Impact of star-formation histories and dust on the selection of quiescent galaxies with JWST/MIRI

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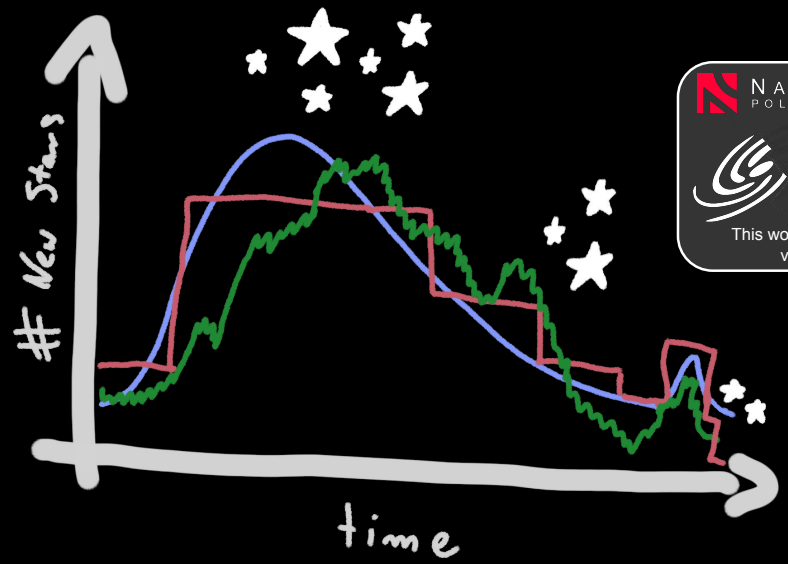


National Science Centre Poland

The Astrophysics Division of National Centre for Nuclear Research

This work is supported by National Science Centre via grant UMO-2023/49/N/ST9/00746

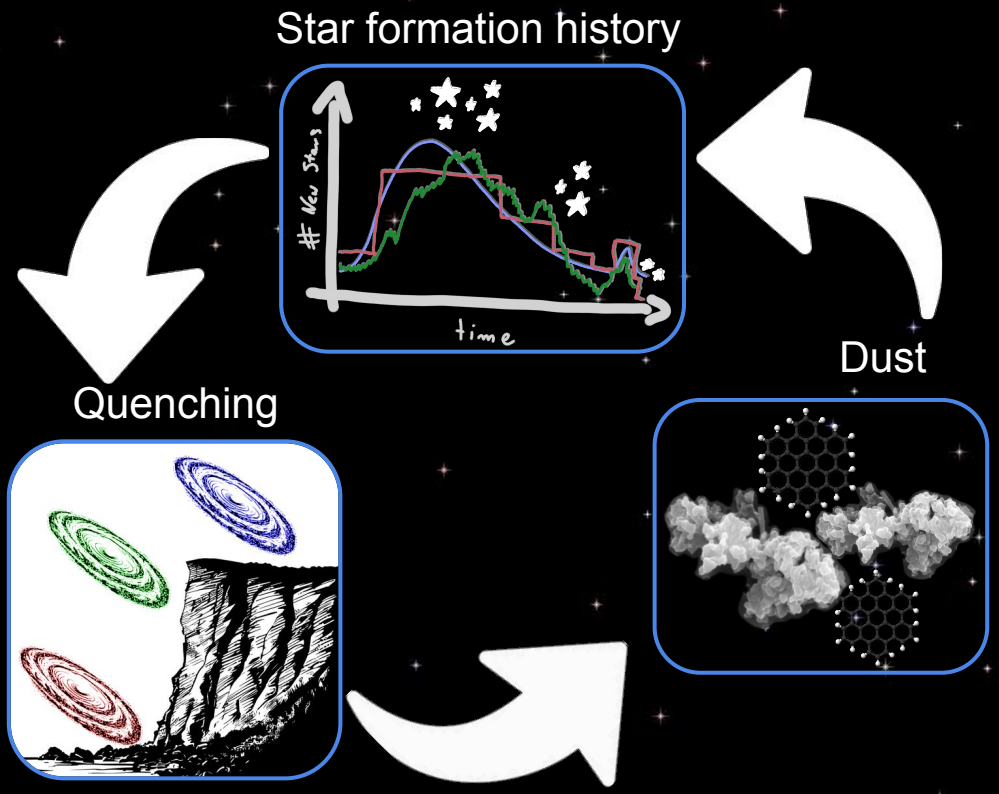
Influence of SFH on physical properties

Current state

- Advances in SFH modelling
- Dusty quiescent galaxies

Our questions

- How does the SFH model influence the physical properties of modeled galaxy?
- When substantial dust in QGs can influence their selection and physical properties?
- Can we constrain the quenching process with studying only the photometry?



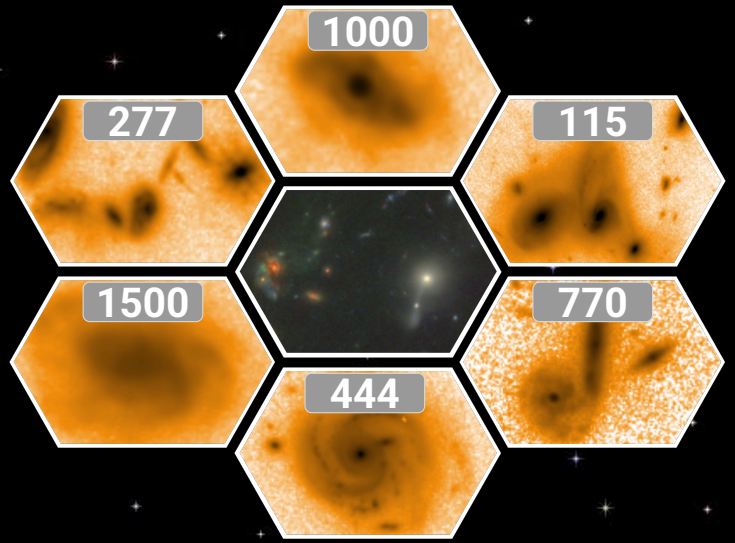
Modeling galaxies props with diverse SFH implementation

Aim & method

I implemented different SFH models **[NonParametric and Regulator]** in CIGALE code to examine selection of QG candidates with and without dust models.

Data

I use HST and JWST (NIRCam and MIRI) photometry within the CEERS field to model SEDs of 5 thousand galaxies.



Why do we test MIRI?

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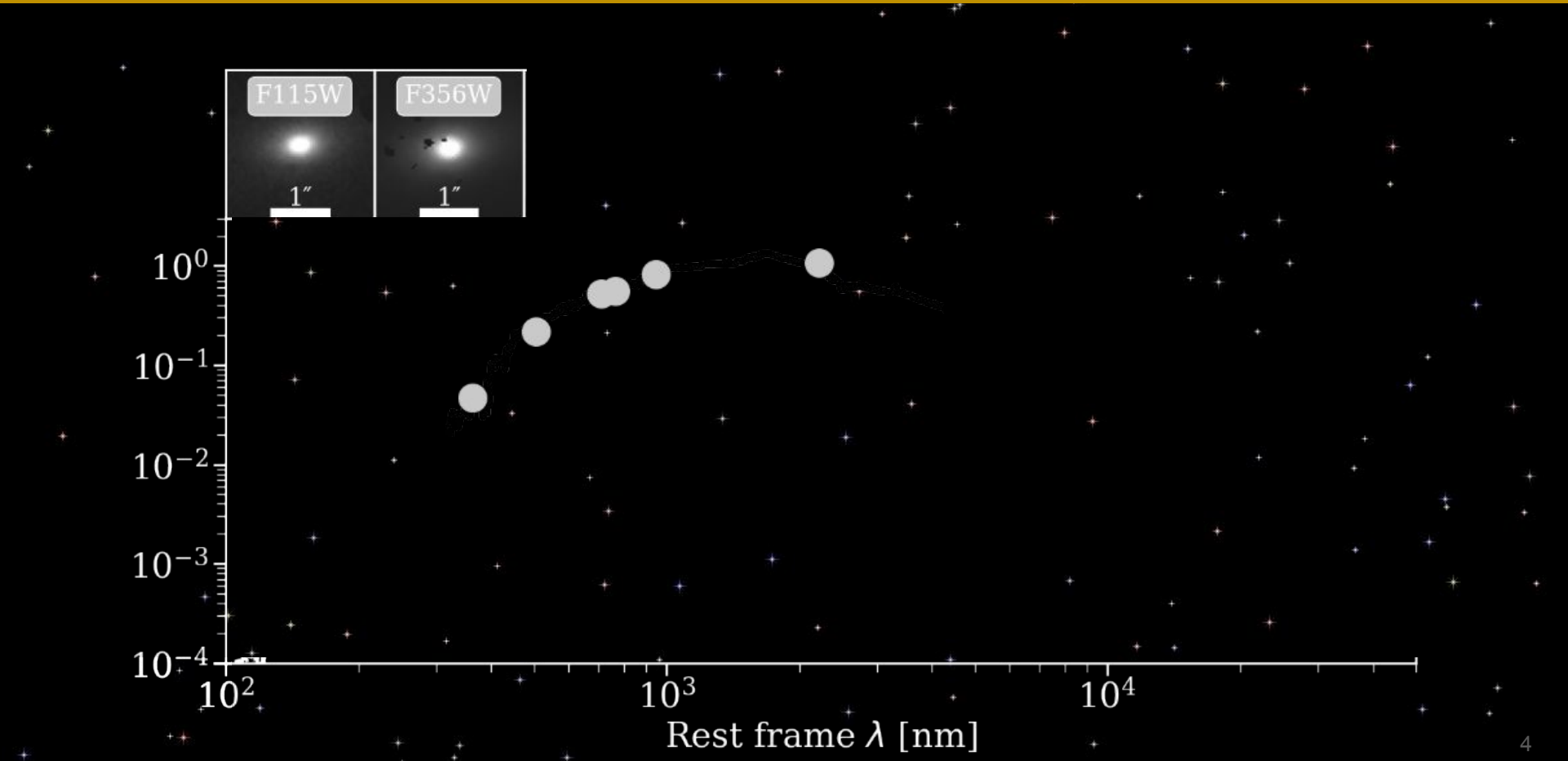

