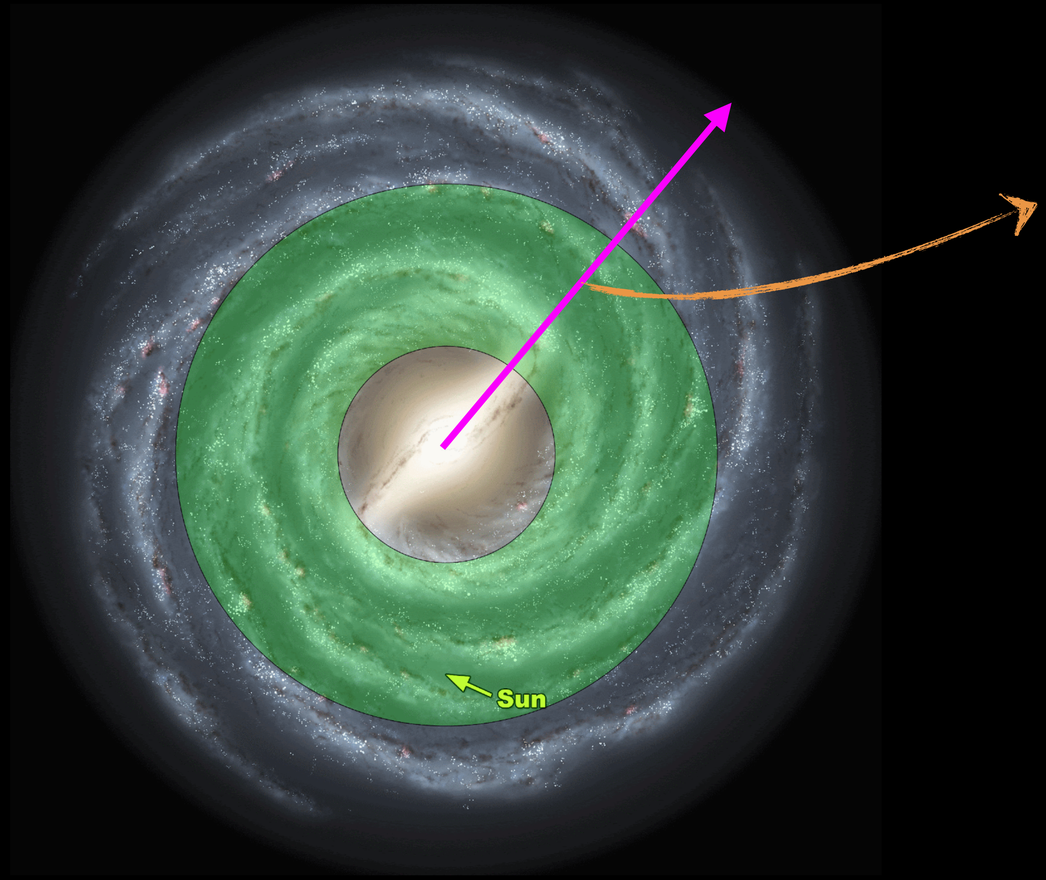

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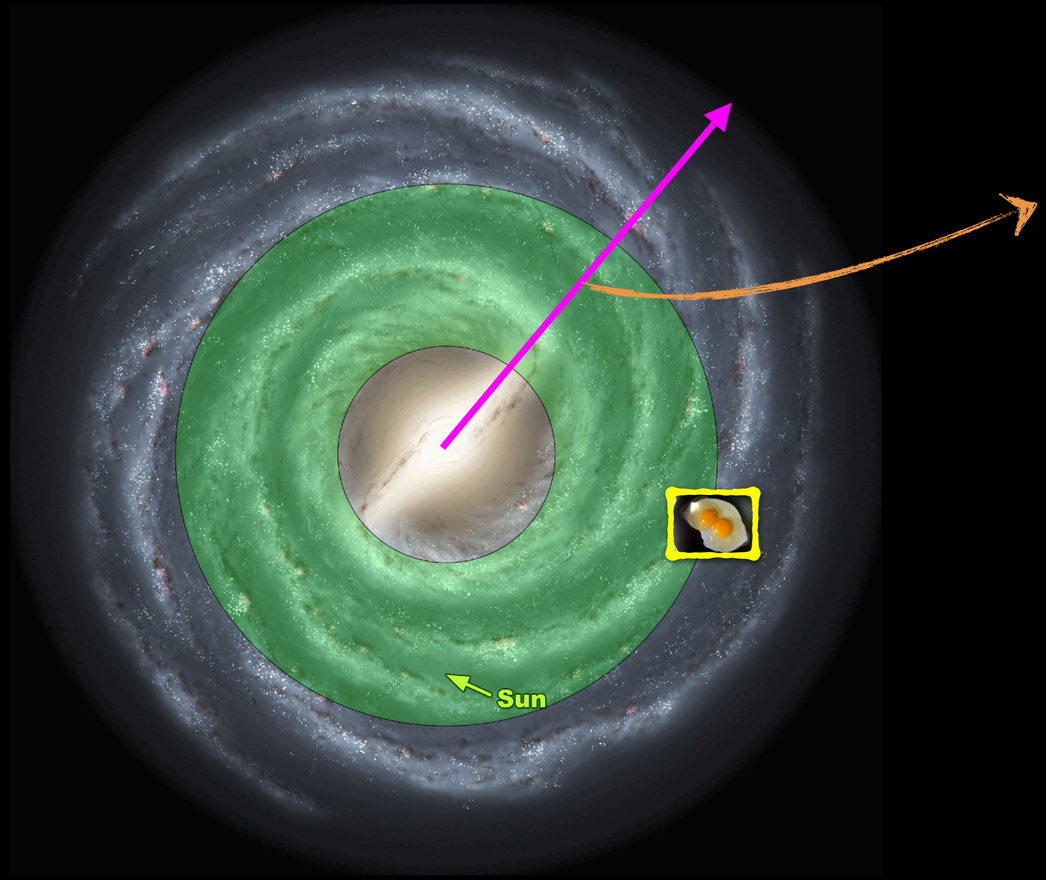

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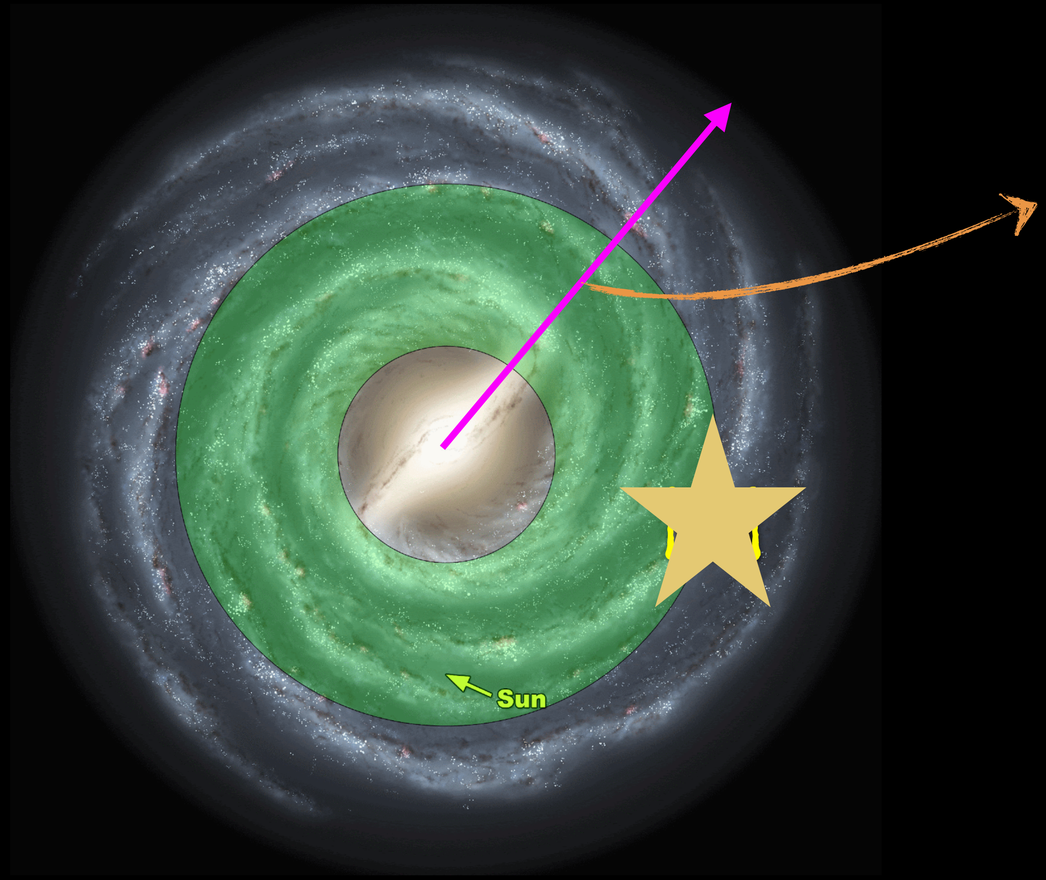

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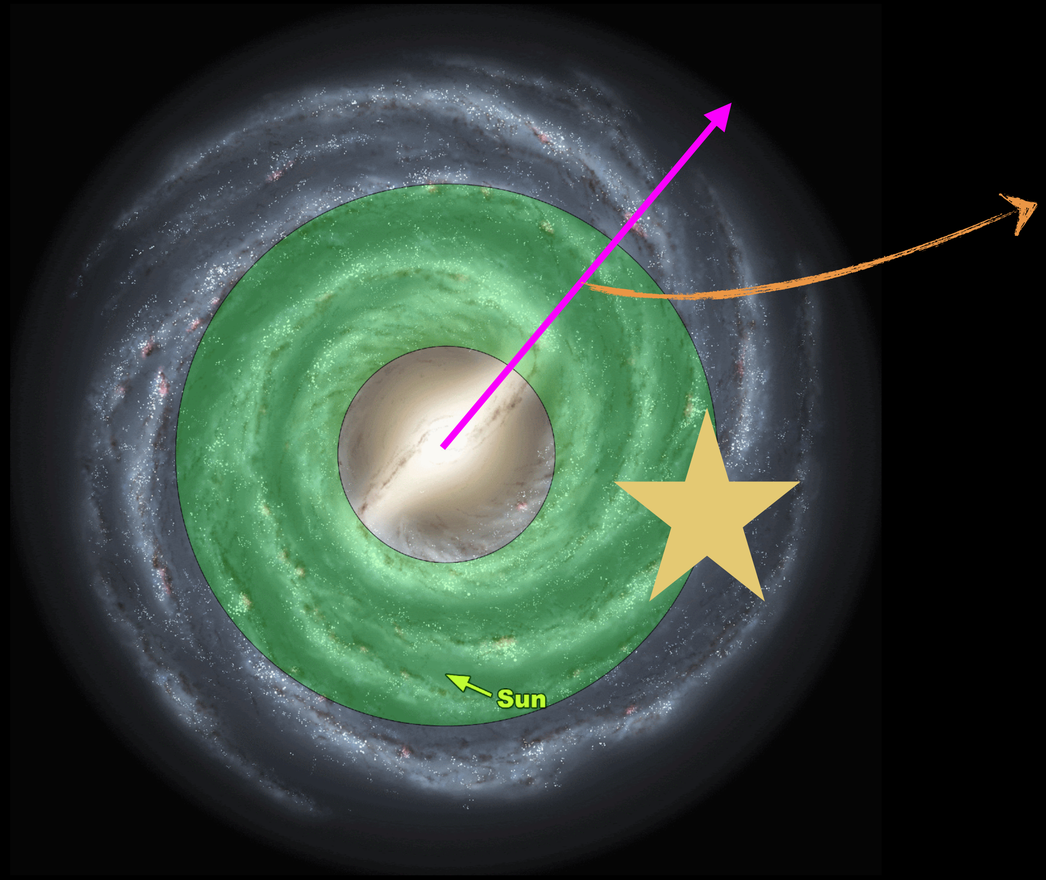

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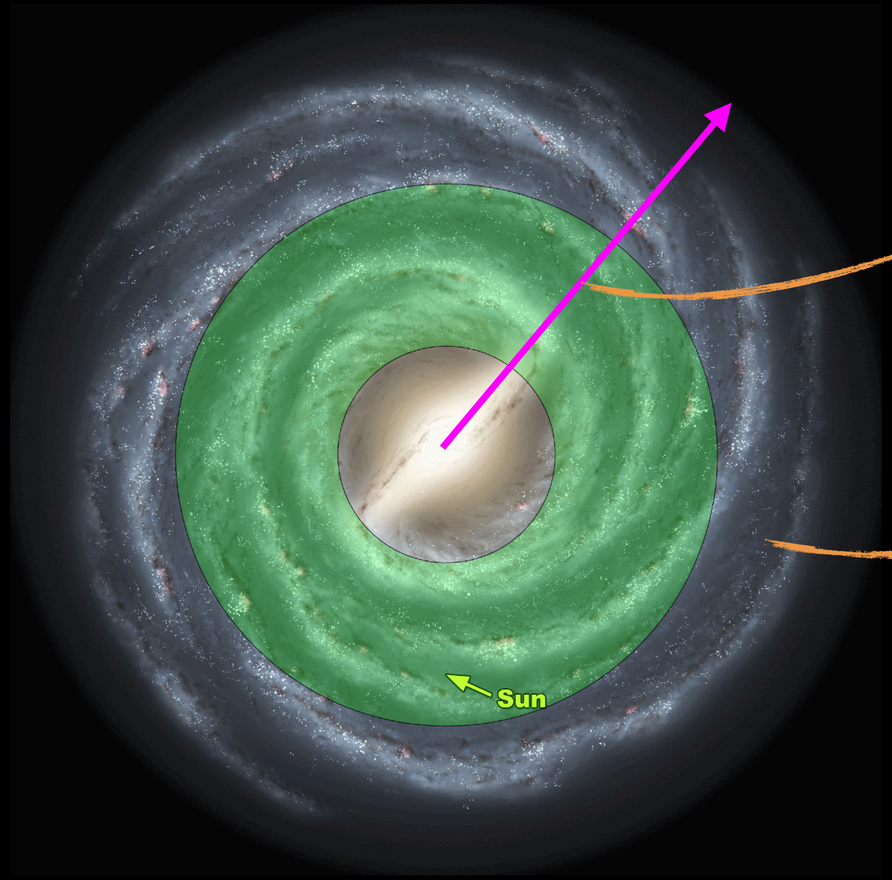

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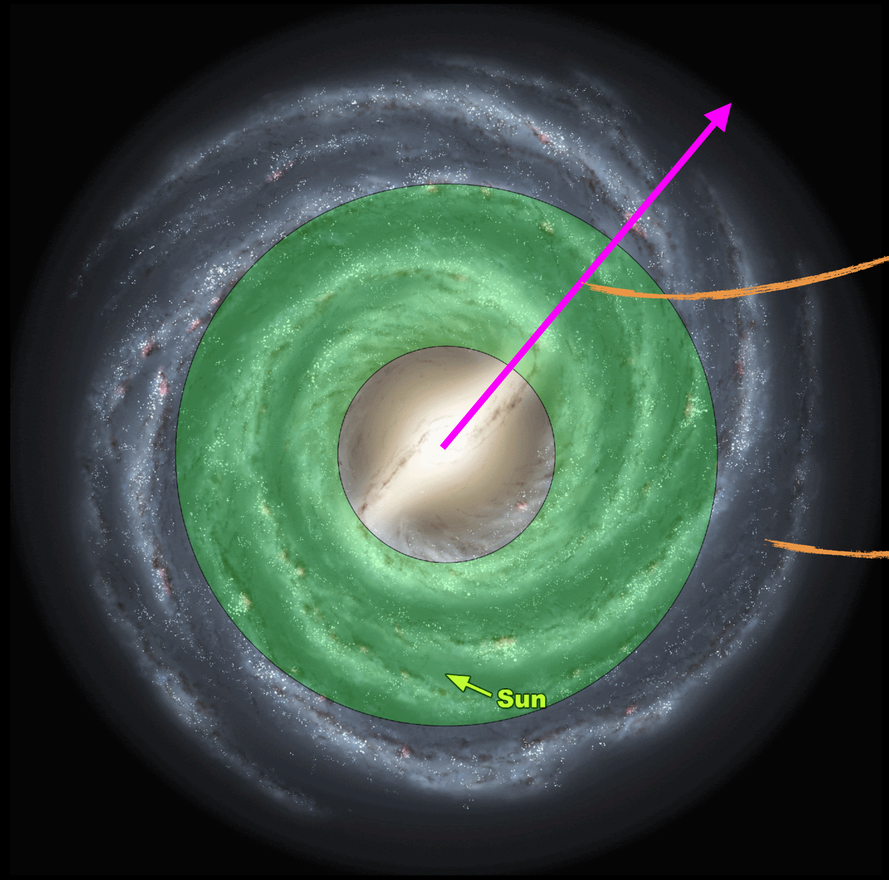

