Quenching routes and dust attenuation in distant quiescent galaxies

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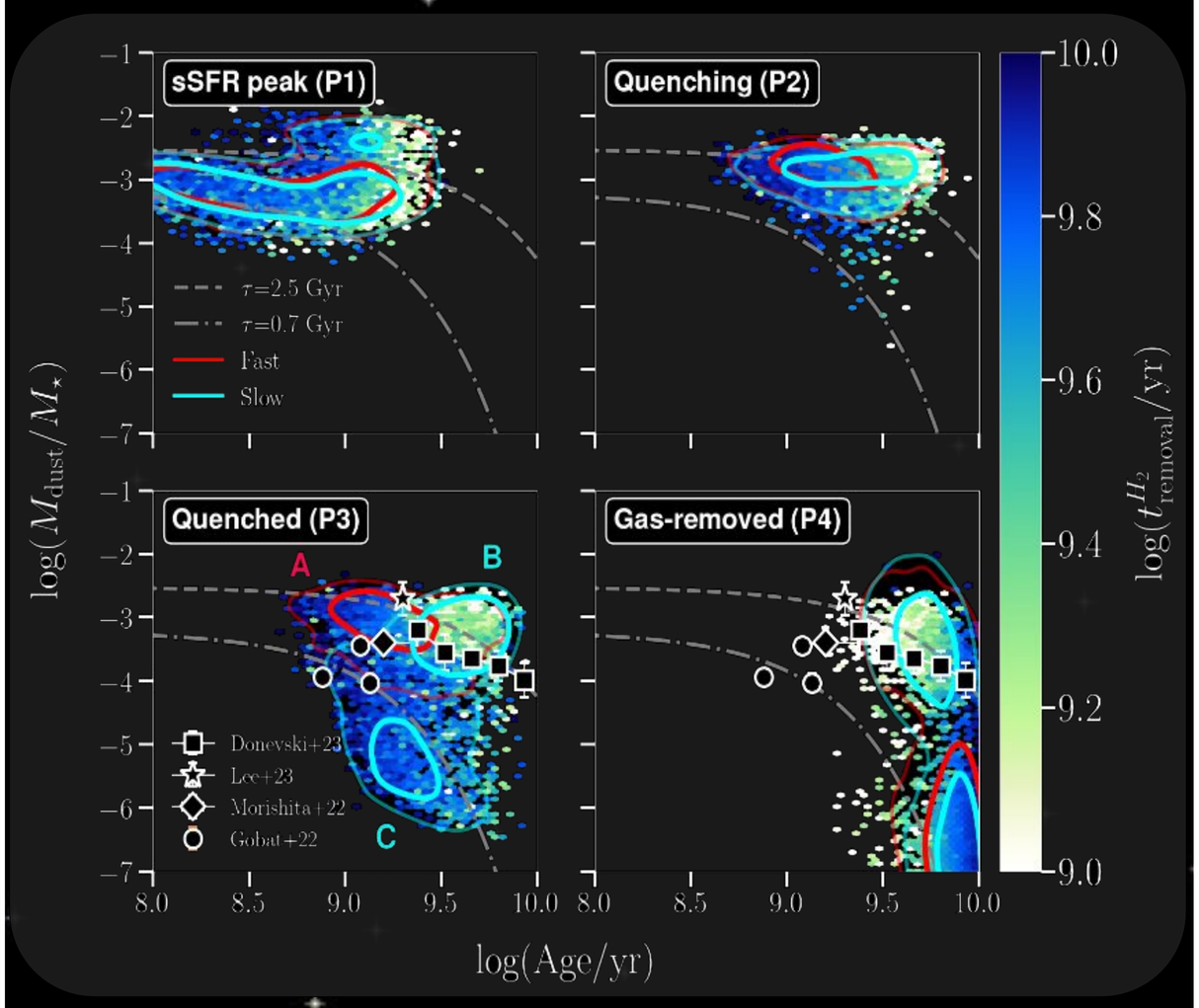
Despite its importance in galaxy evolution, the interplay between baryonic components and the interstellar medium (ISM, dust, metals and gas) in quiescent galaxies (QGs) is poorly understood beyond the local Universe. Using SIMBA [1], the state-of-the-art cosmological simulation, and JWST observations, we try to shed light on this physics. Our goal is to characterize the late ISM evolution in QGs above the local Universe.