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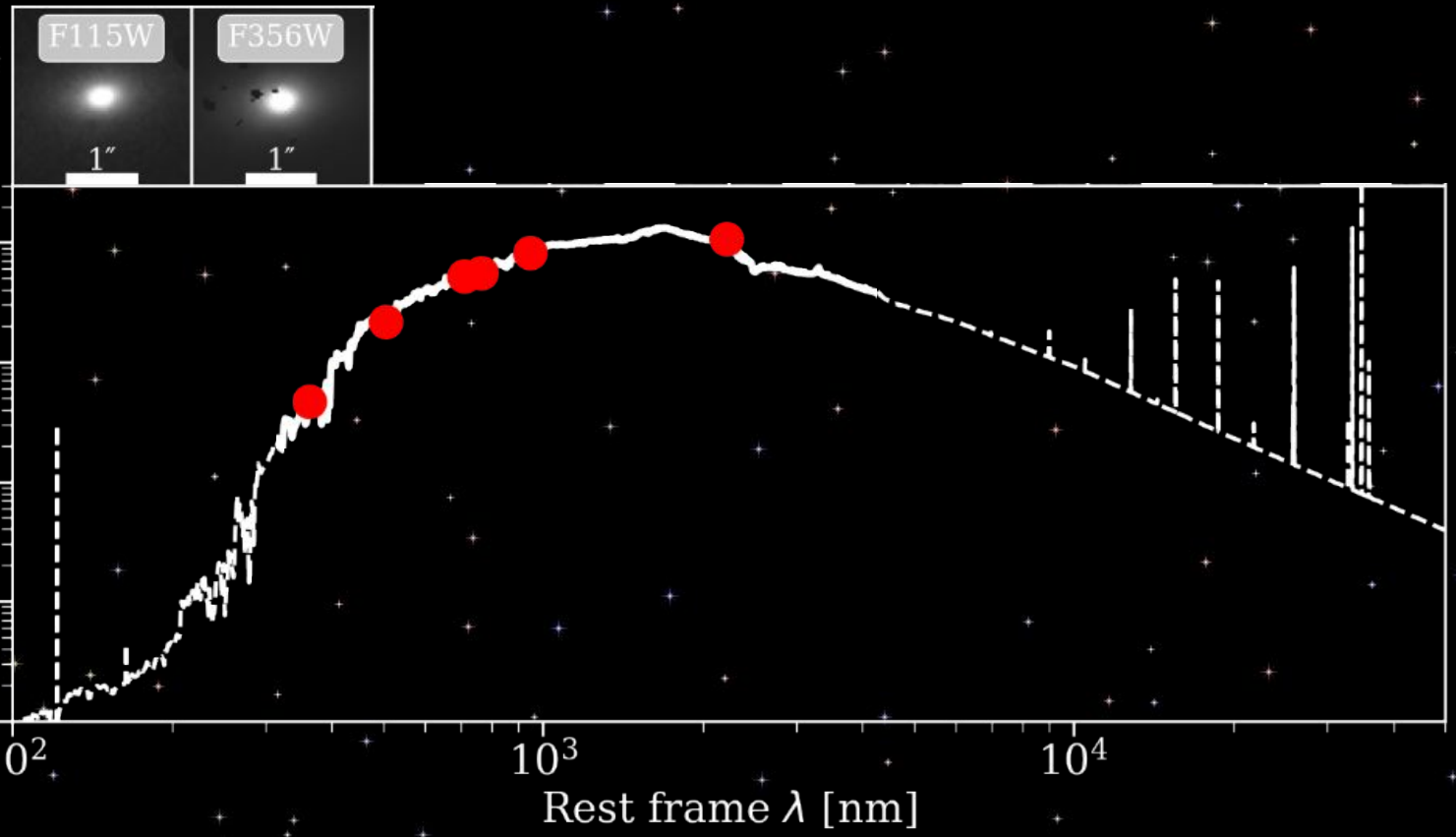

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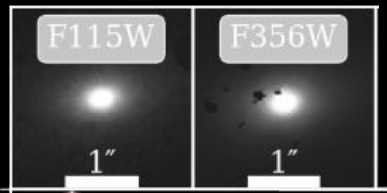
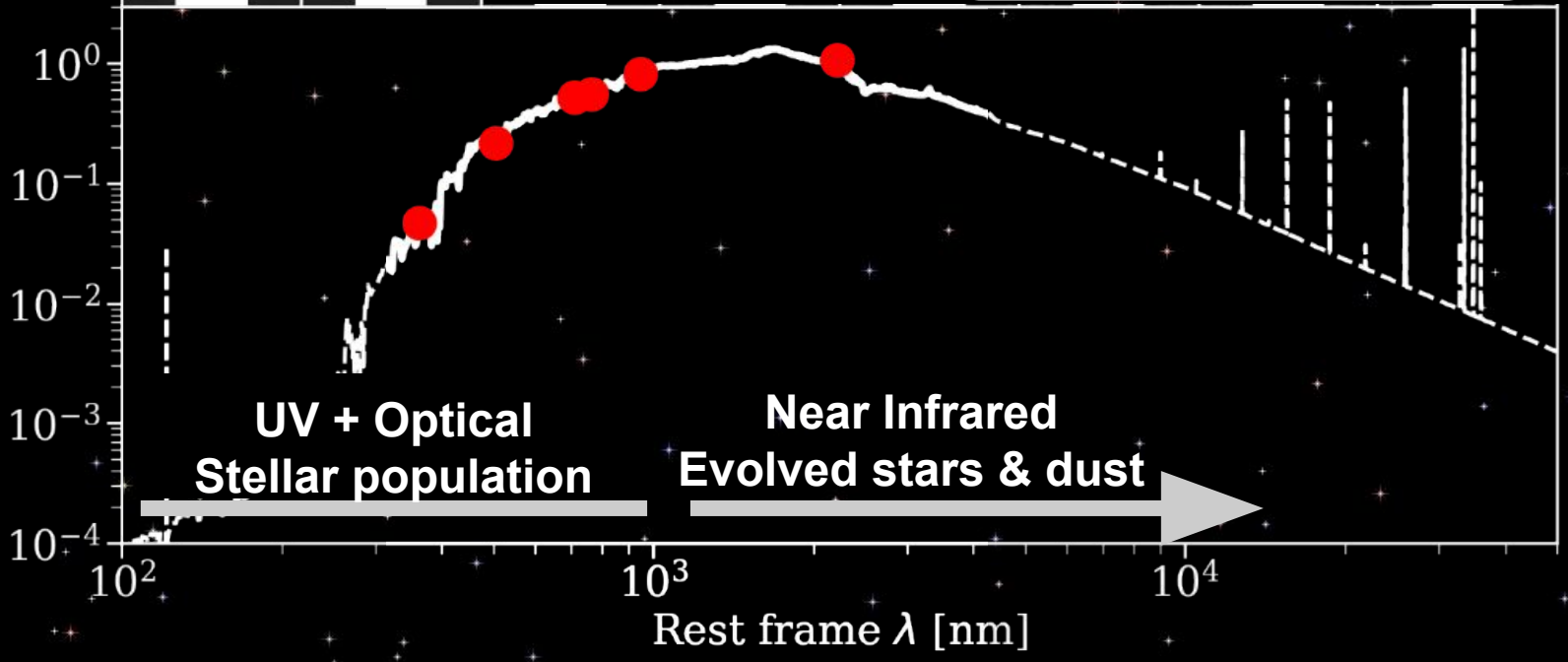
Age-dust degeneracy
Is red galaxy red due to being dusty or due to being old? Or both?





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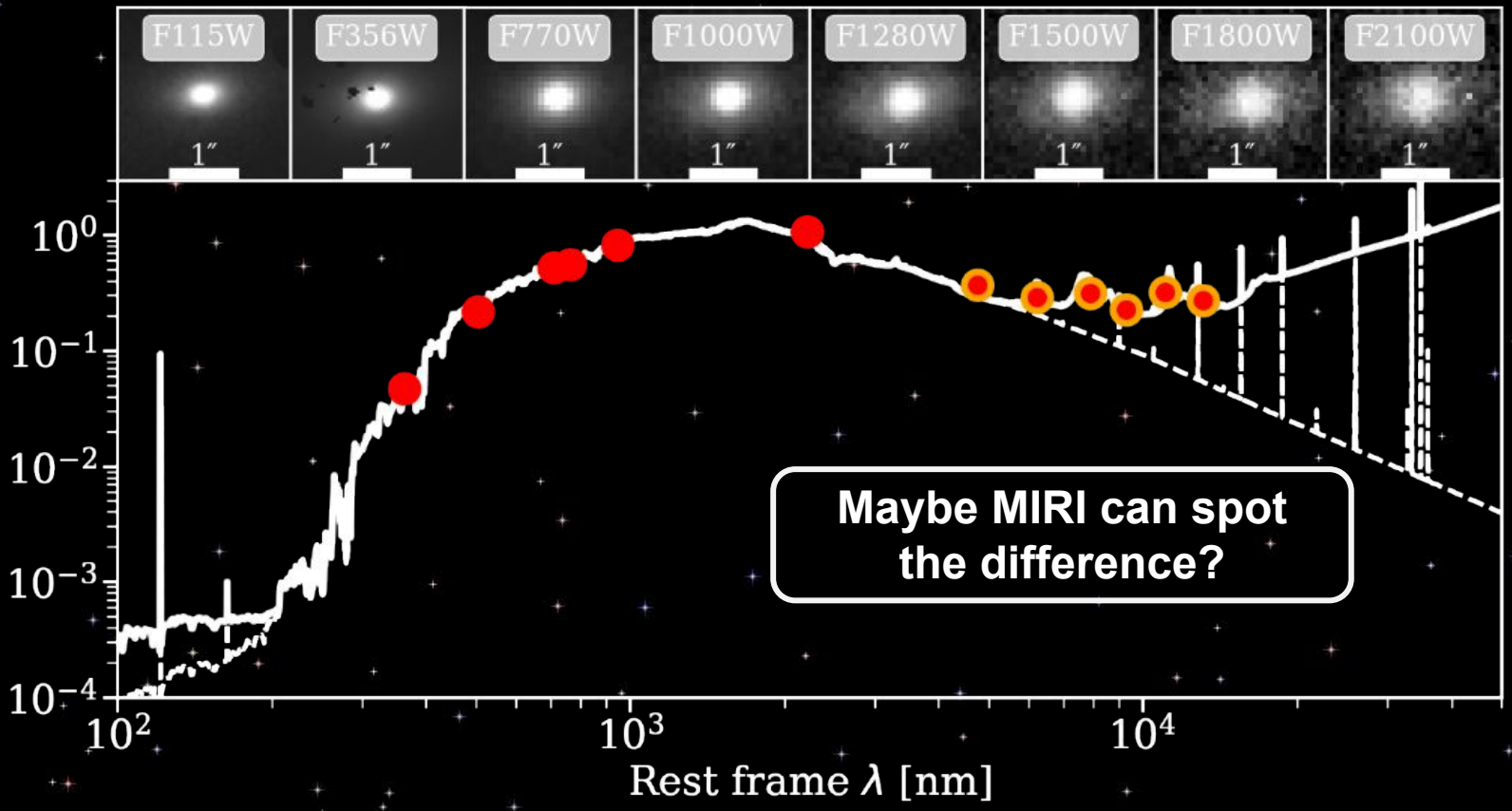