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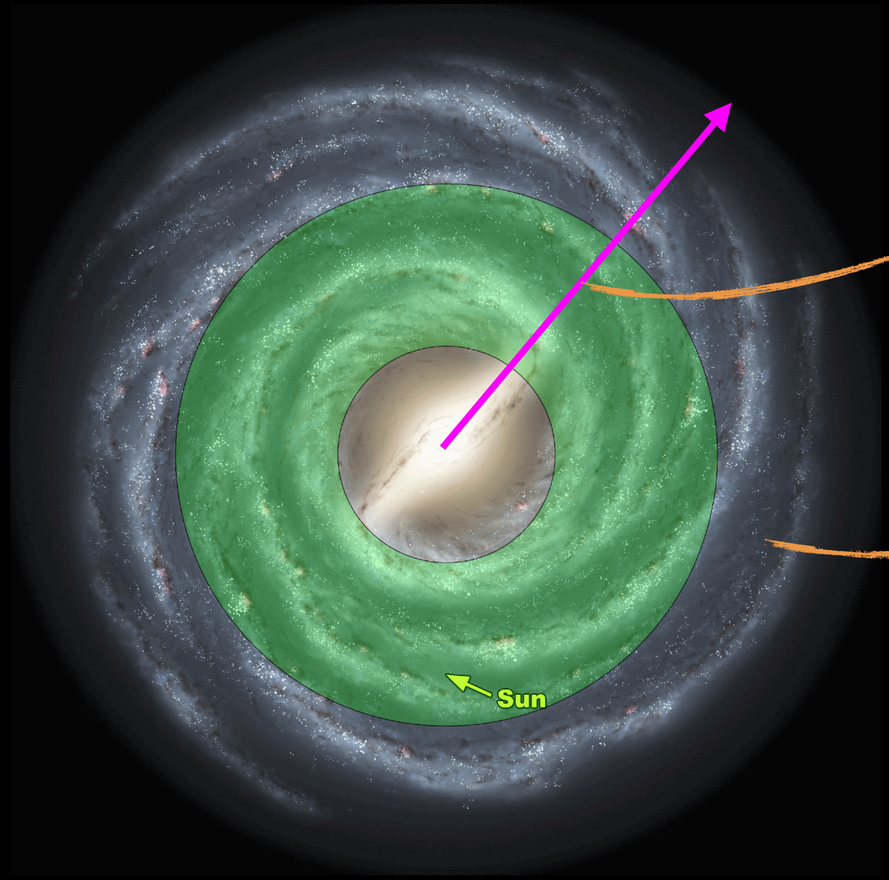

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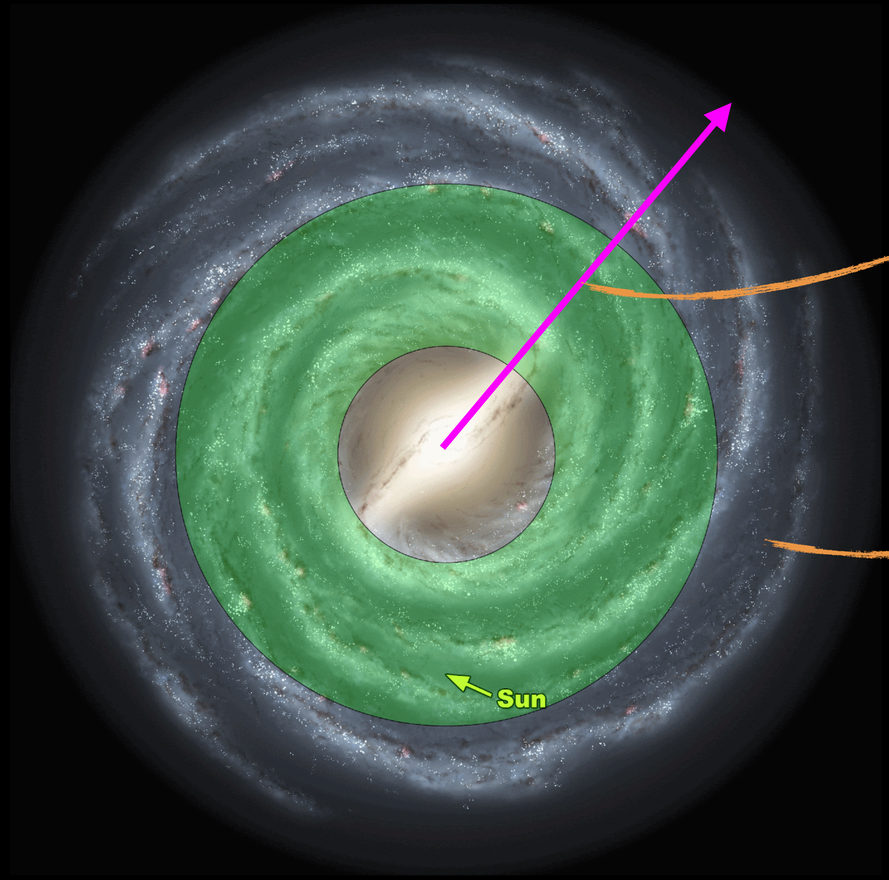

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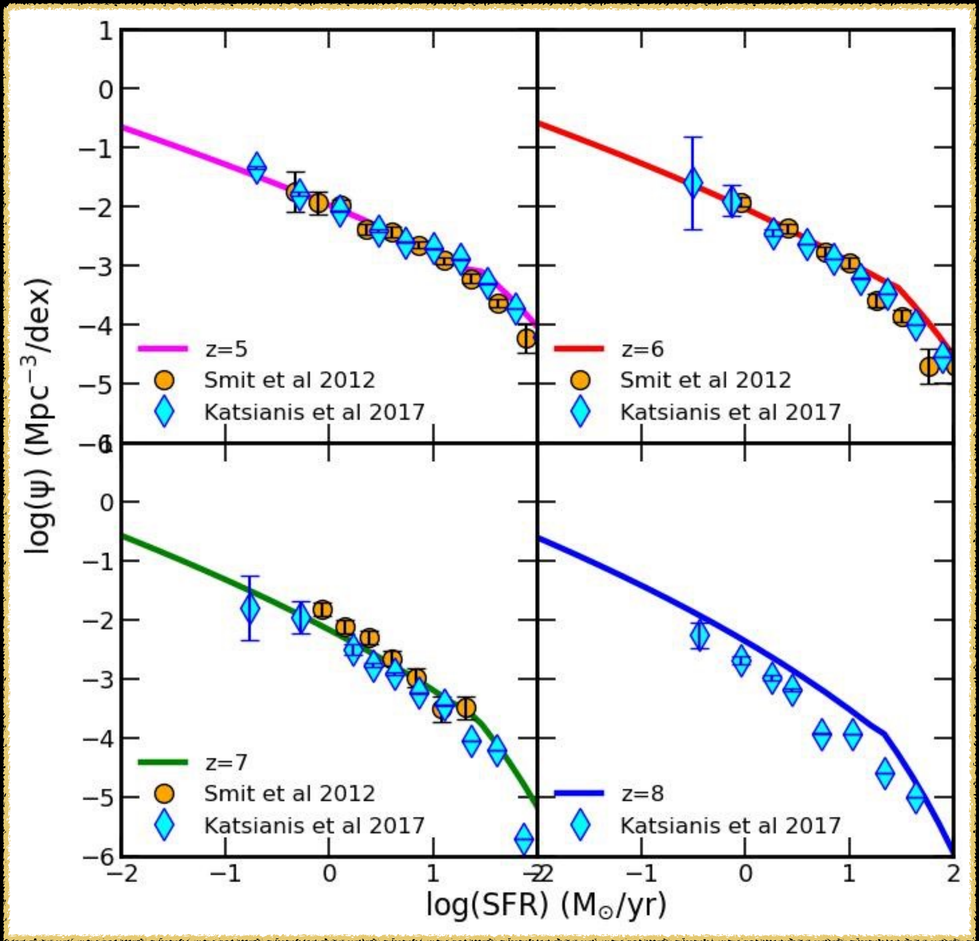

SFRD function

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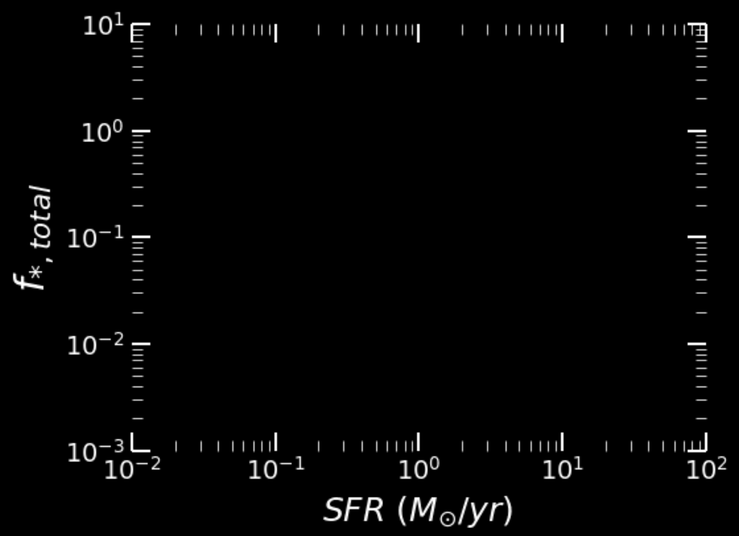
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10^{-1}
10^{-2}
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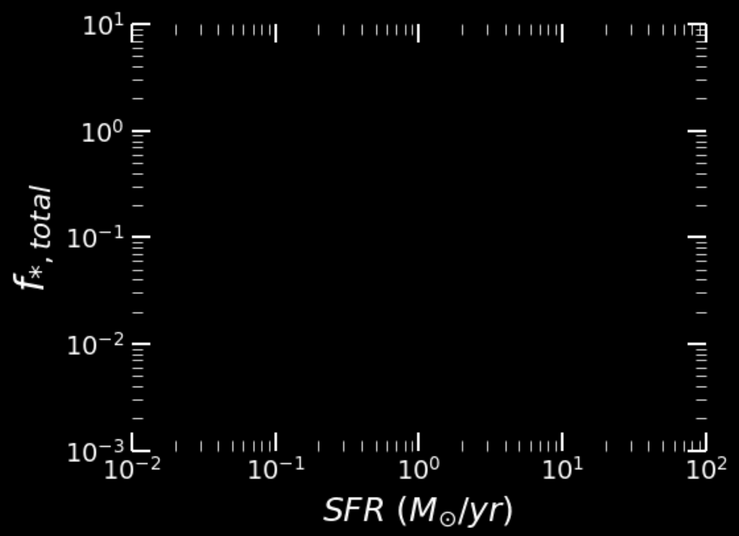
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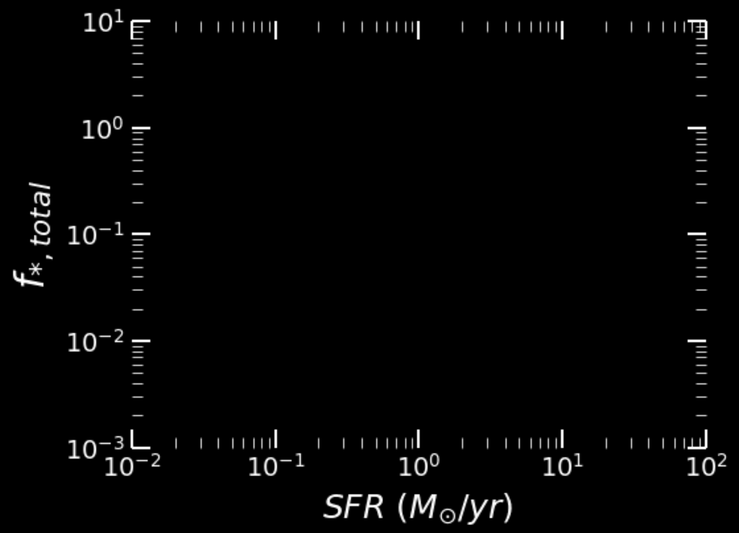
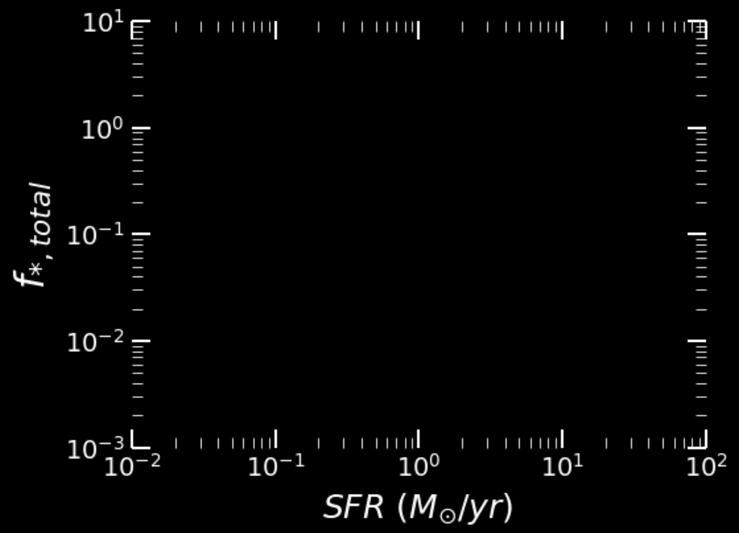


Total stellar mass:



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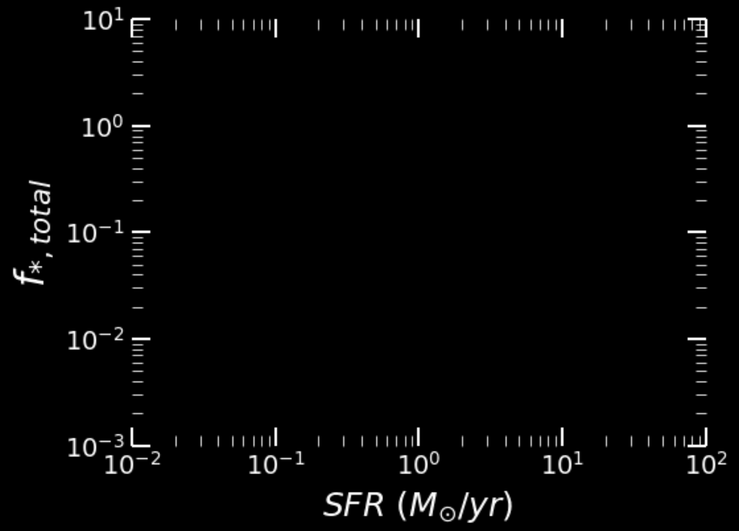