Selection of quiescent sources

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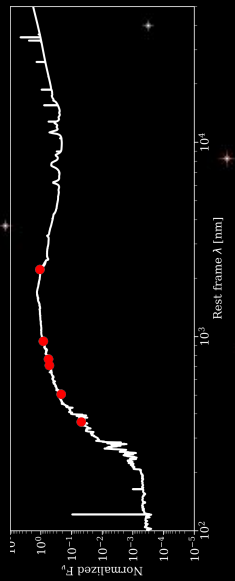
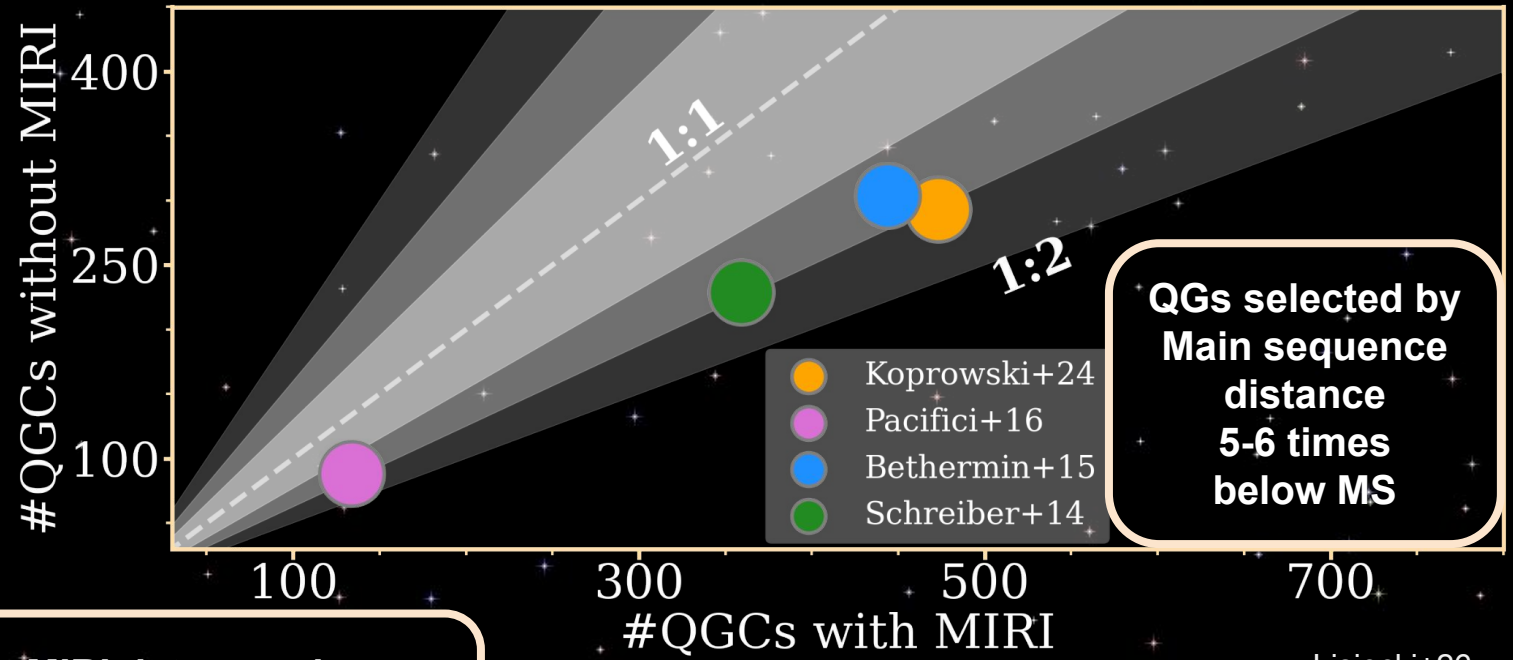
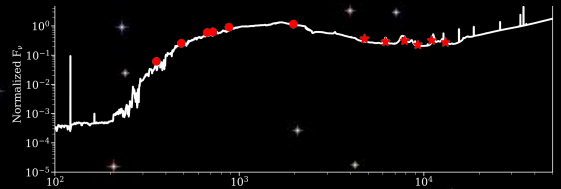




QGs selected by Main sequence distance 5-6 times below MS

Interestingly, with MIRI data, we always find more QGs, than when we fit SED without MIRI!



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Selection of quiescent sources

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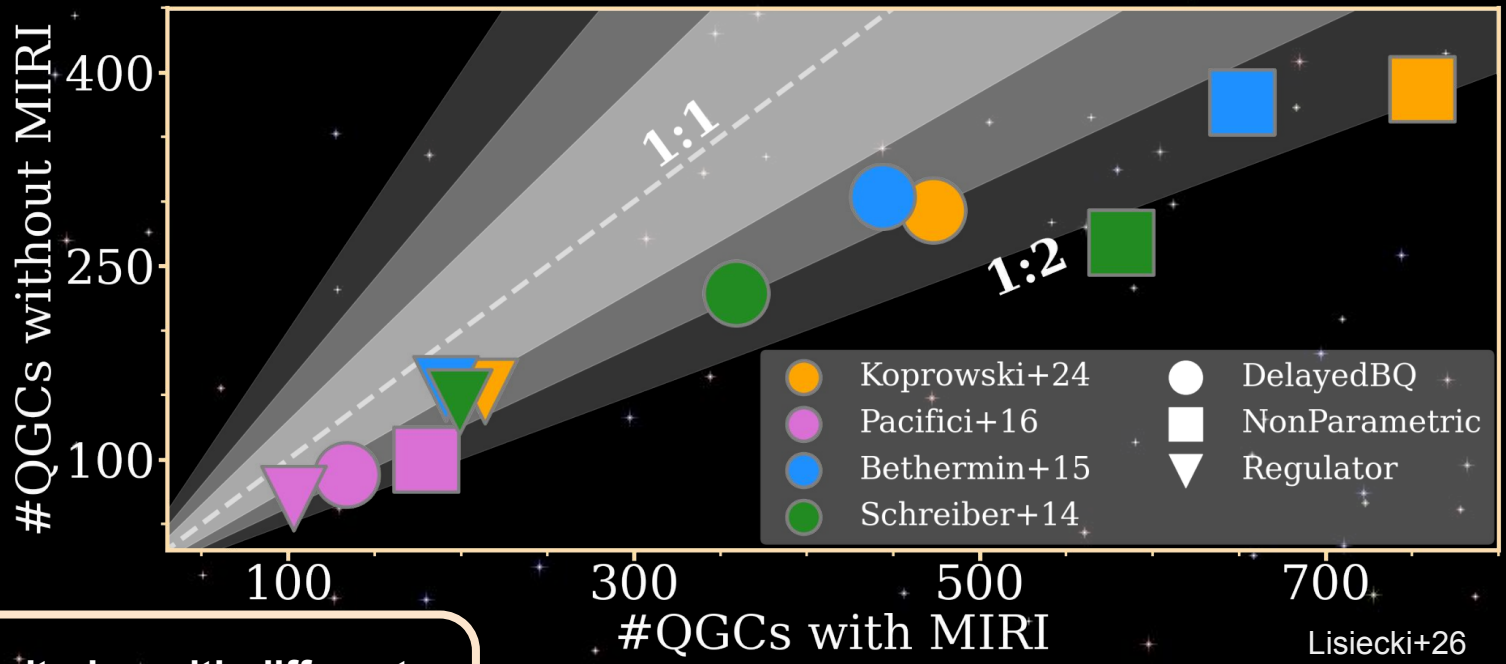
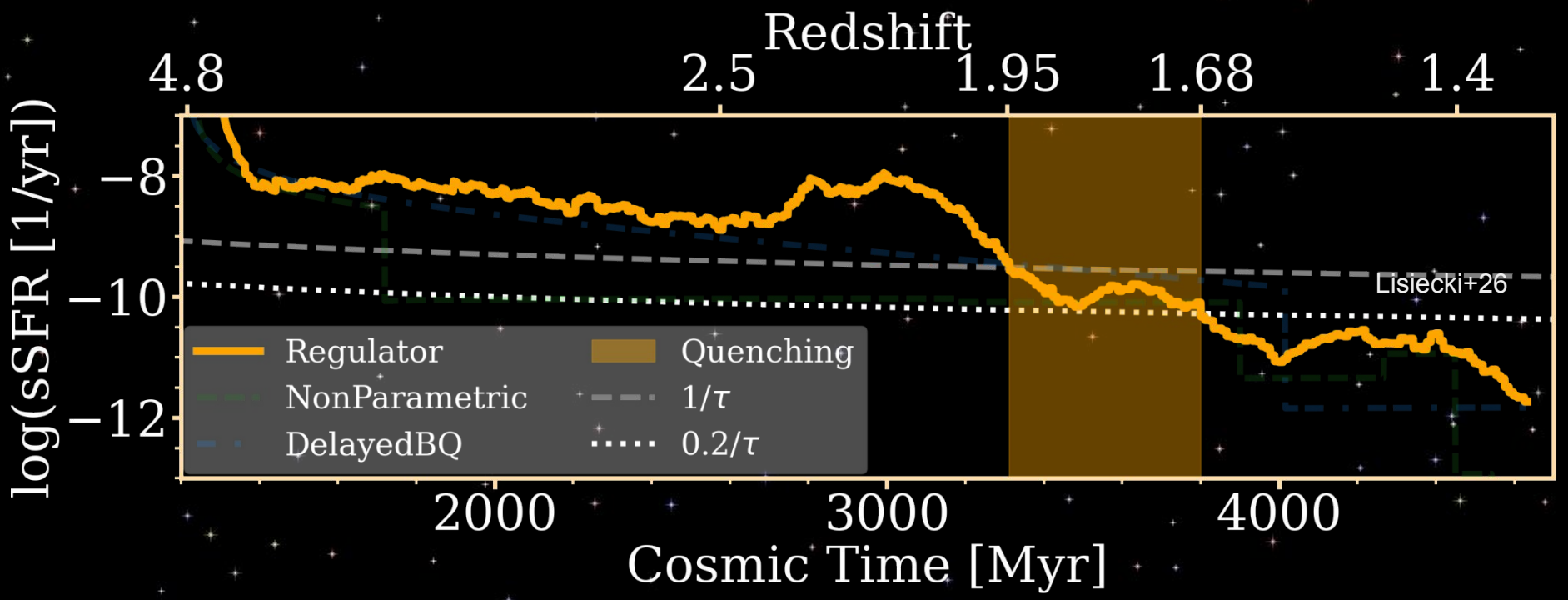
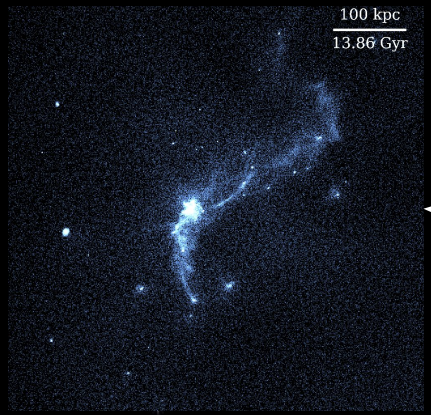