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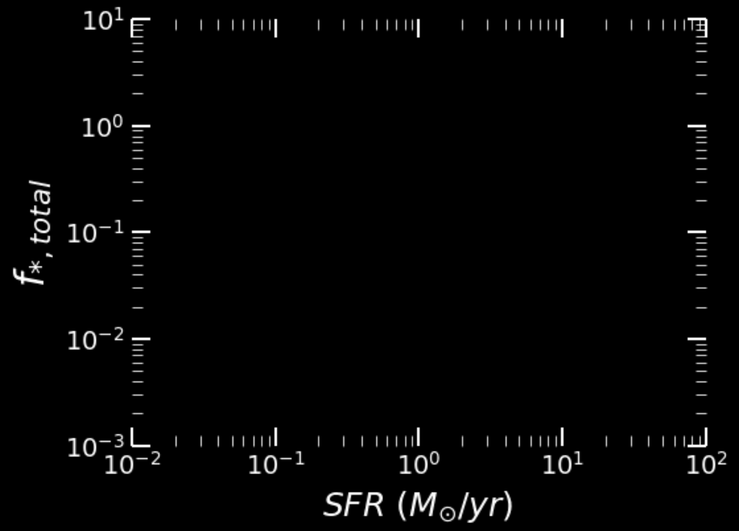

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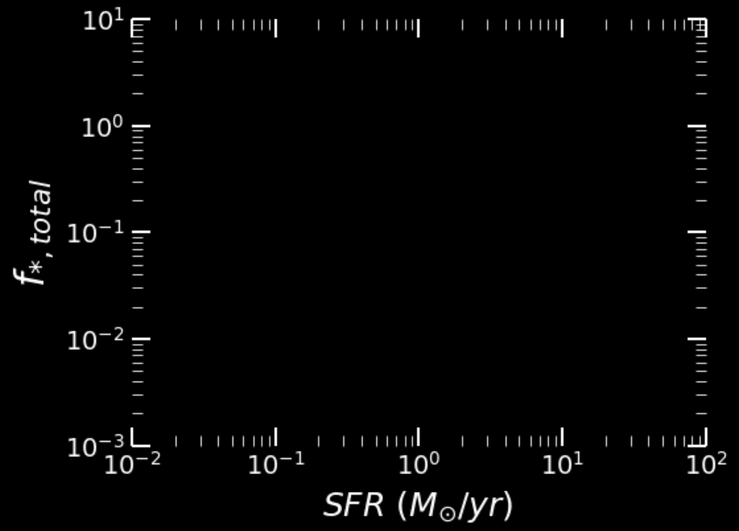

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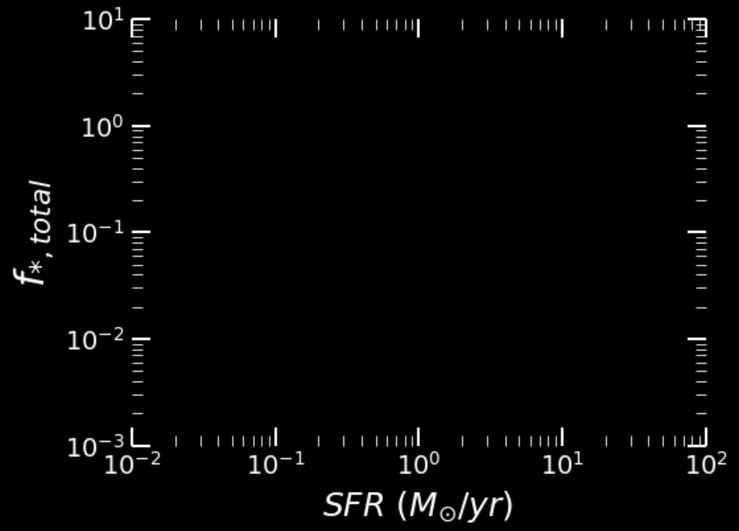

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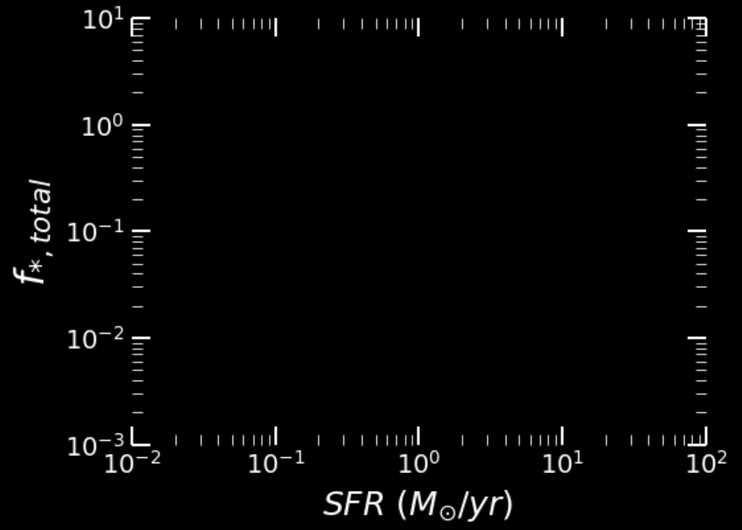

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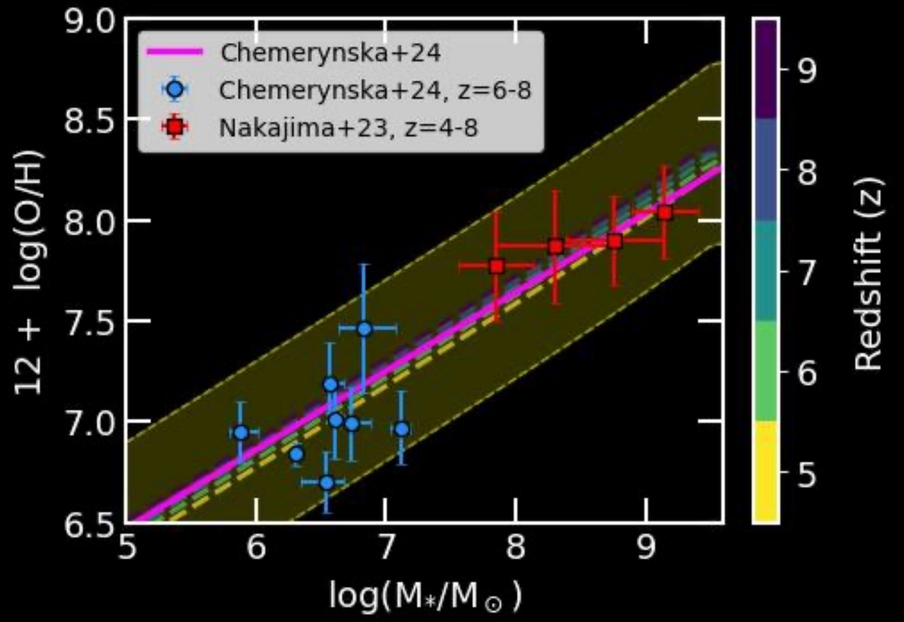

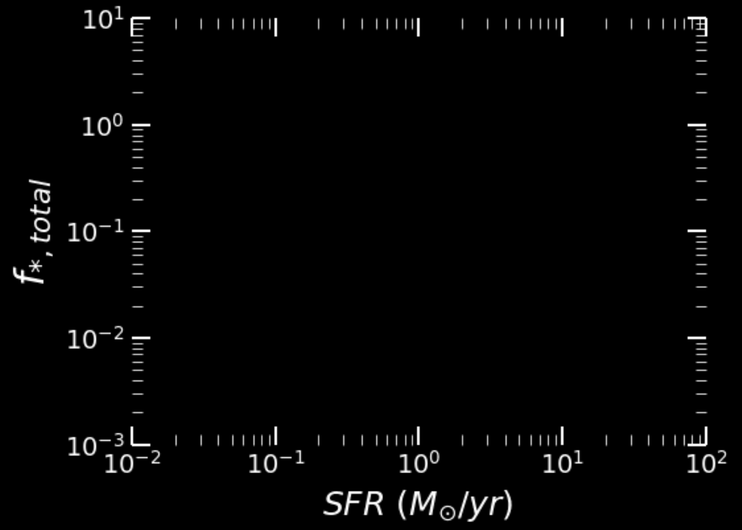

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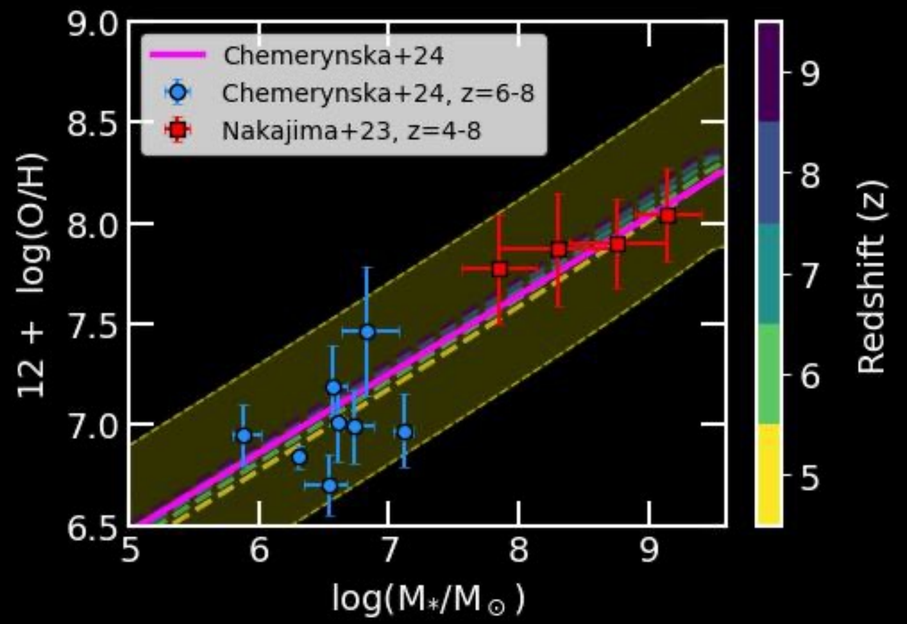

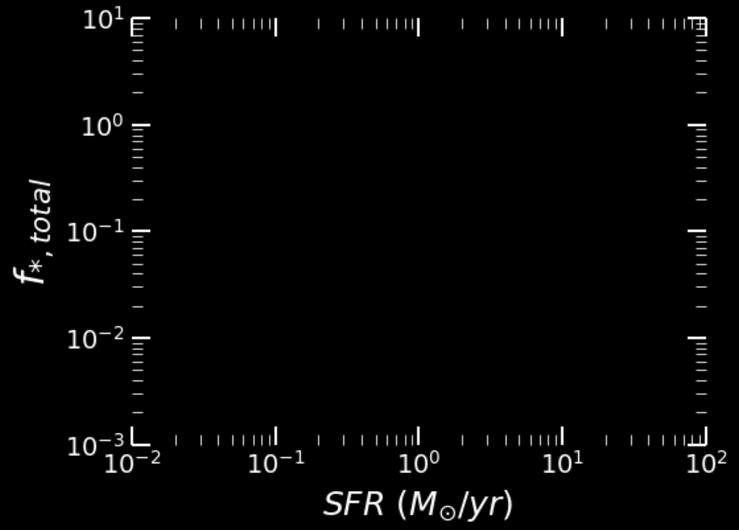

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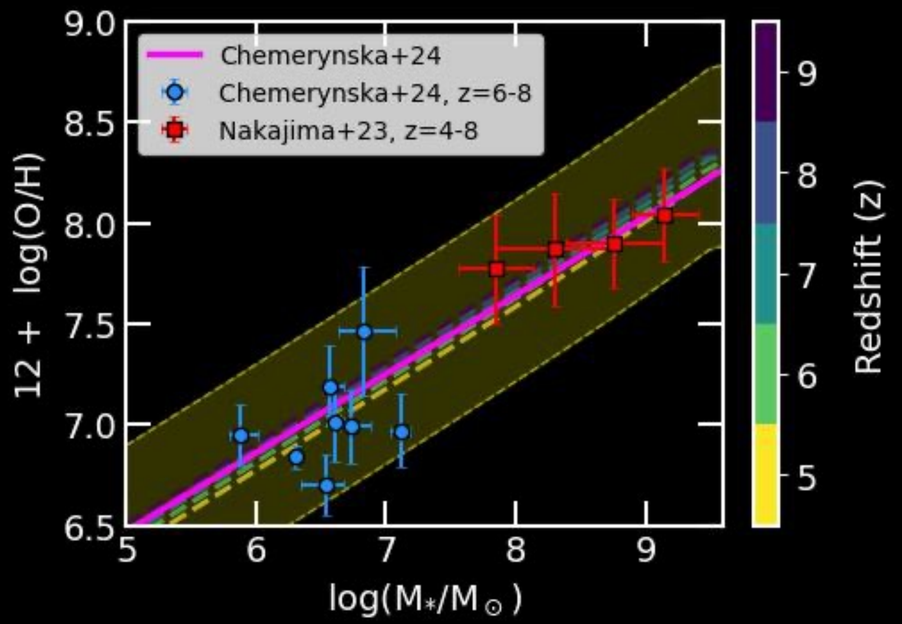

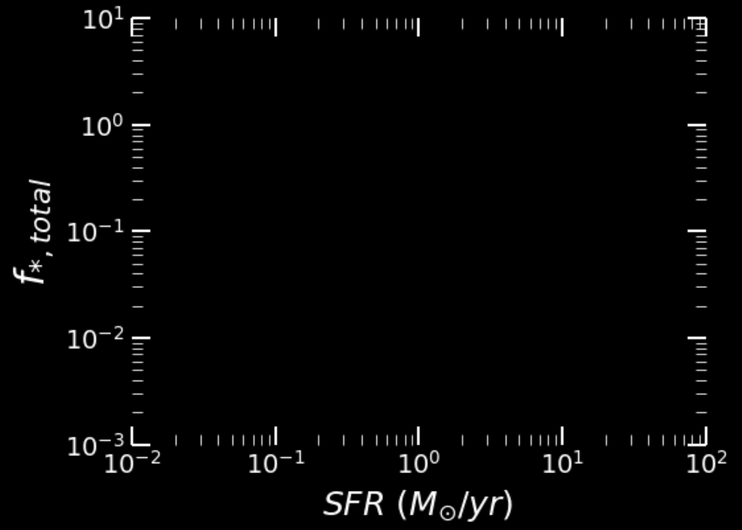

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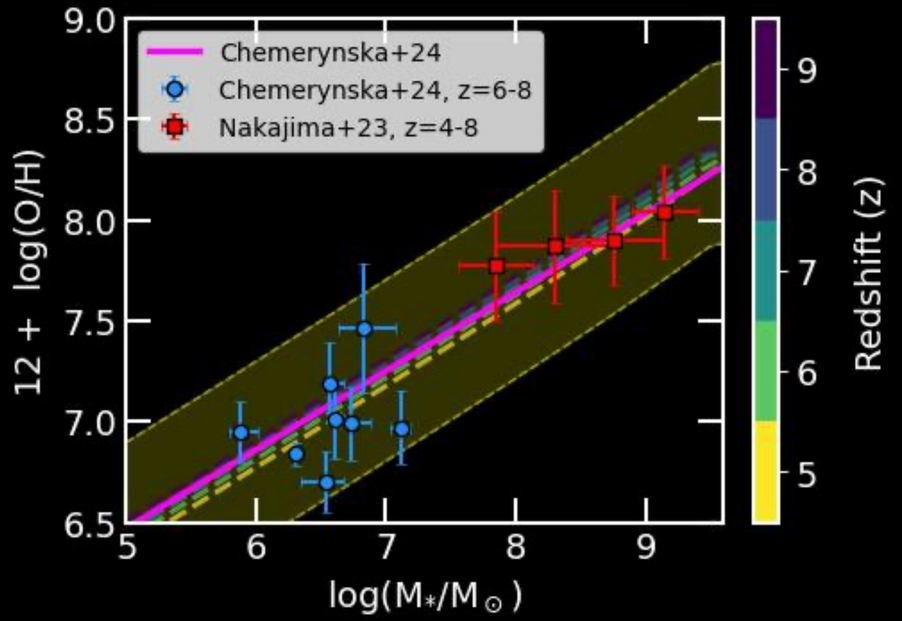
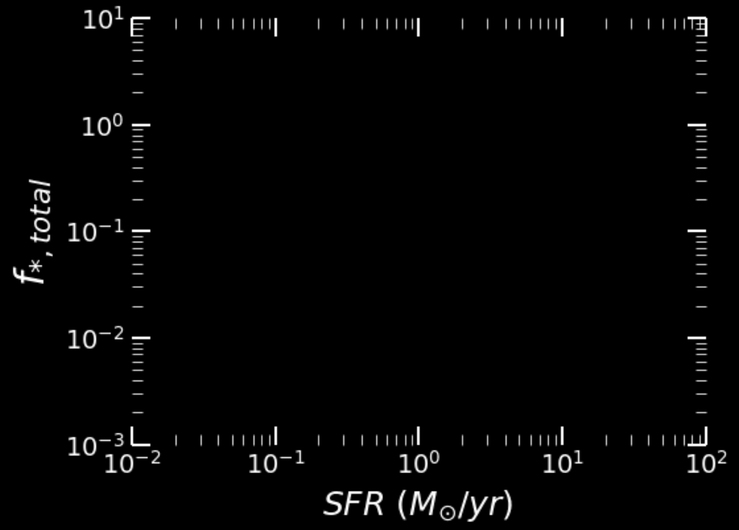