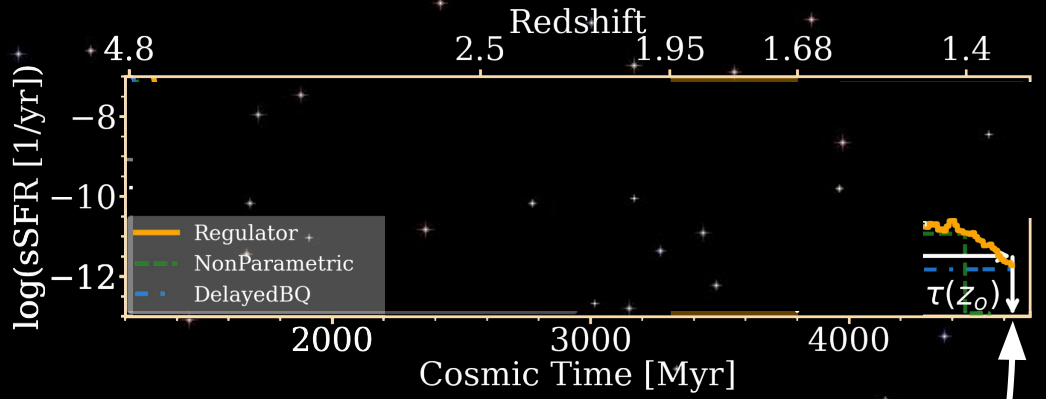
Using the same criterion with different SFH model can lead to ~3 times more/less QGs!

Star formation histories



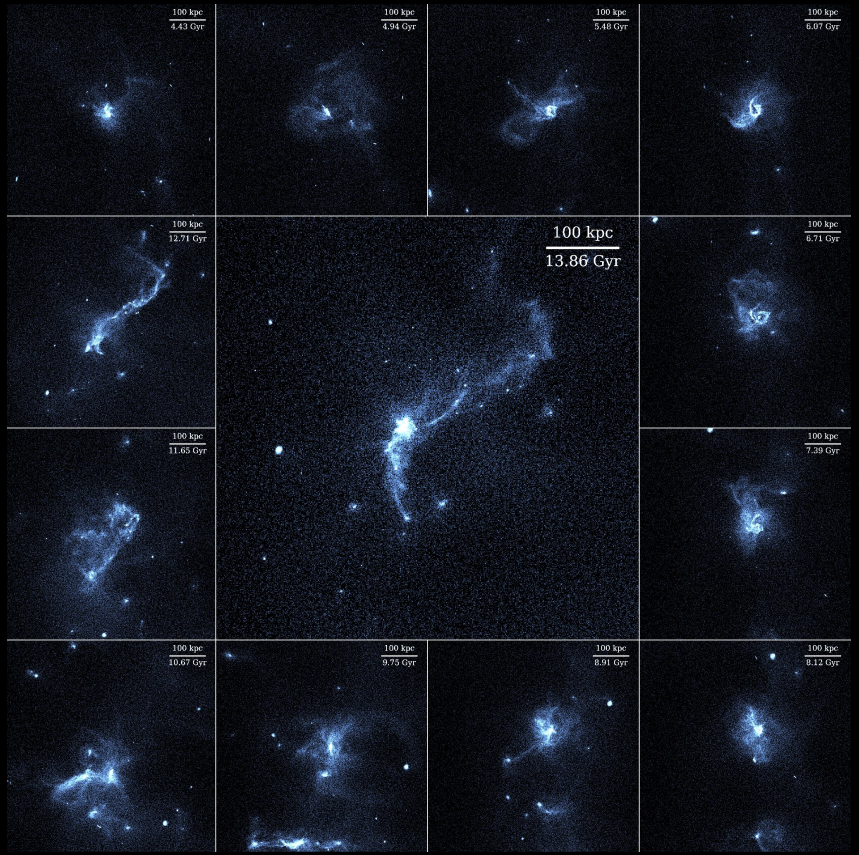
Star formation histories



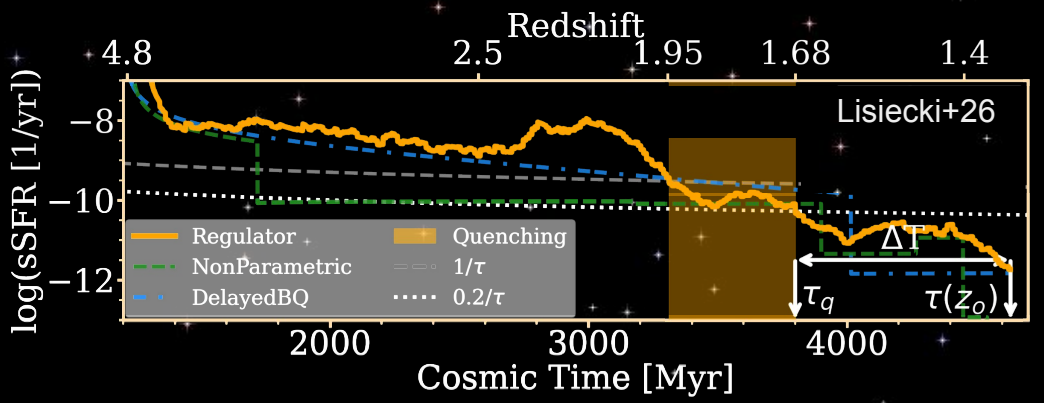


Current observation = current state
How do we extrapolate?

Star formation histories

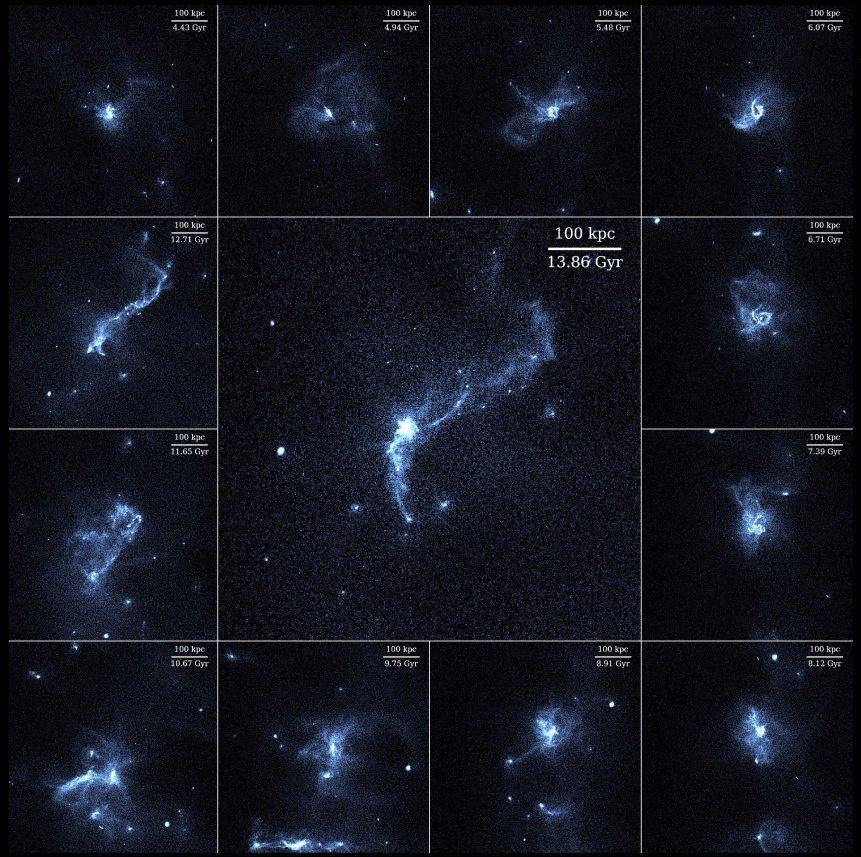


Evolution of group of galaxies, SIMBA simulation



We can model SFH by looking for specific observational features: D4000, emission/absorption lines, etc.