At fixed SFR, we find a scatter of 0.45 dex in metallicity



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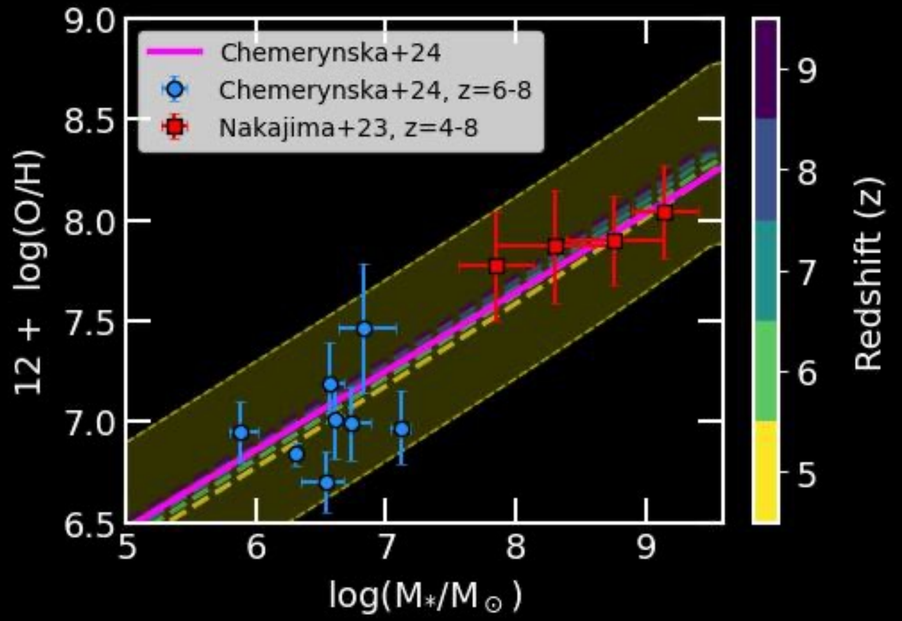

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This scatter later answers the steeper luminosity function

Role of turbulence in shaping galactic disc properties

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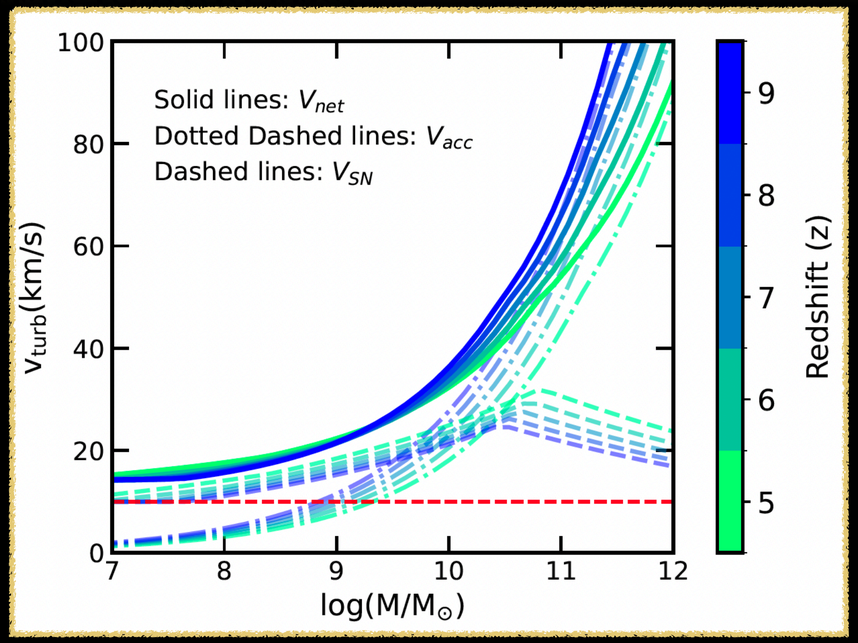

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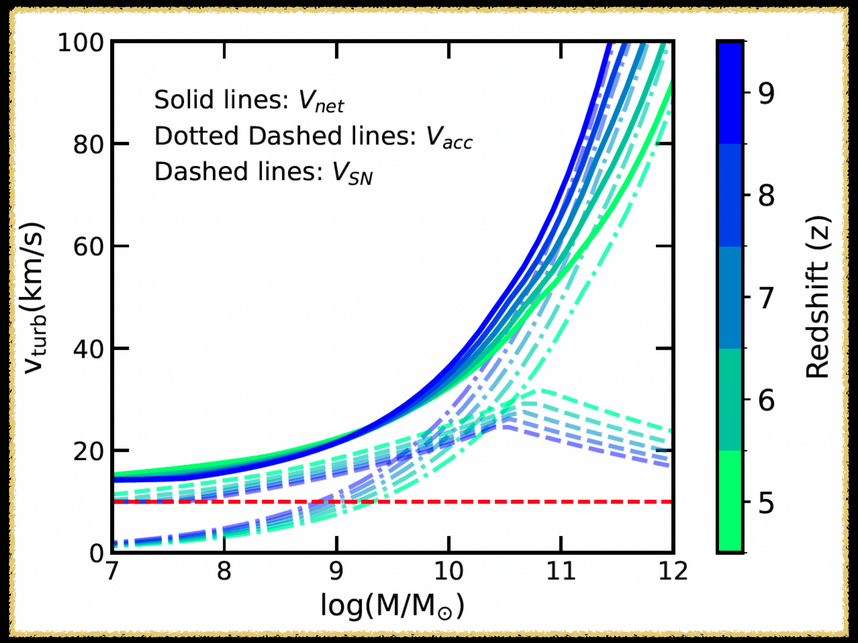

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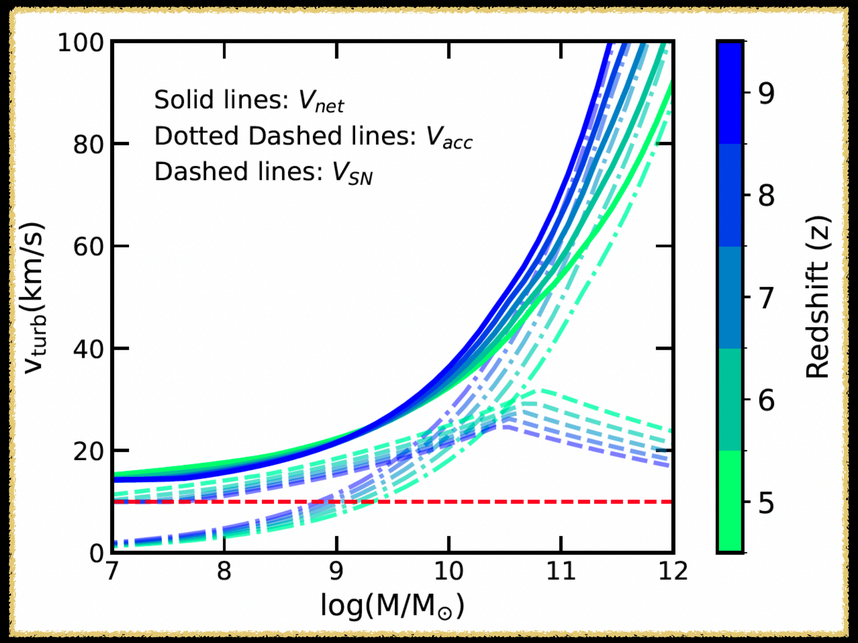

- *Turbulence is sustained via an energy balance between the energy sources and its dissipation in the interstellar medium.*

We modify the physical conditions within the ISM by considering the turbulence

Turbulence effect on various properties

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Scale height comparison

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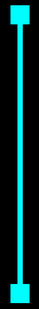

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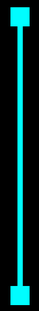

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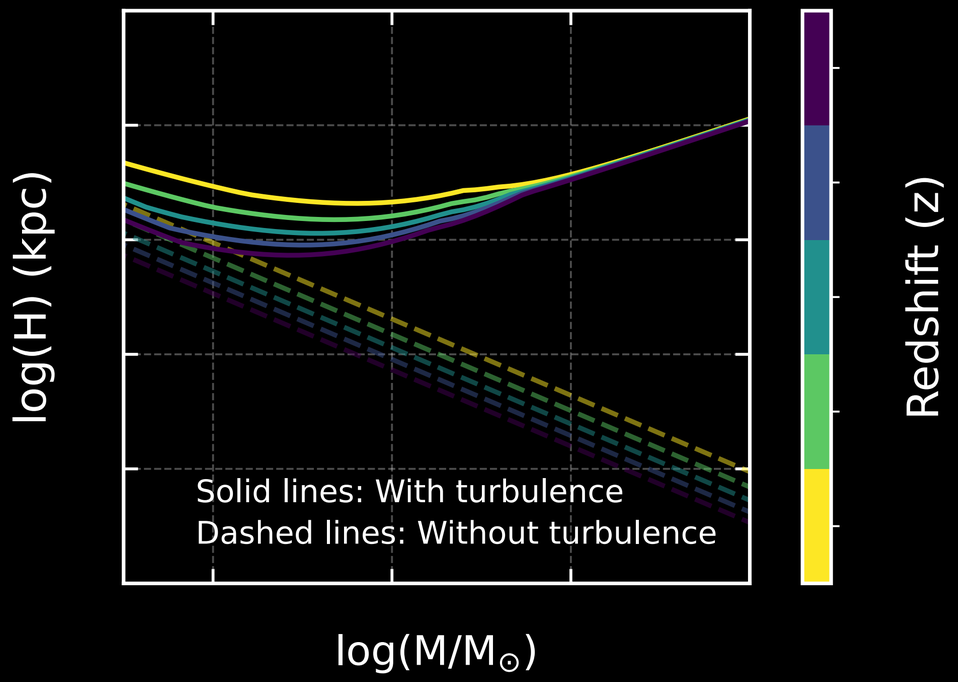

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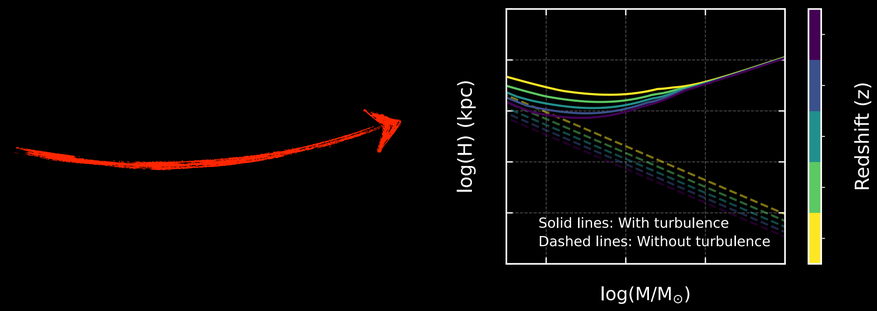

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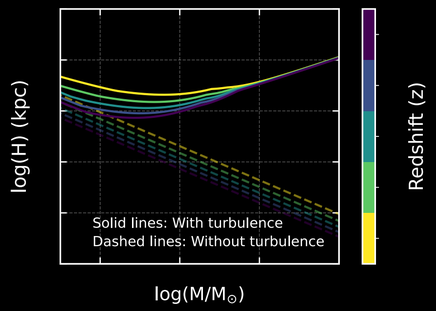

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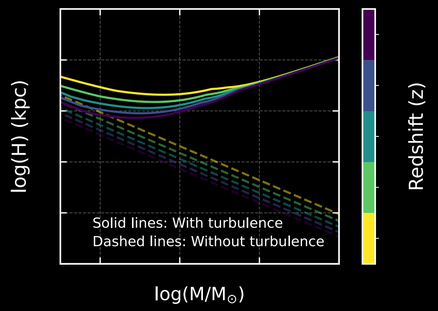

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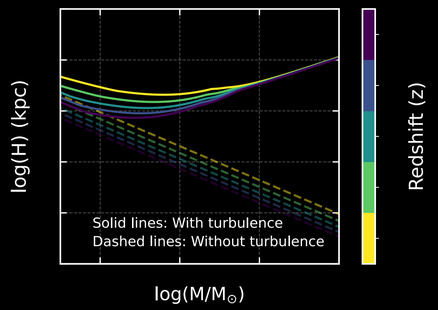

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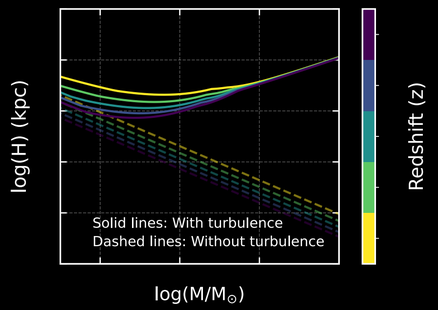

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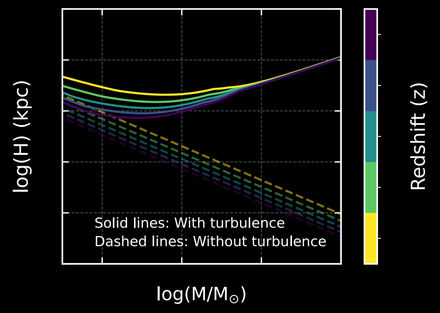

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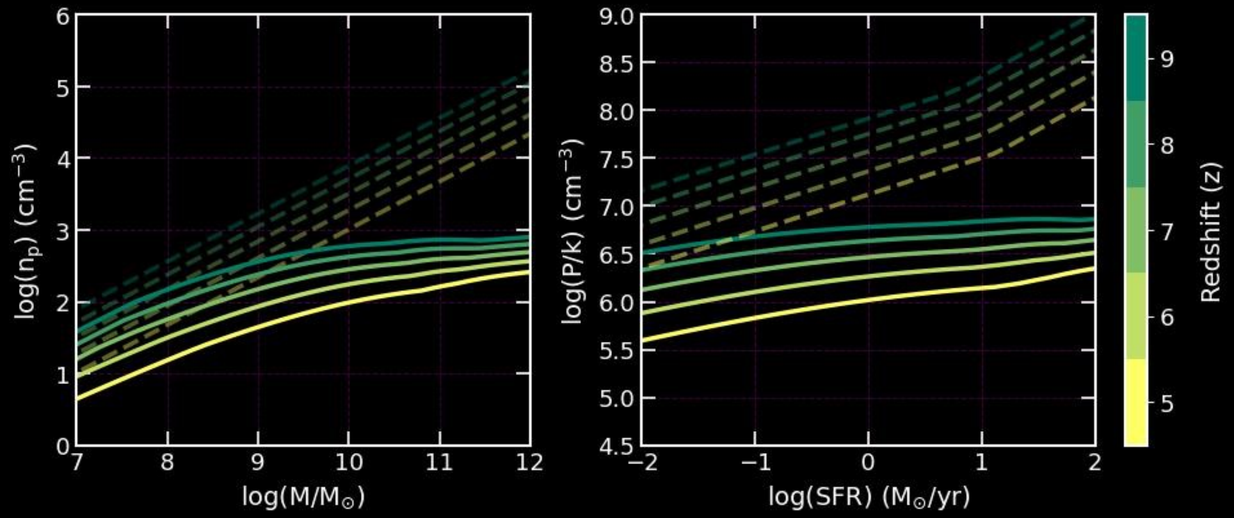

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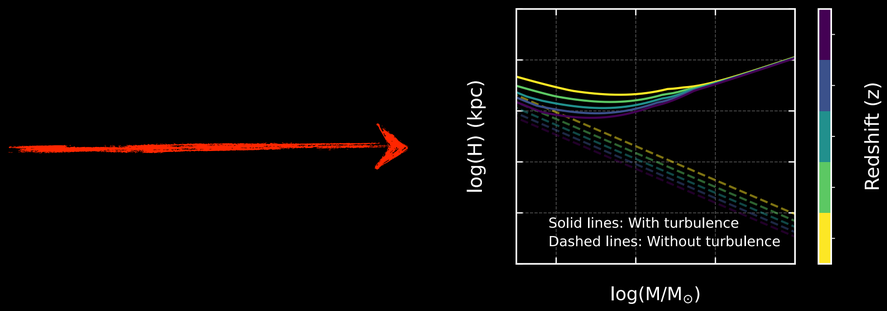

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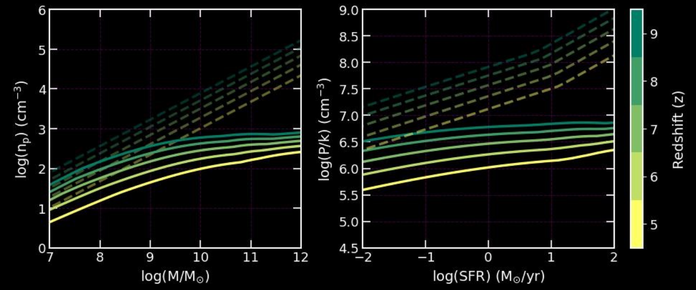

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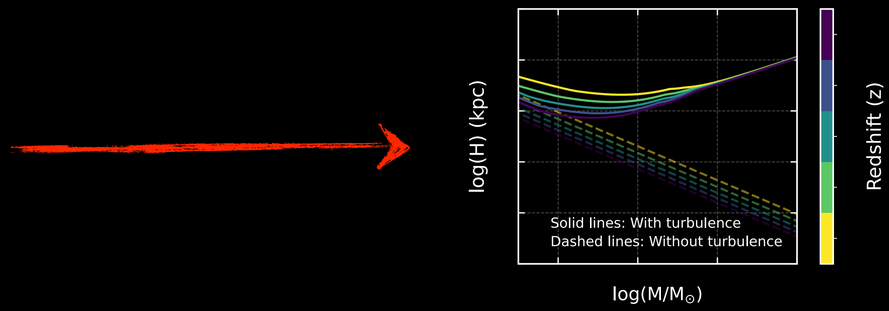

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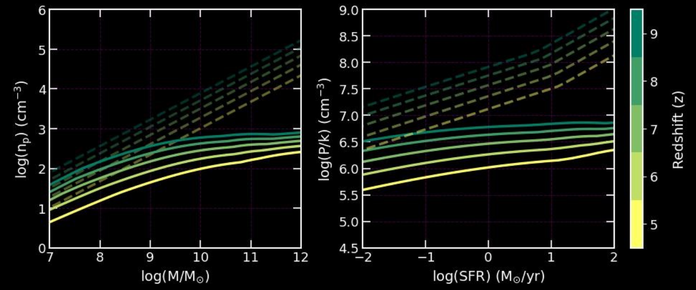

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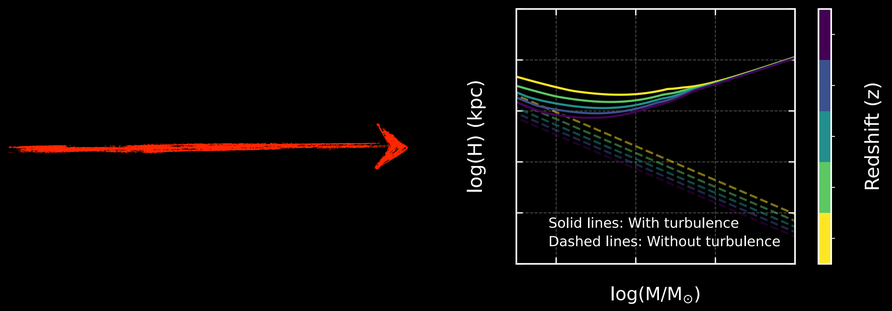

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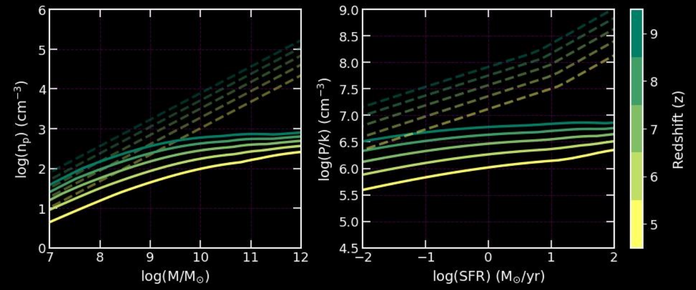

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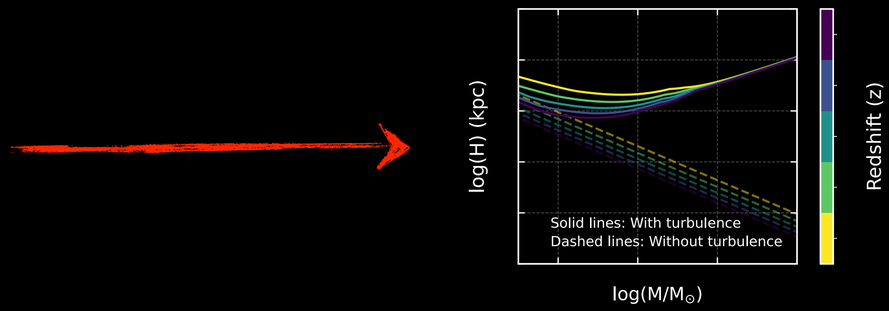

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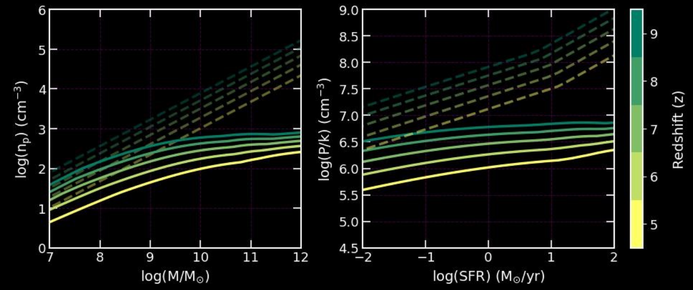

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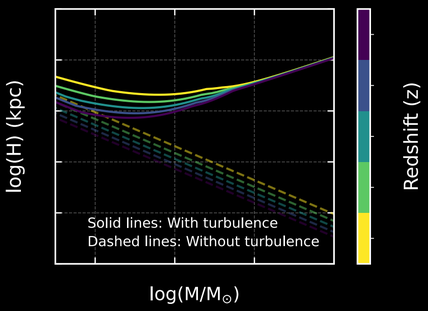

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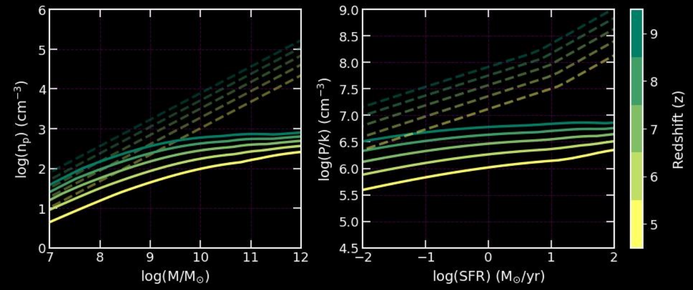

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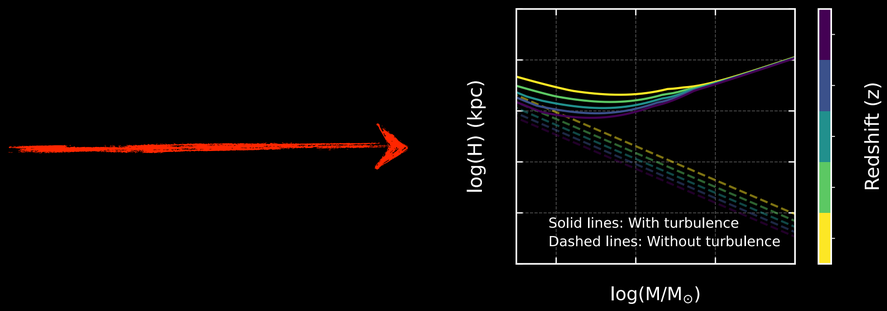

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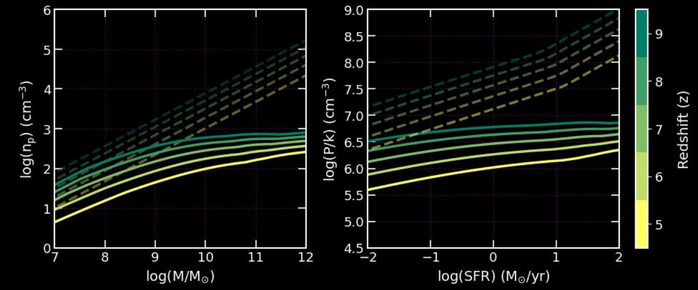

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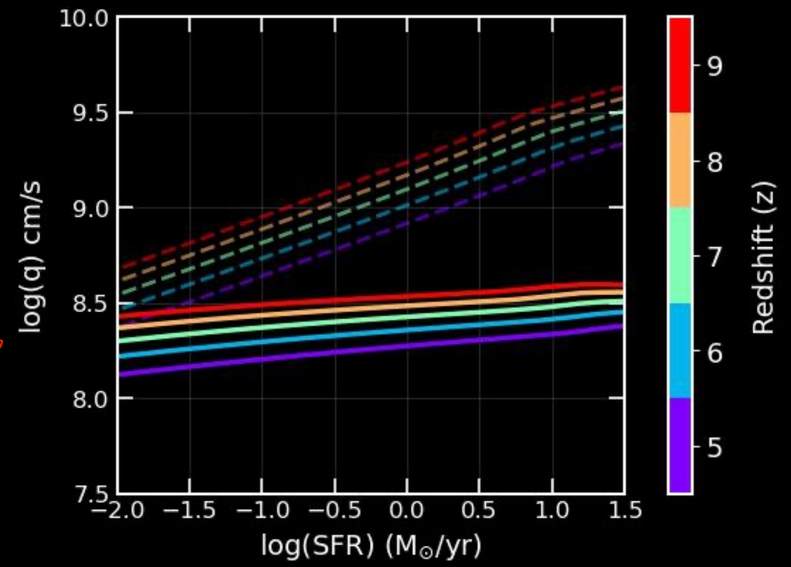

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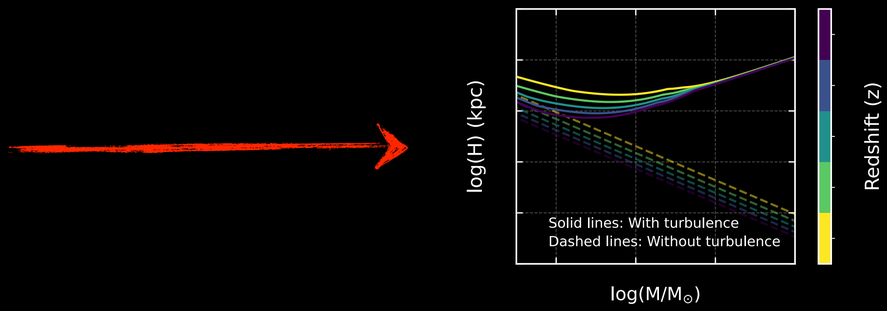

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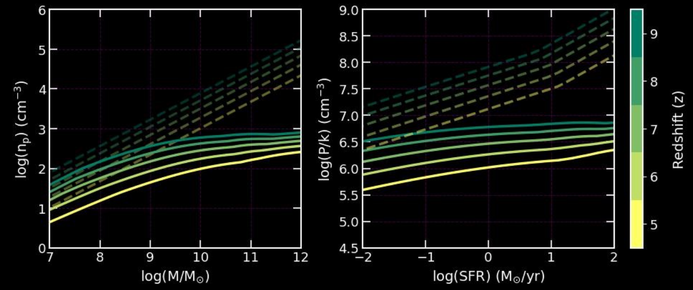

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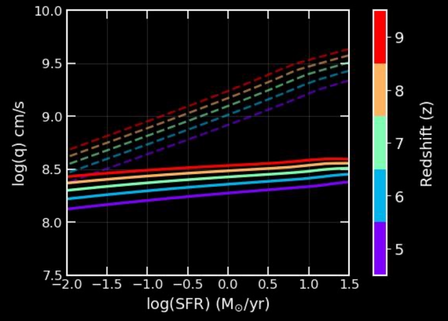

Estimating luminosity functions and flux ratio for [OIII] line emission

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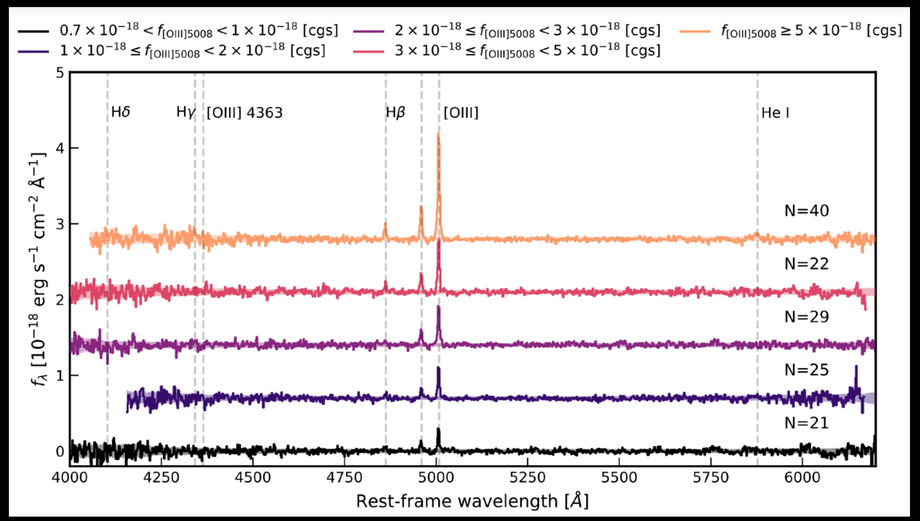

Meyer et al 2024

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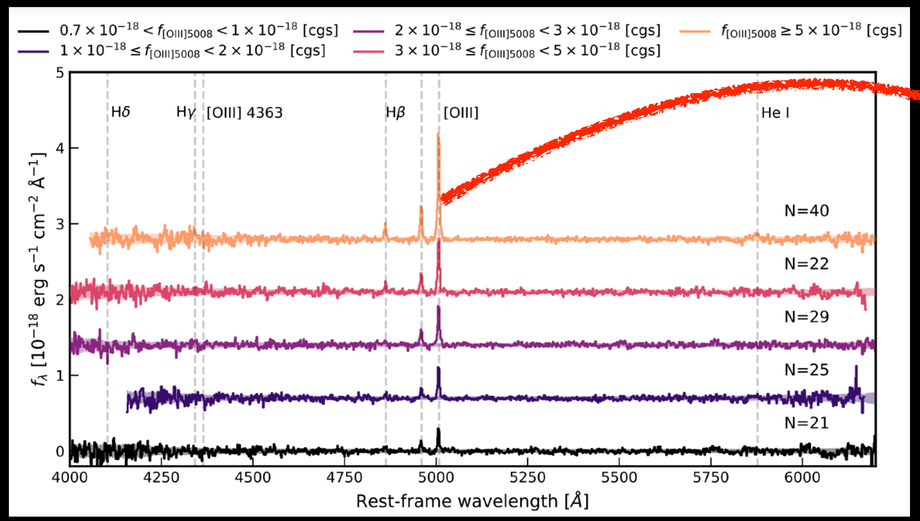