Star formation histories



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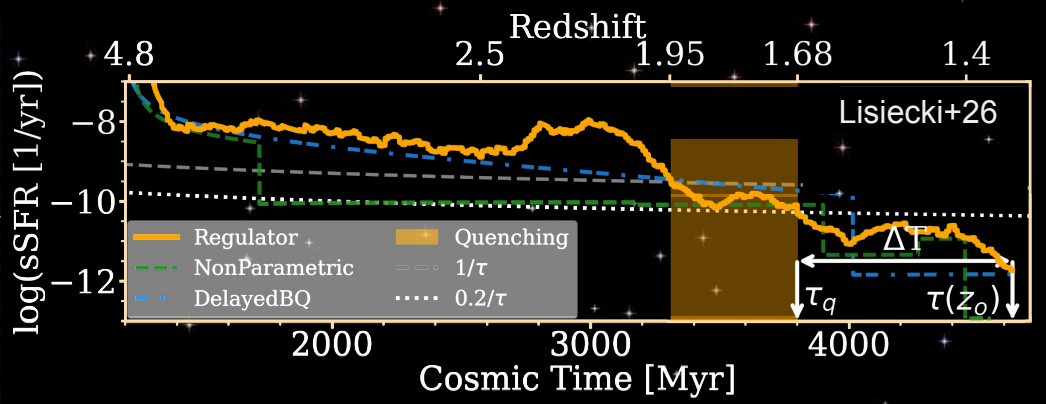
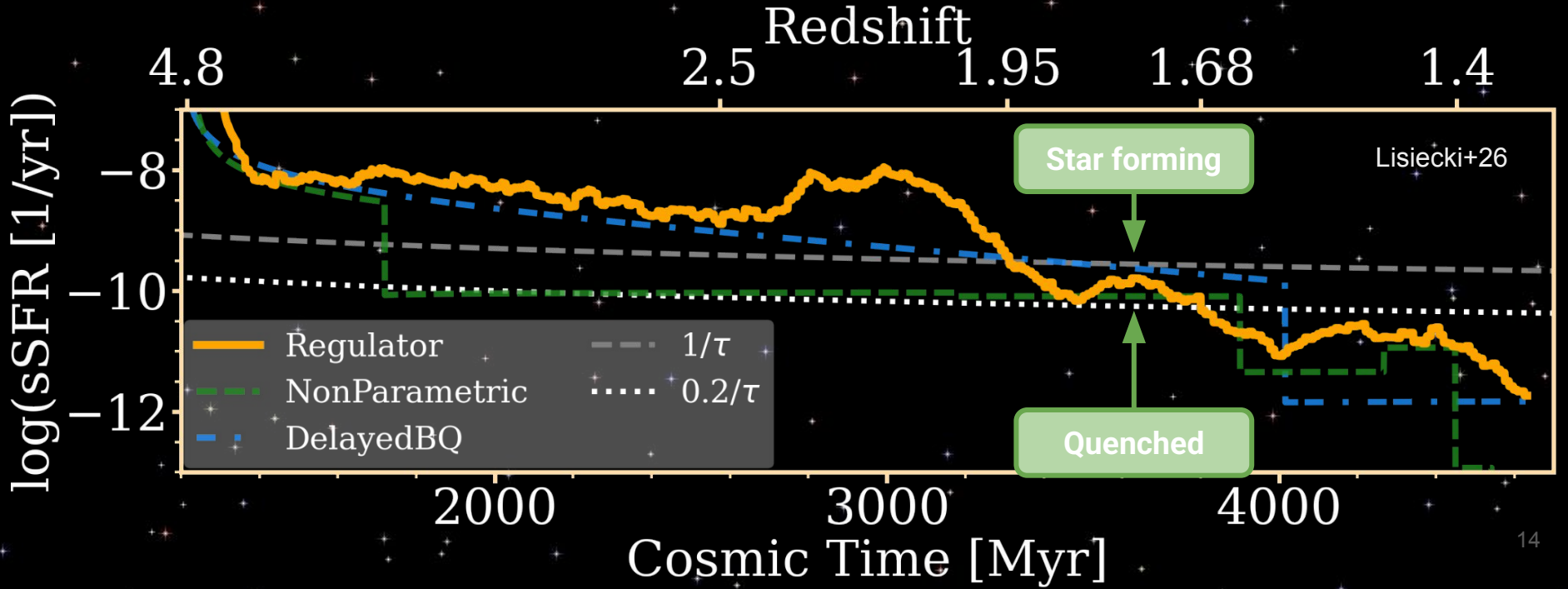


We can model SFH by looking for specific observational features: D4000, emission/absorption lines, etc.

But how much can we achieve with SFH based solely on photometry?

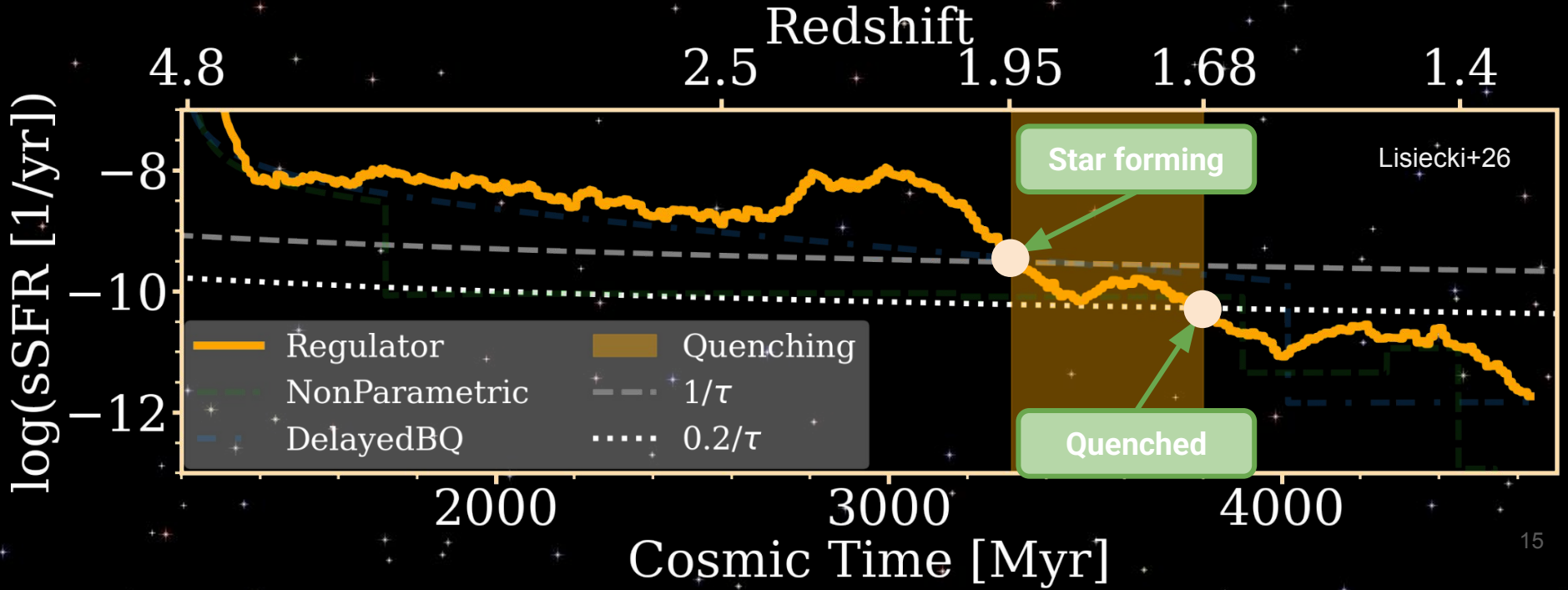
Star formation histories

Comparison of tree specific SFHs for a QG candidate, constrained with CEERS photometry only. DelayedBQ is flexible delayed with instant quenching [Ciesla+21]; NonParam [Carnall+18, Leja+19]; Regulator [Tacchella+20]



Star formation histories

With use of SFH we can study the quenching process.