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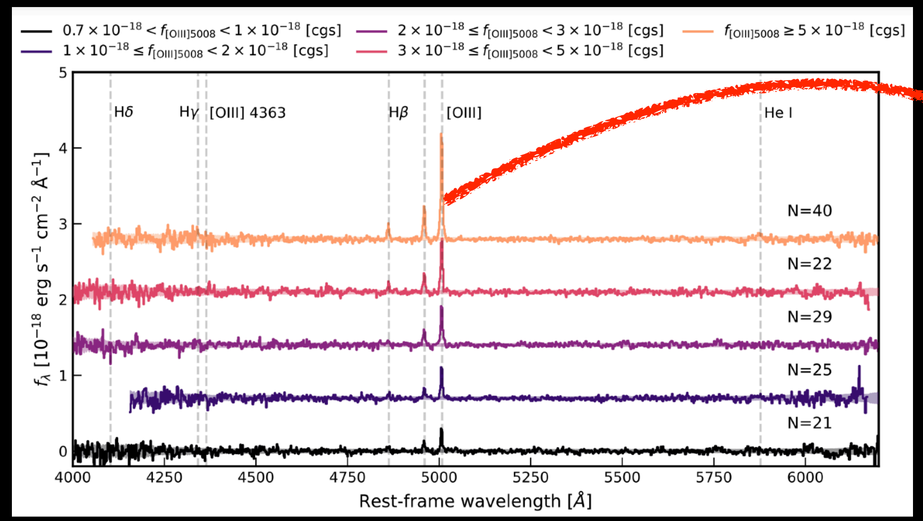

[OIII]5007 emission line luminosity

Meyer et al 2024

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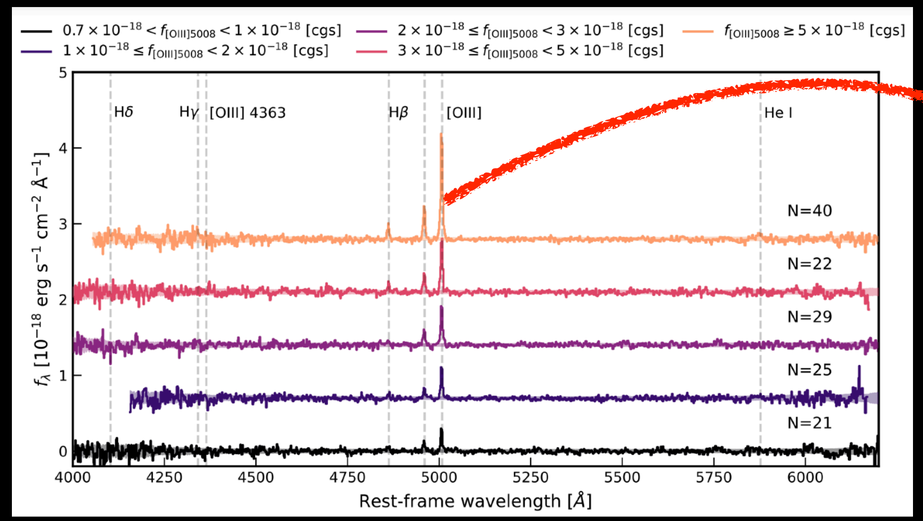

Meyer et al 2024

[OIII]5007 emission line luminosity

$$L_{[OIII]} = \left(\frac{n_O}{n_H}\right)_\odot \frac{Z}{Z_\odot} (k_{03} + k_{04}) \frac{A_{43}}{A_{43} + A_{41}} h\nu_{32} \left(\frac{Q_{HI}}{\alpha_{\beta,HII}}\right) \left(\frac{V_{[OIII]}}{V_{HII}}\right)$$

Yang and Lidz (2020)

Estimating luminosity functions and flux ratio for [OIII] line emission

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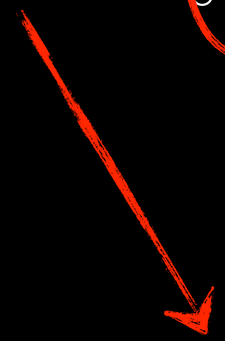

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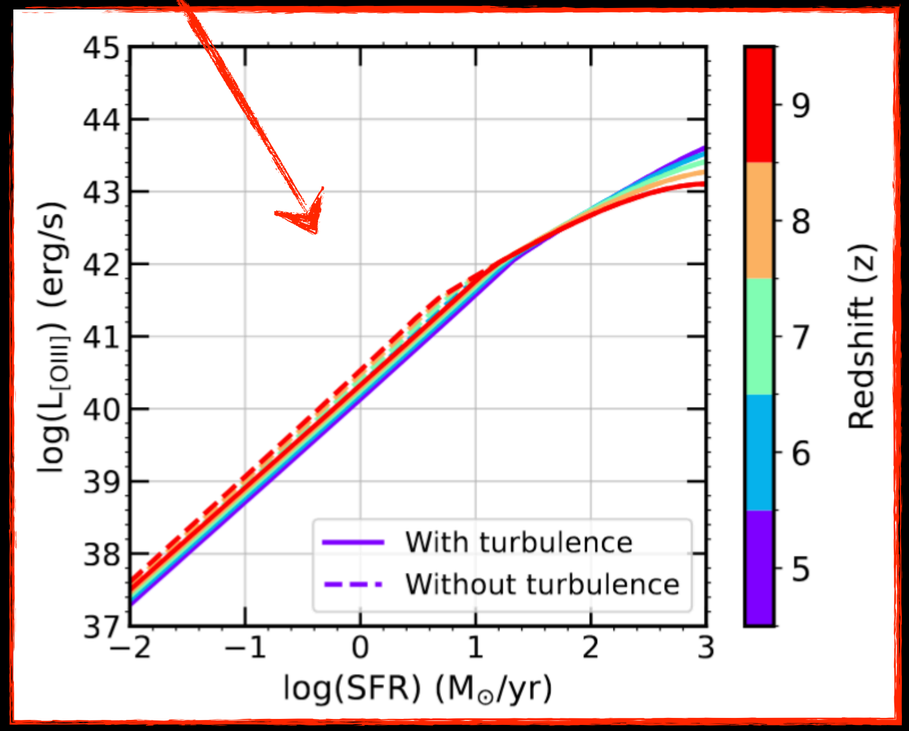

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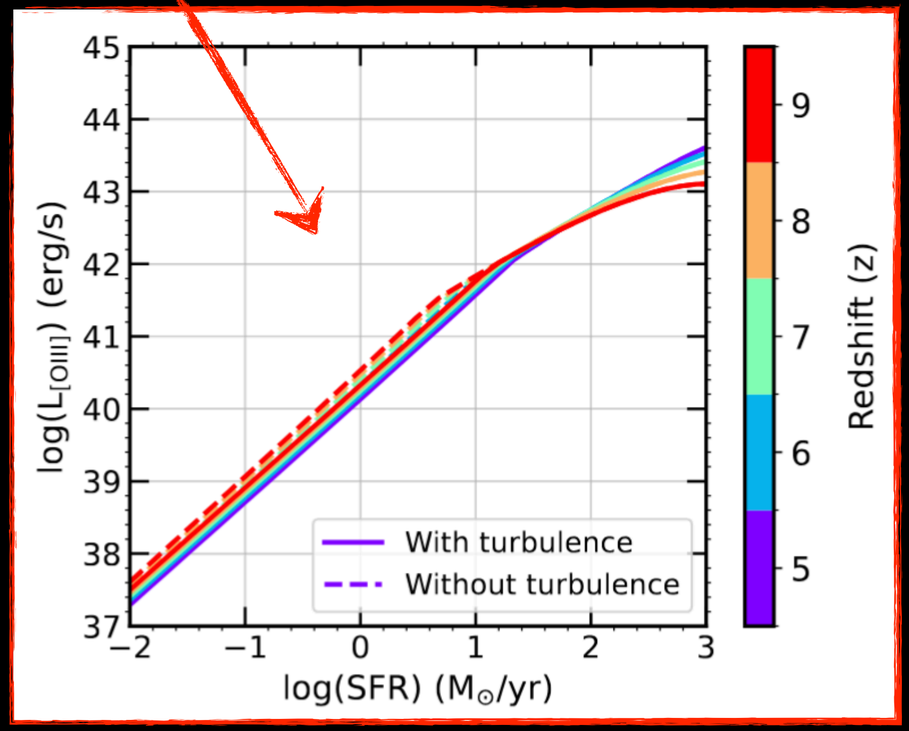

[OIII]/UV variation with UV luminosity

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[OIII]5007 emission line luminosity

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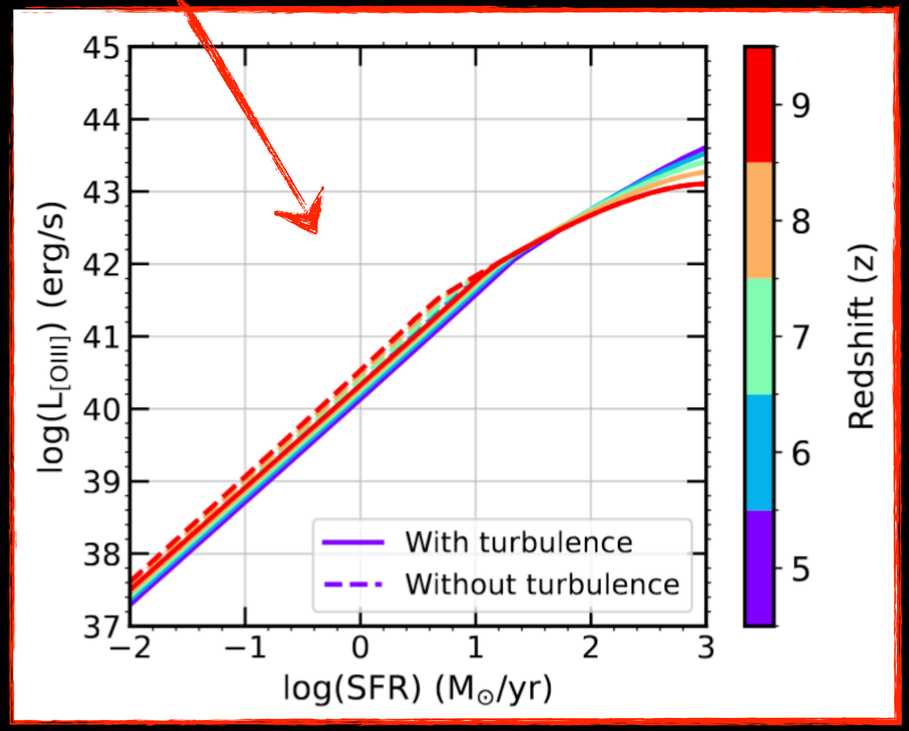

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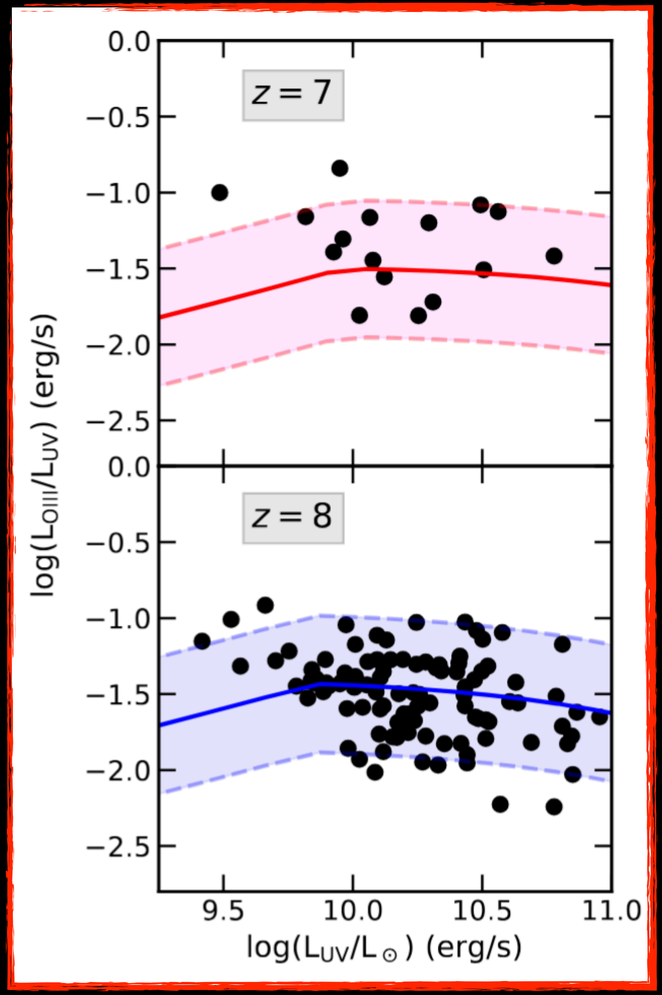

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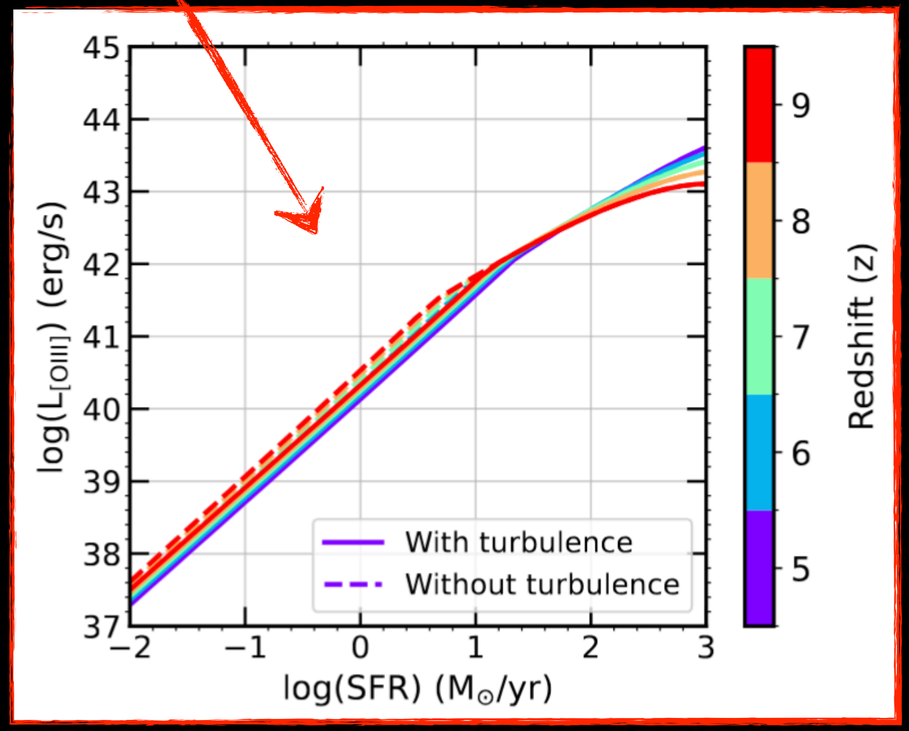

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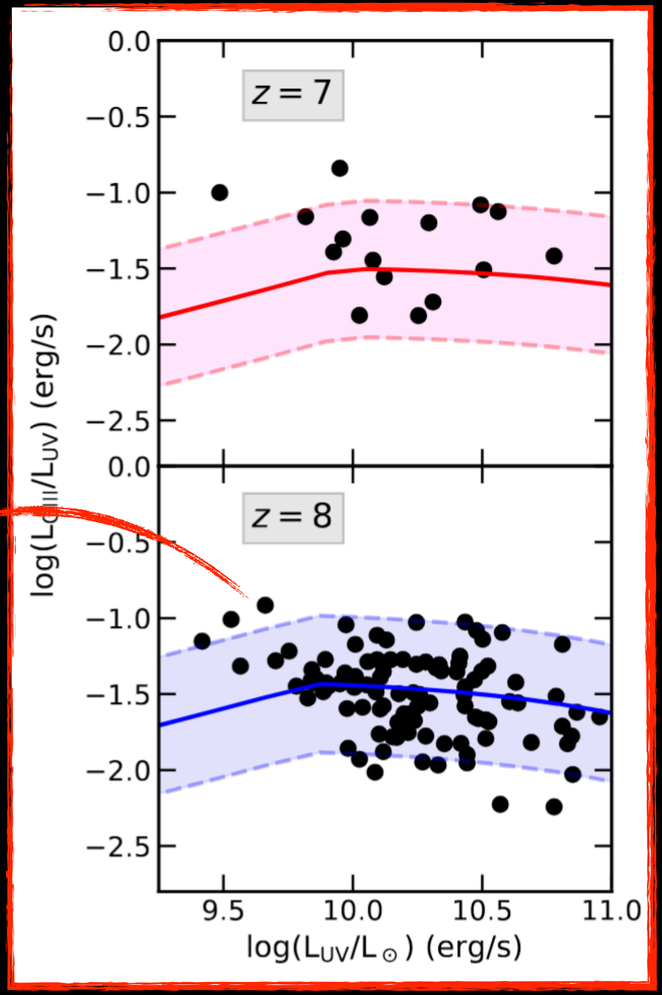

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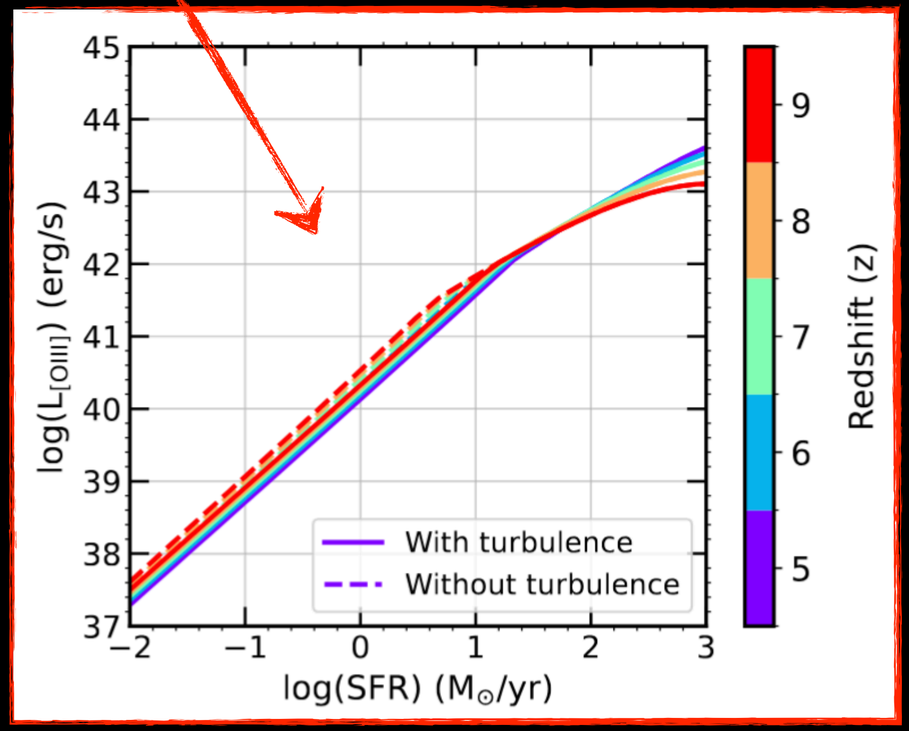

JWST FRESCO survey

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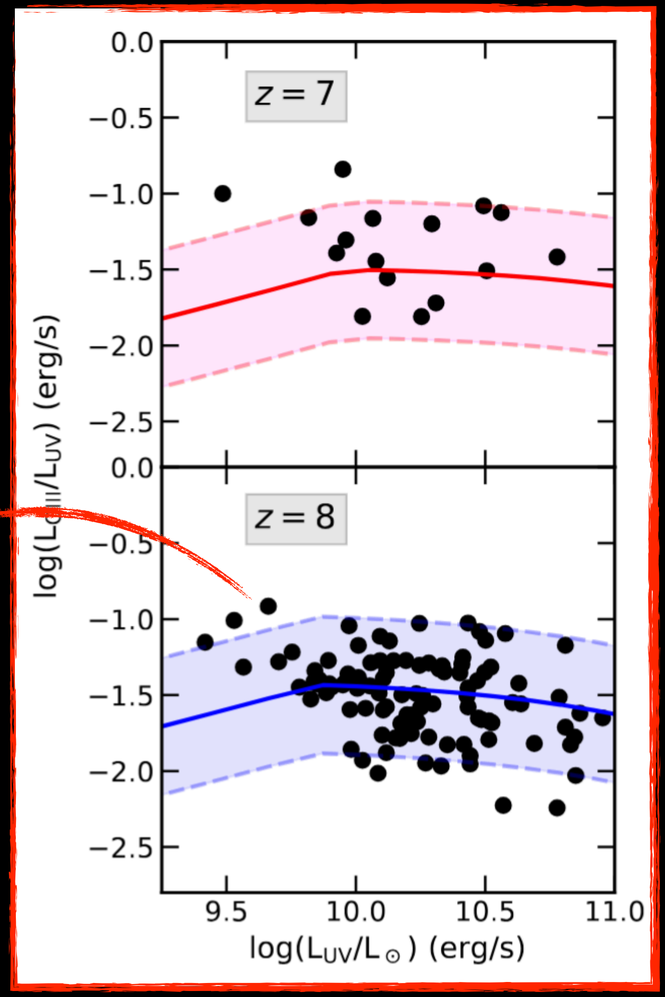

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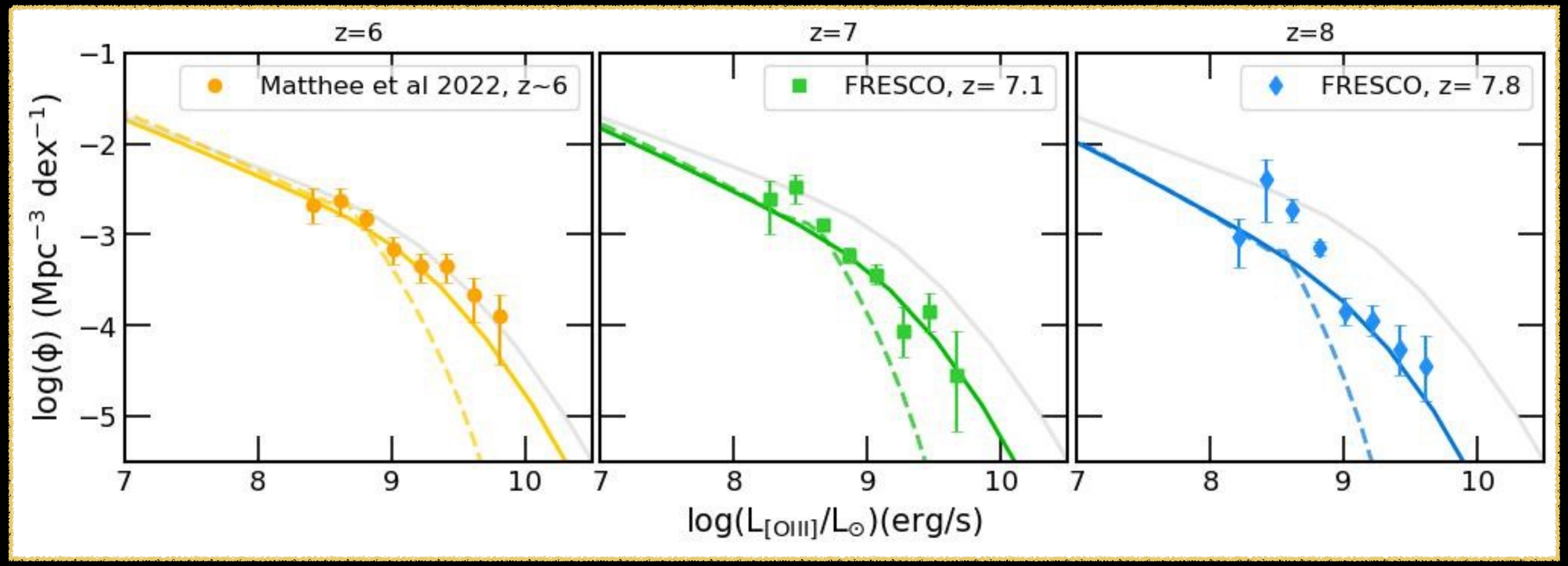

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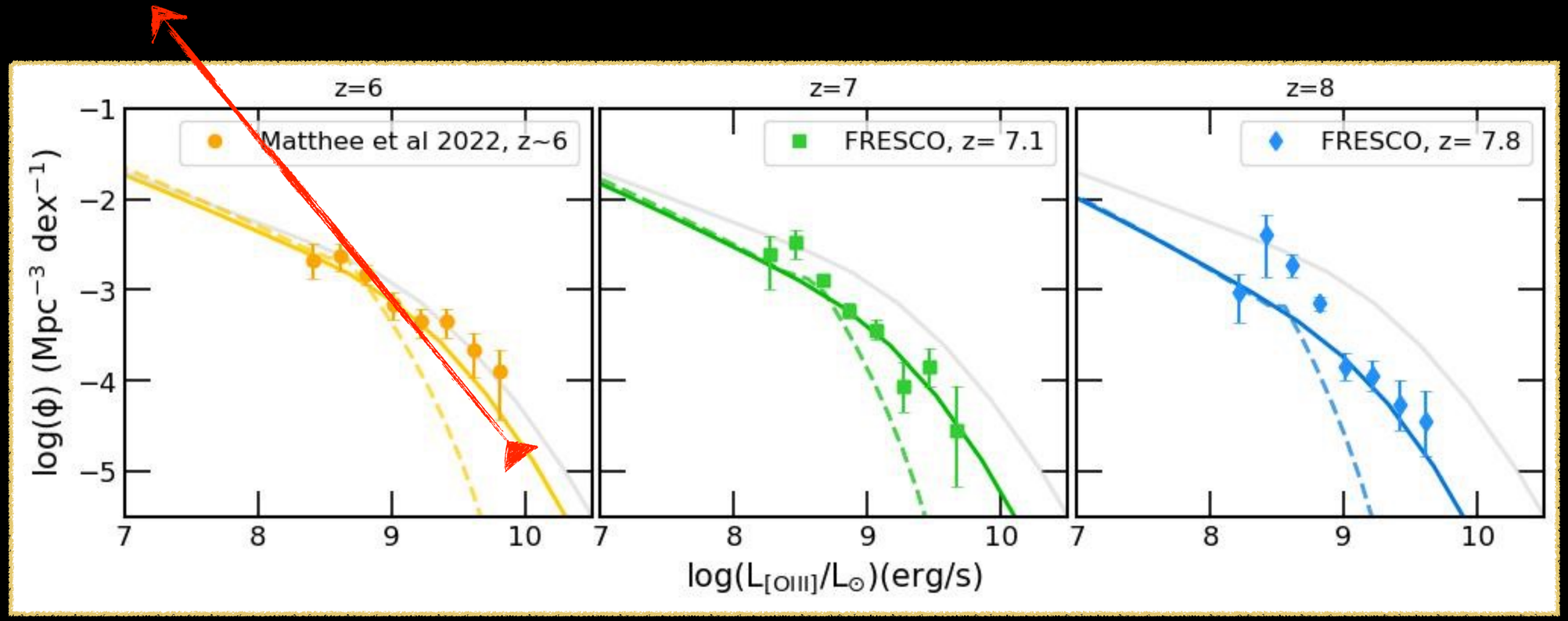
Luminosity Function

Solid lines: LF with 0.45 dex of scatter.

Gives more stepper LF matching with the observations.



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$[OIII]/H_\beta$ *Flux ratio*

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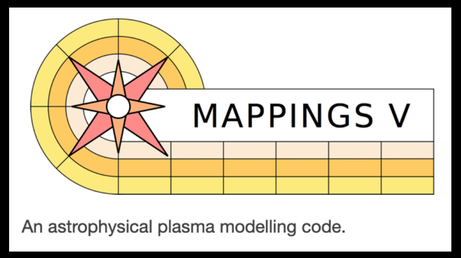

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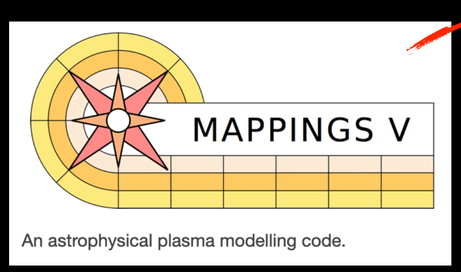

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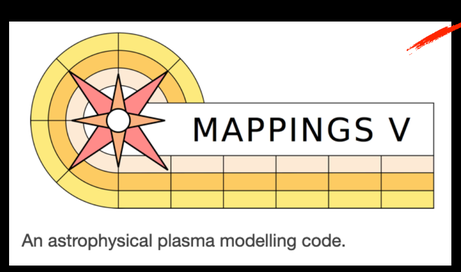

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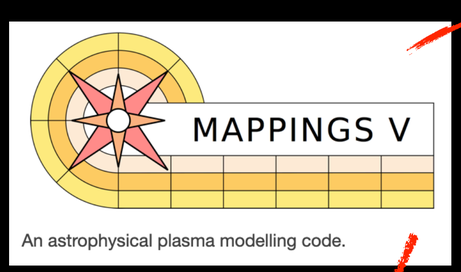

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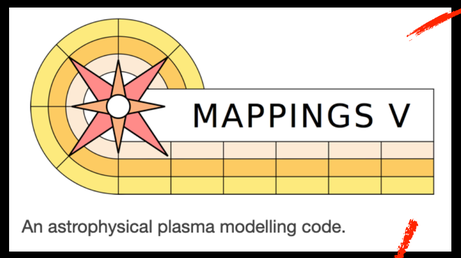

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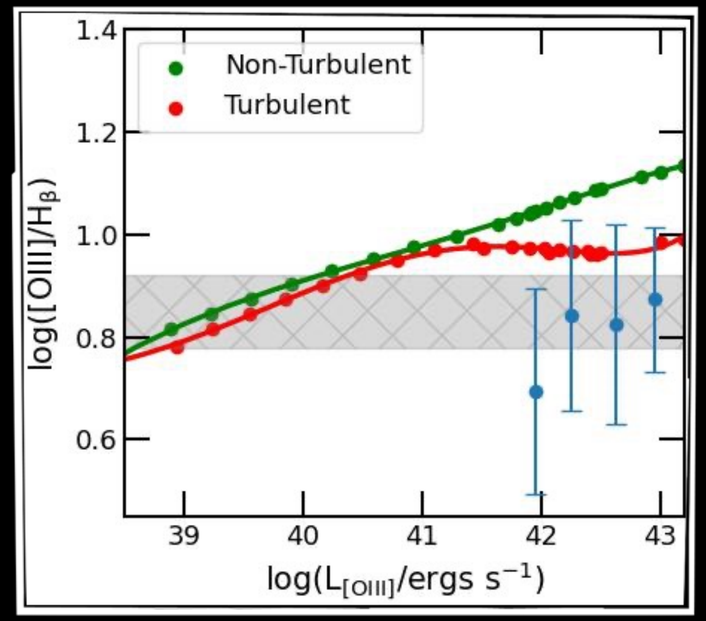