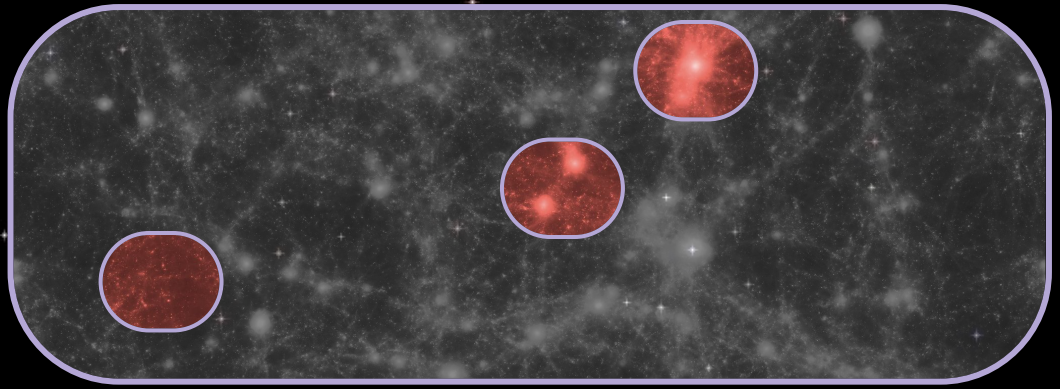


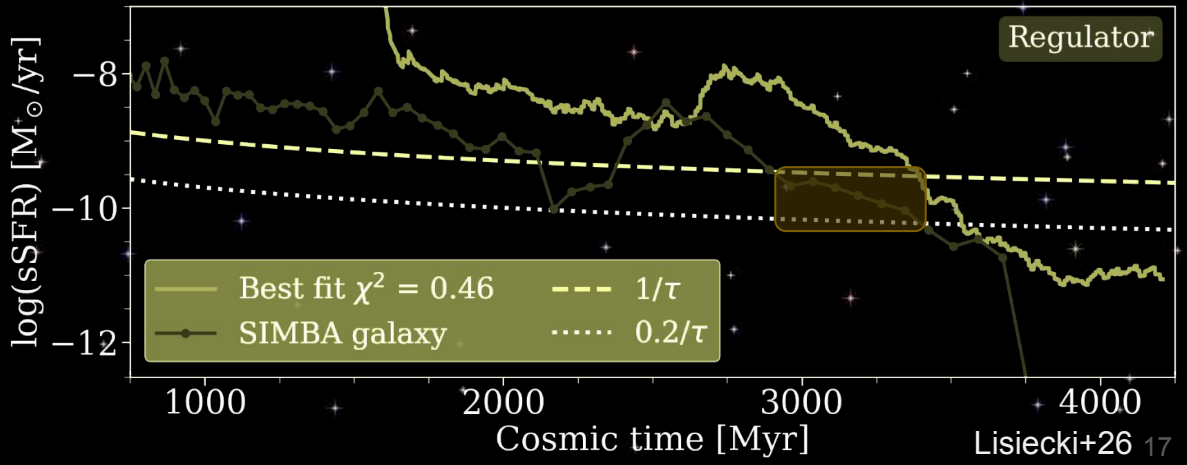
Star formation histories

With use of SFH we can study the quenching process.
And its corresponding timescales!

Can we trust our quenching timescales? Insight from SIMBA

Combining SIMBA and SED fitting results, I report the quenching time cannot be constrained with photometry only…





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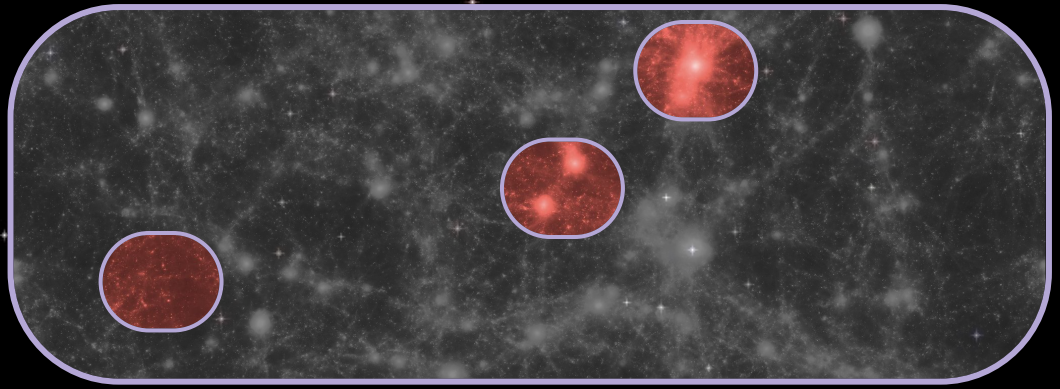
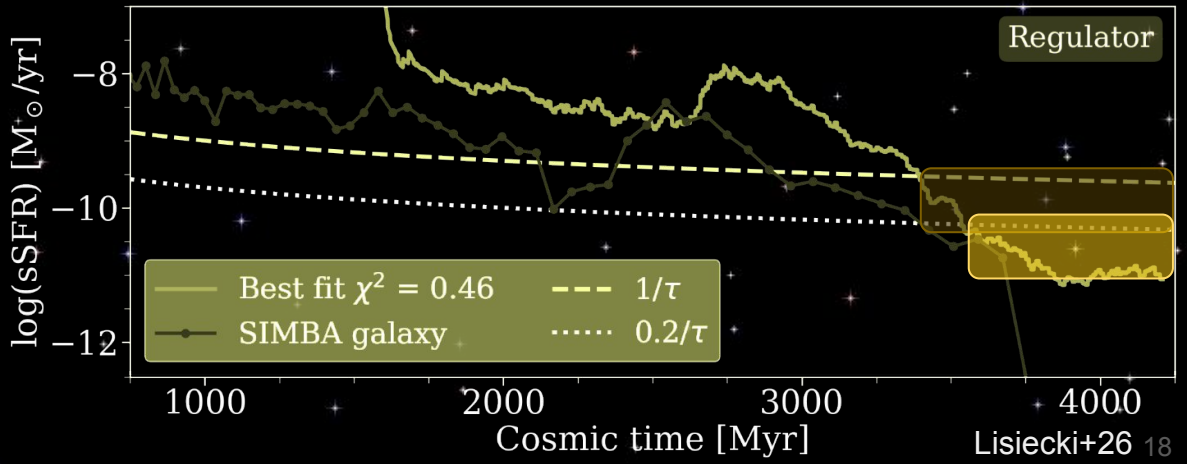
Can we trust our quenching timescales? Insight from SIMBA

Combining SIMBA and SED fitting results, we report the quenching time cannot be constrained with photometry only…

But time since quenching can! (up to ± 30% accuracy)





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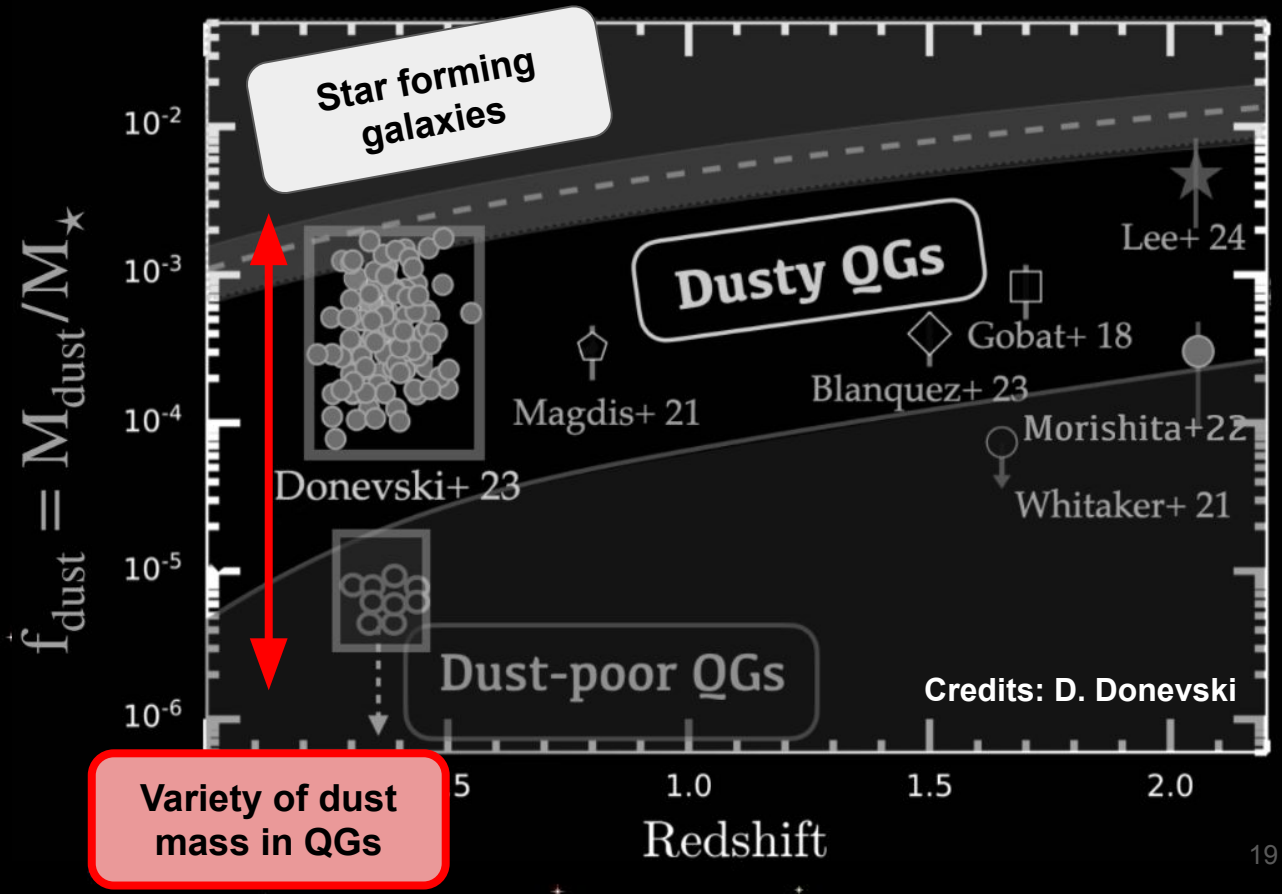
Dust in quiescent galaxies

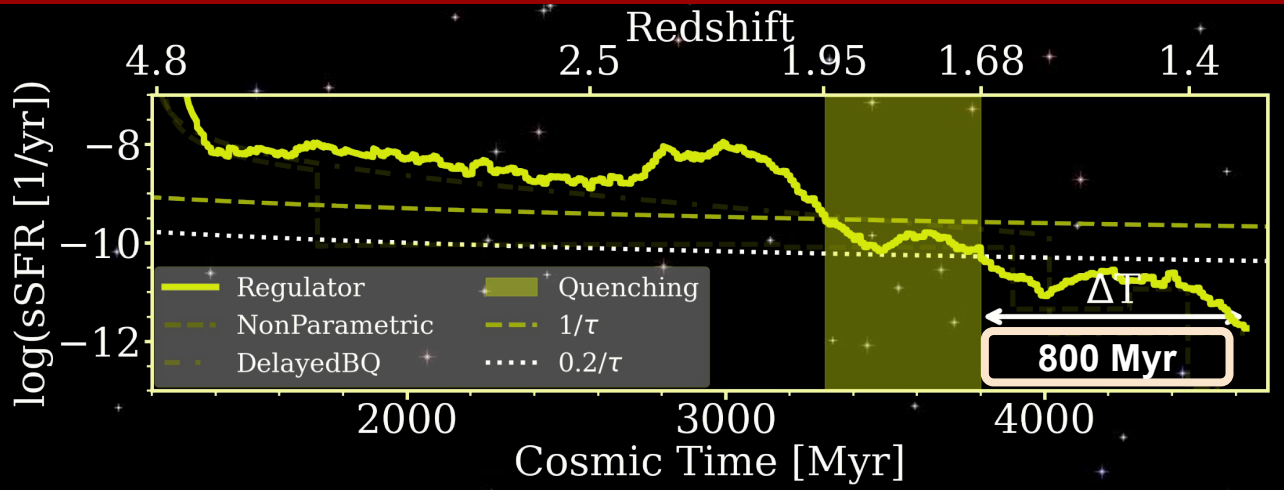
Recent studies (including Lorenzon 25a,b) show there is non-negligible population of dusty QGs!