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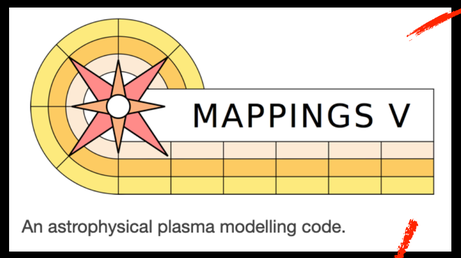

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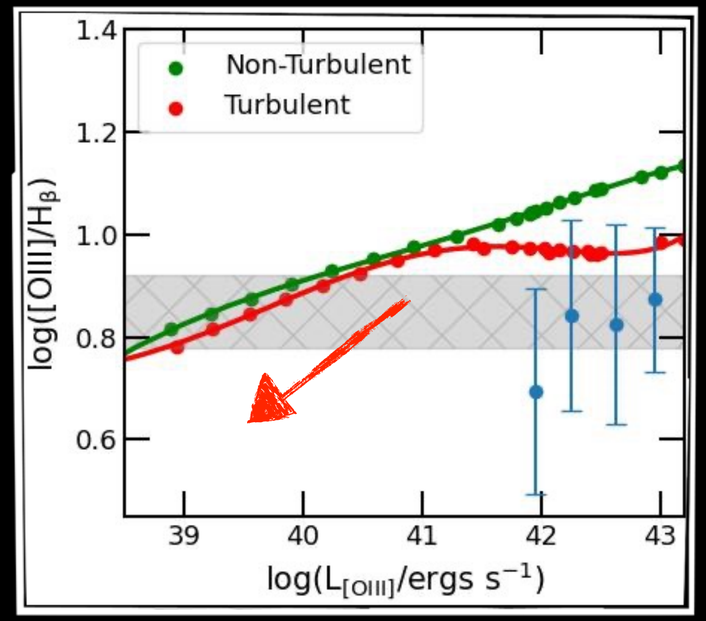

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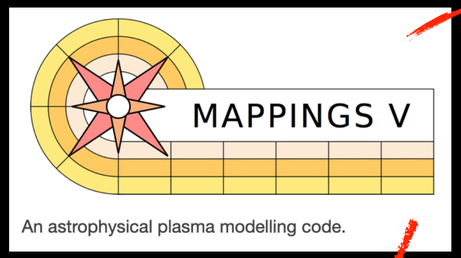

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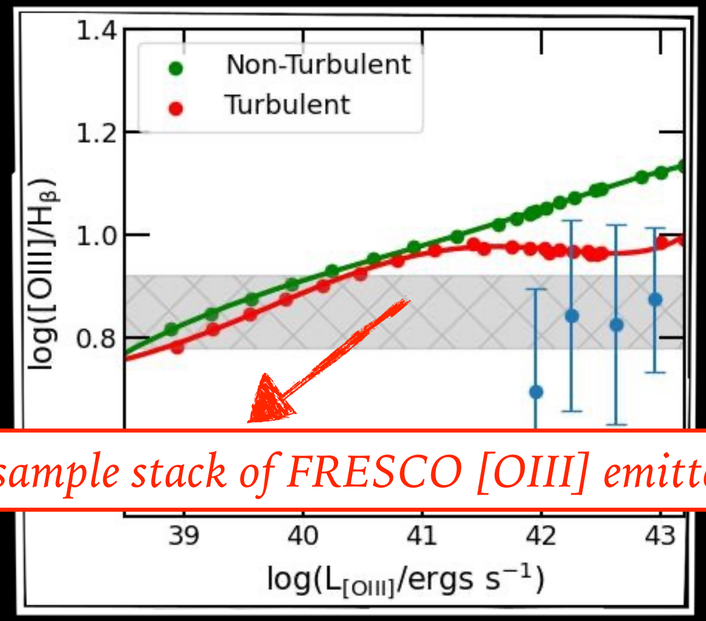

Full sample stack of FRESCO [OIII] emitters

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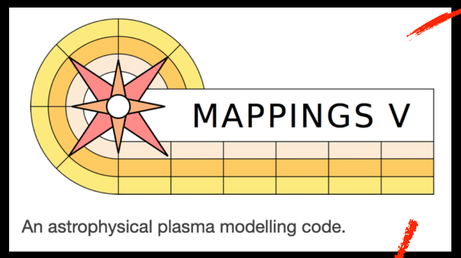

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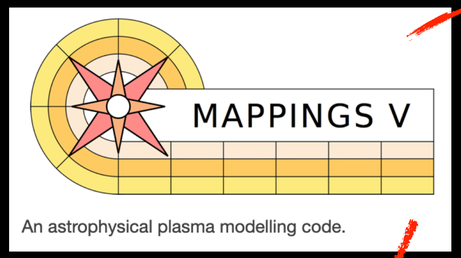

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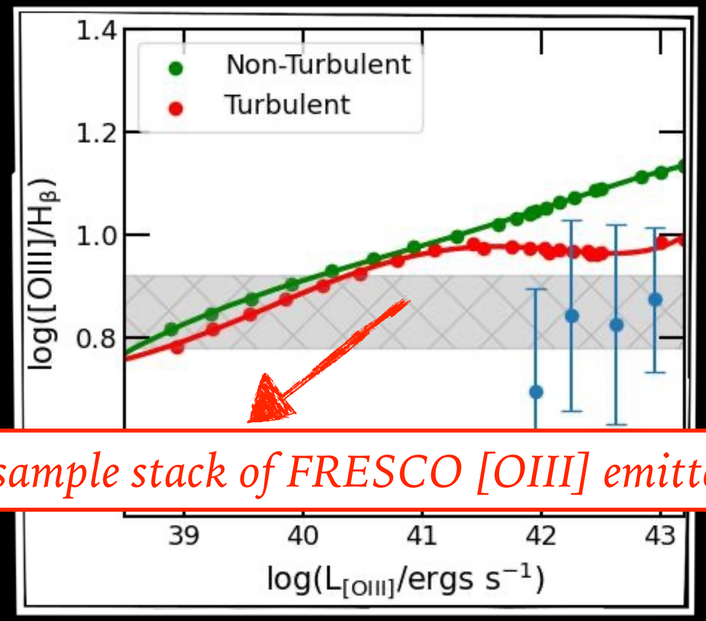

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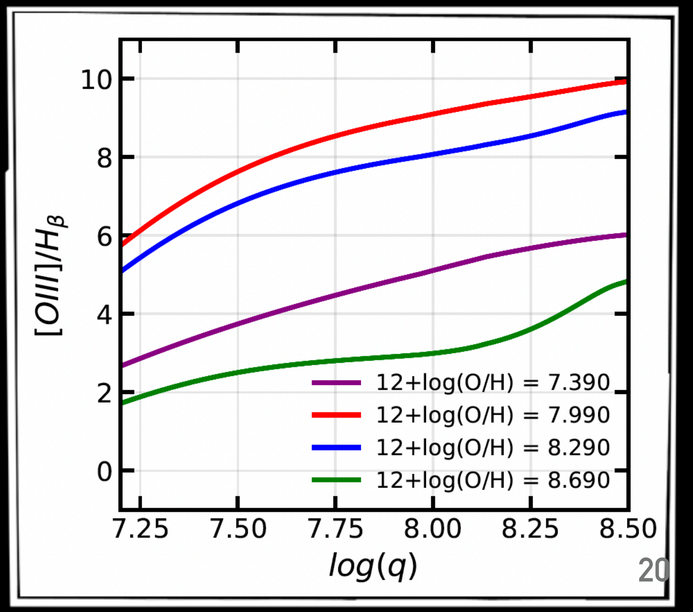

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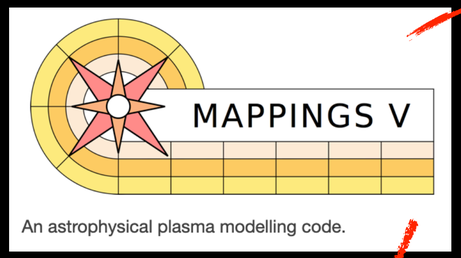

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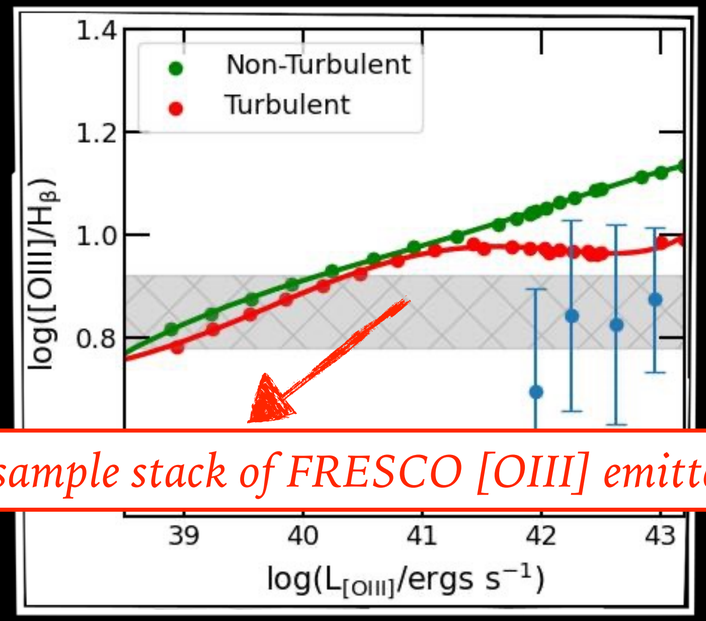

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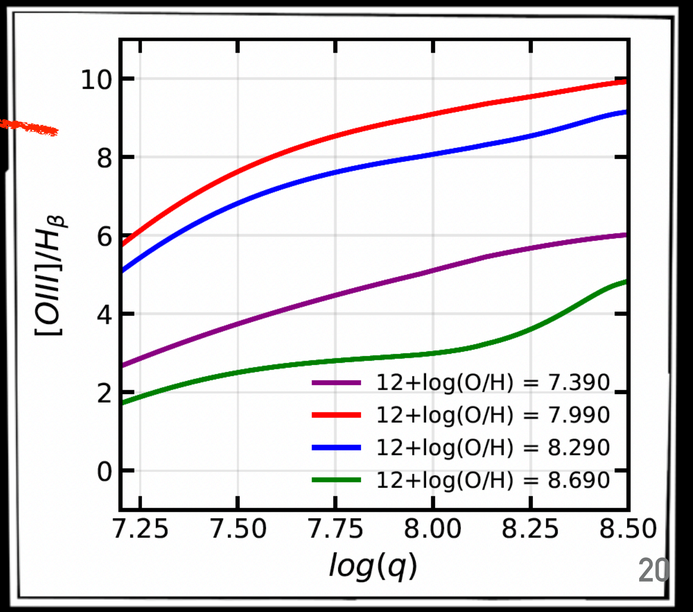

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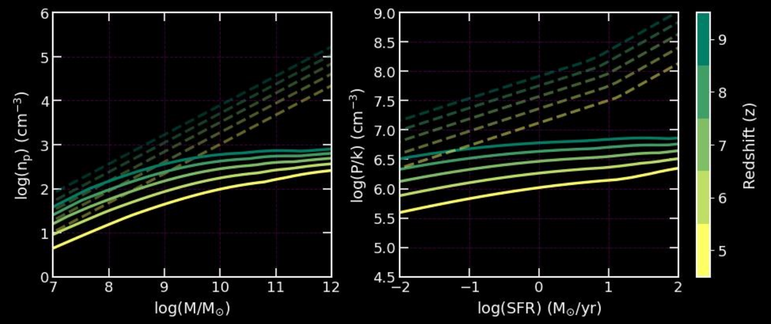

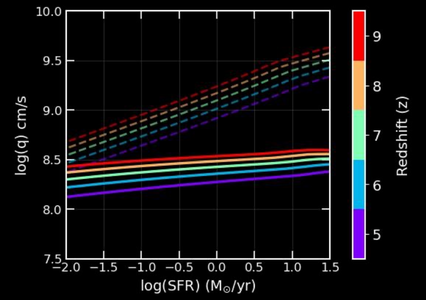

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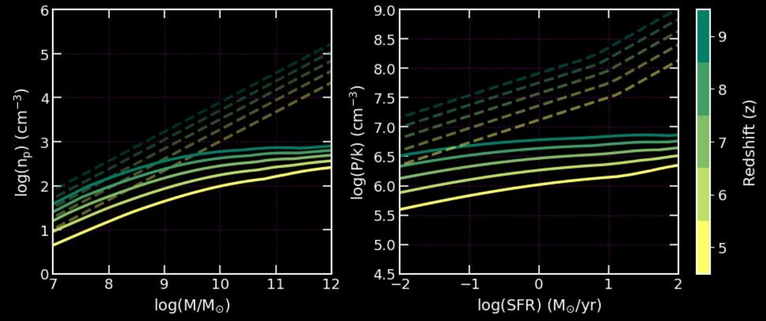

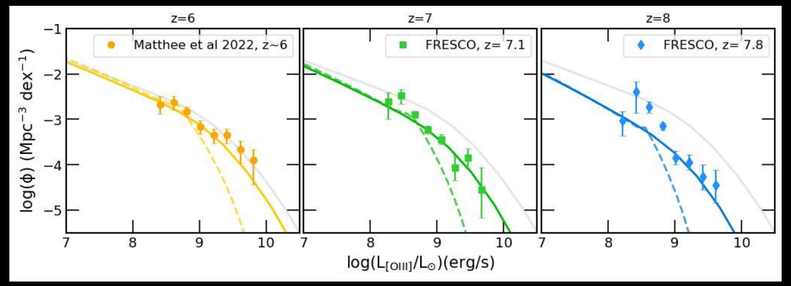

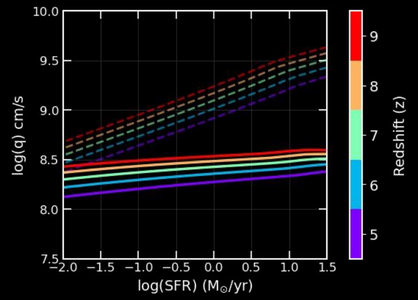

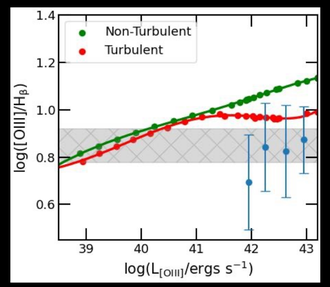

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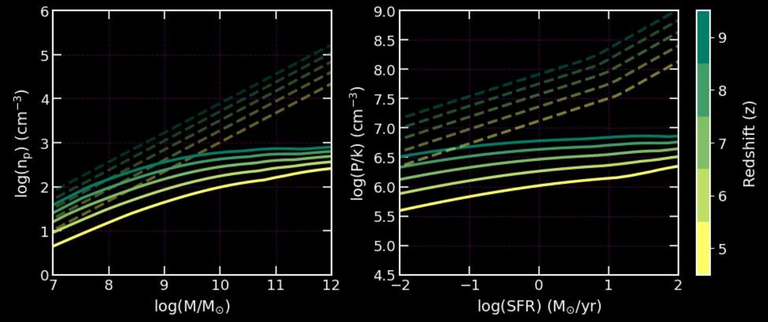

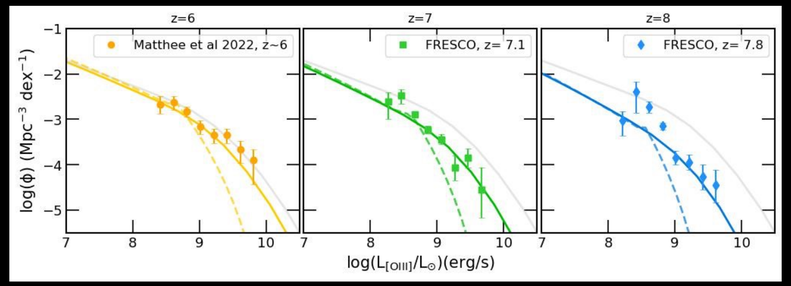

Thank You