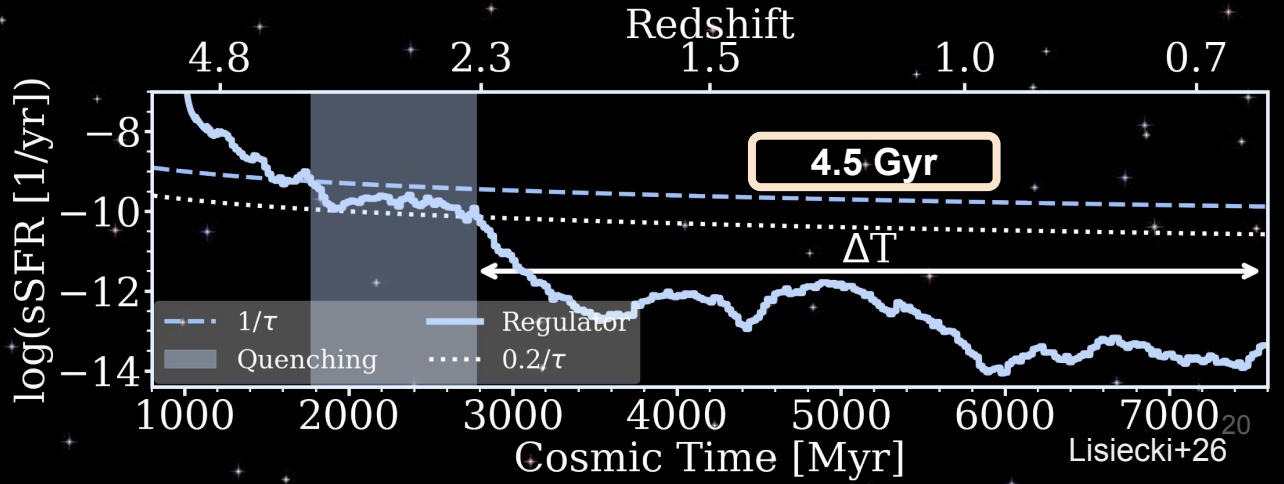


Mature vs immature QGs

How does dust attenuation changes with time since quenching?

Classically, since dust should be removed or destroyed, the attenuation should drop after quenching.





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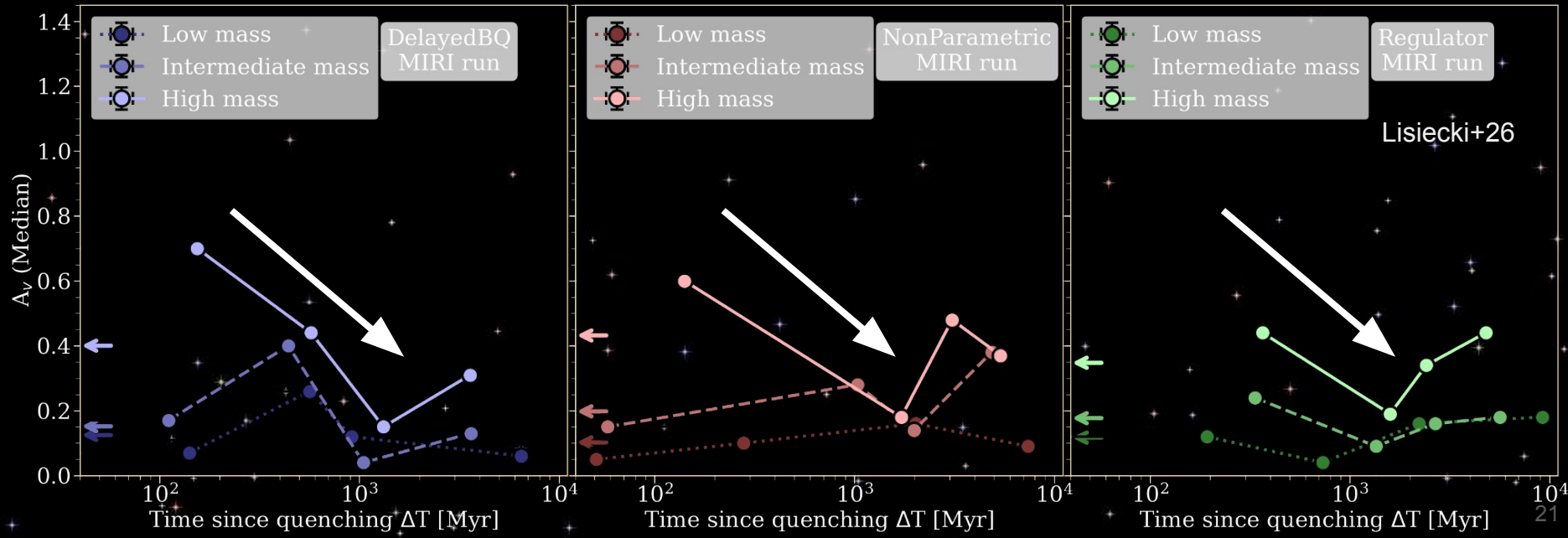
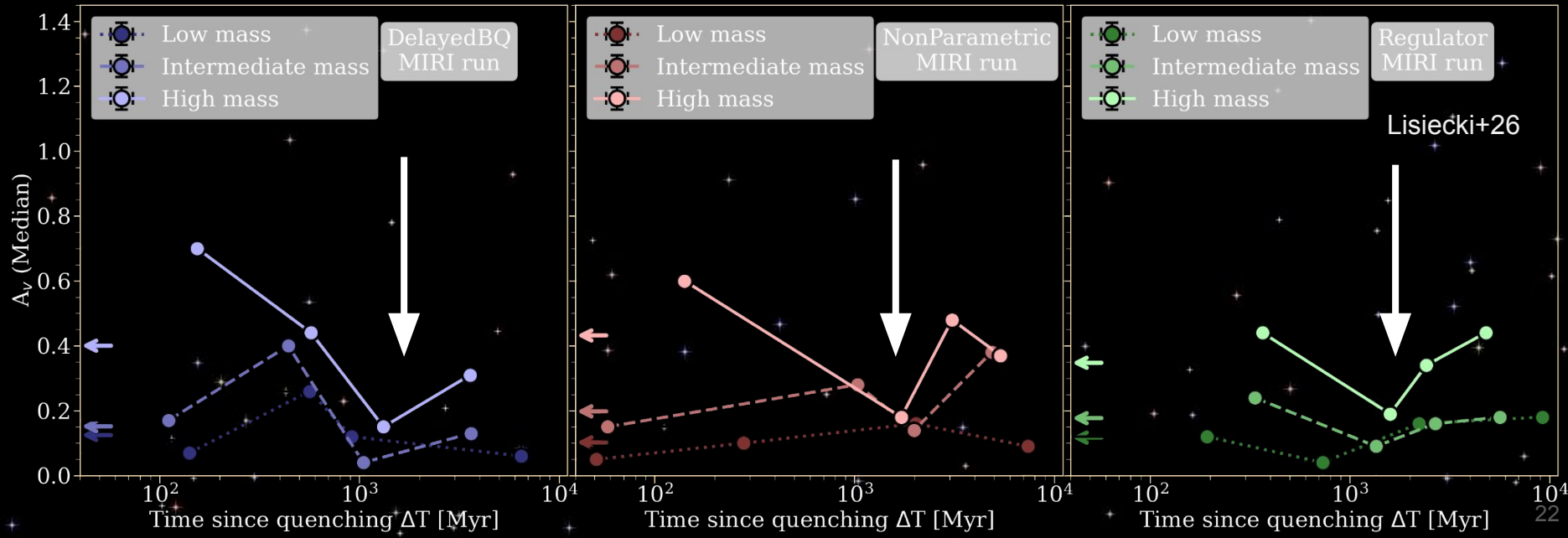
Mature vs immature QGs

While for the low mass QGs, the evolution is barely visible, the prediction works for the **massive ones up to 1-2 Gyr!** They lose attenuation after quenching.



Mature vs immature QGs

But ~1-2 Gyr after quenching we see a dip in each SFH run!
Sustaining mechanism: AGB production [Beveaqua25], ISM dust reformation [Donevski+23, Loreznon25]?



Take away messages

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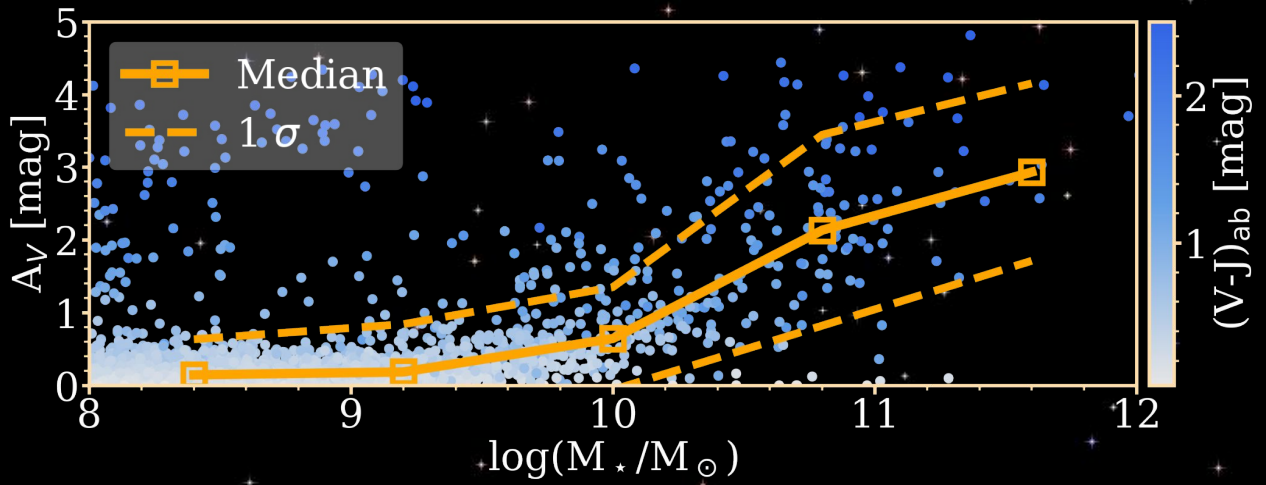
Paper on stochastic SFH in QGs: arxiv.org/abs/2509.10117

- **SFH changes the number of QGs** up to a factor of ~3!
- **Time since quenching can be fairly well constrained with photometry only!**
- We do not find clear dust evolution after quenching but despite used SFH model there is a **dip in attenuation after 1-2 Gyr after quenching!**

Thank you for attention!

Dust – stellar mass relation

Recent studies clearly show, that more massive star forming galaxies are more attenuated.
We find the same result.



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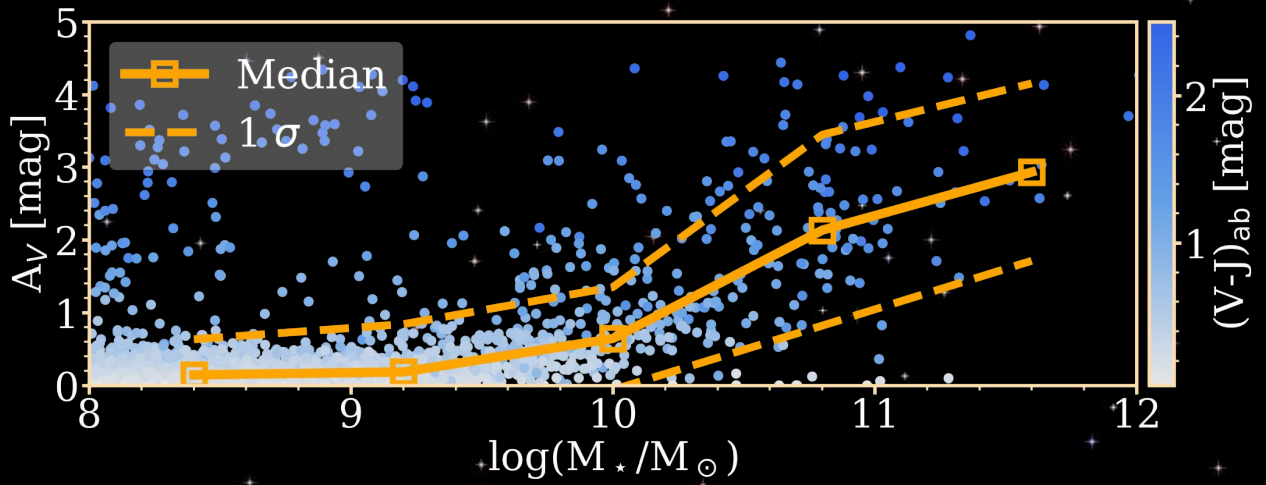
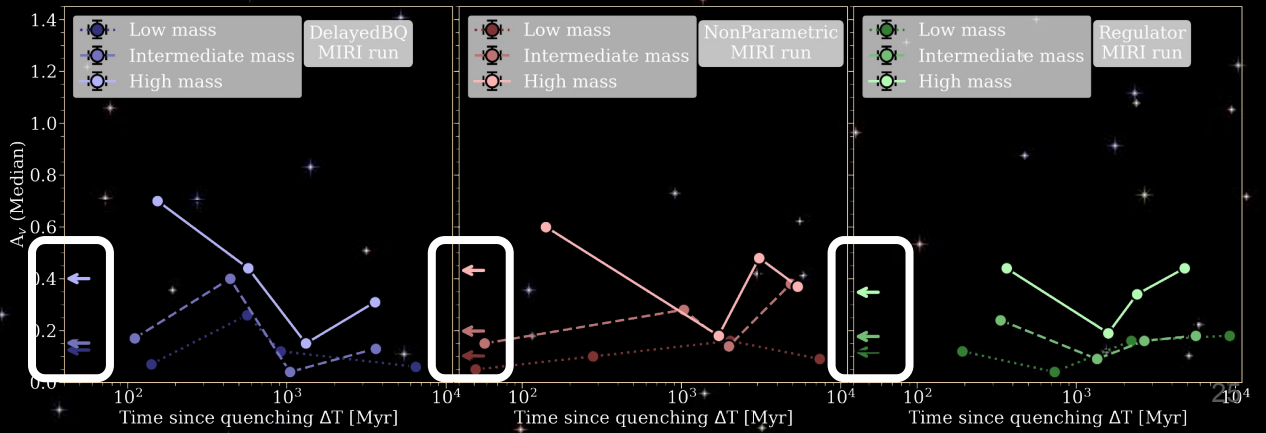


But does it transfer to quiescent galaxies?
Apparently yes!



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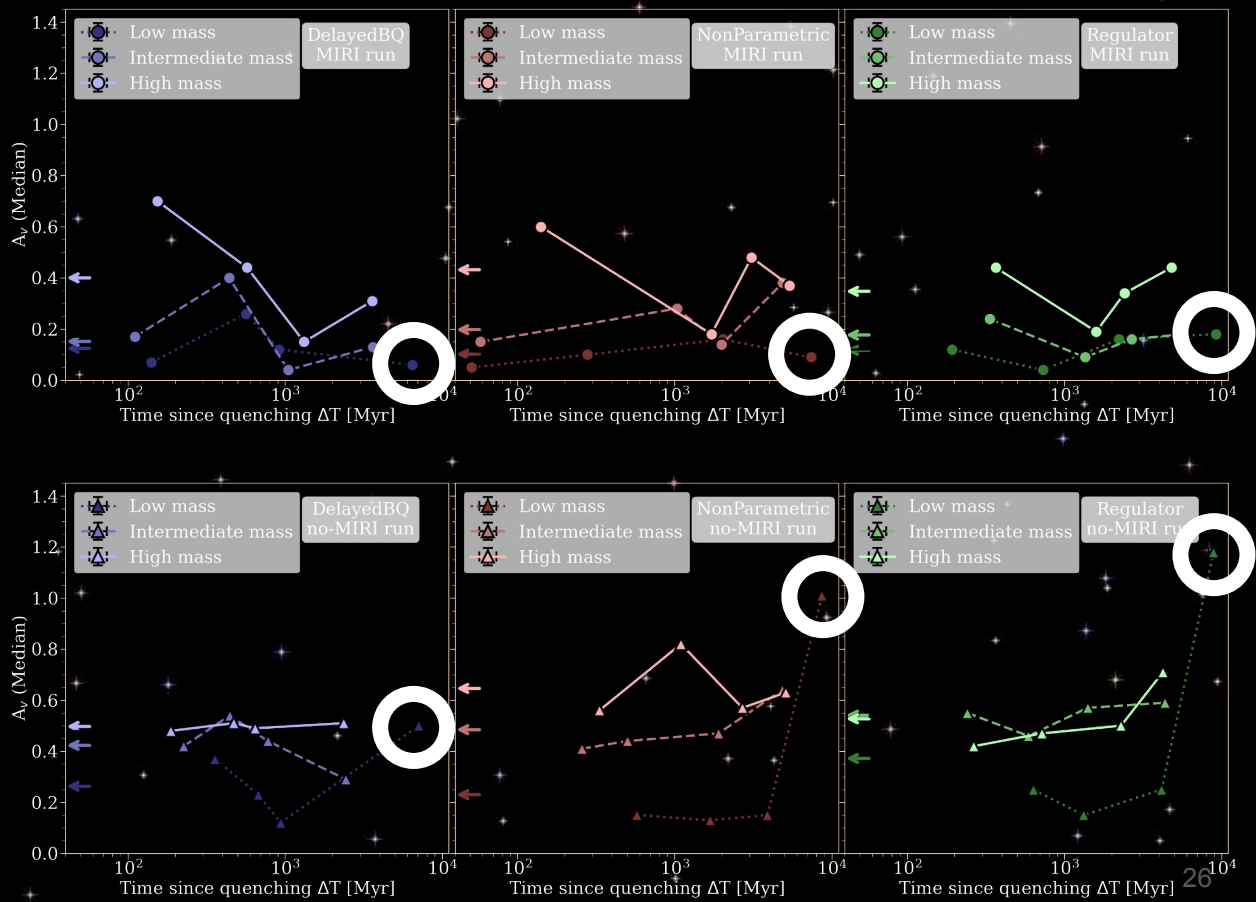
Breaking age-dust degeneracy?

Comparing **run with MIRI (top) constrains the attenuation in the oldest galaxies** better than the one without MIRI (bottom)!



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