Main question

How does the ISM of quiescent galaxies evolves over cosmic time?

Dust content evolution

We studied in total ~10,000 simulated quiescent galaxies in different environments. We developed a consistent method of studying all QGs focusing on evolutionary stages. We defined the four most important stages (look below) and found that the driver of dust fraction is the quenching phase. However, some slow quenchers can end up with a similar dust fraction in the last evolutionary stage!



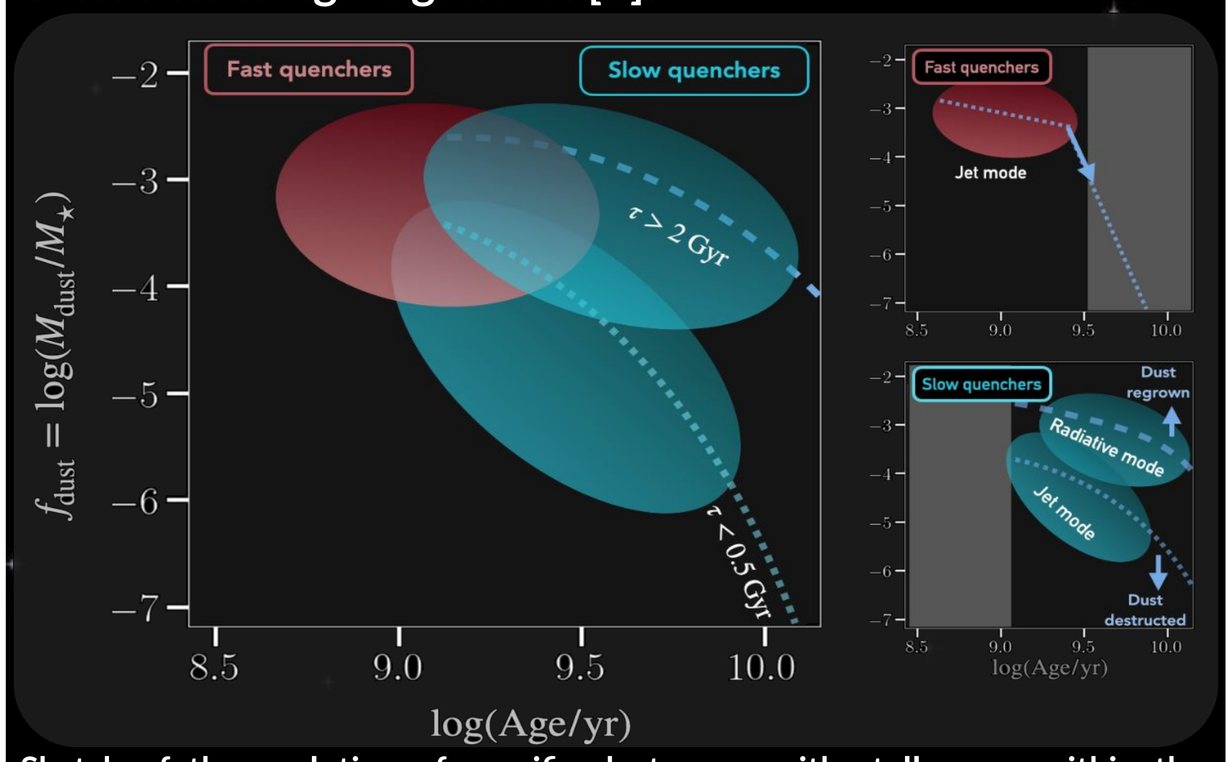
Evolution of specific dust mass with stellar age. Each panel traces one of the evolutionary stages described in the upper left. The colour represents the mean value of the quenching timescale. We compare theoretical results with observational studies. Red (cyan) contours show the distribution for fast (slow) quenchers.

References

[1]Davé et al. 2019, MNRAS, vol. 486
[2]Lorenzon et al. 2024, accepted to A&A (arXiv:2404.10568)
[3]Lisiecki et al. in prep

Quenching mechanisms

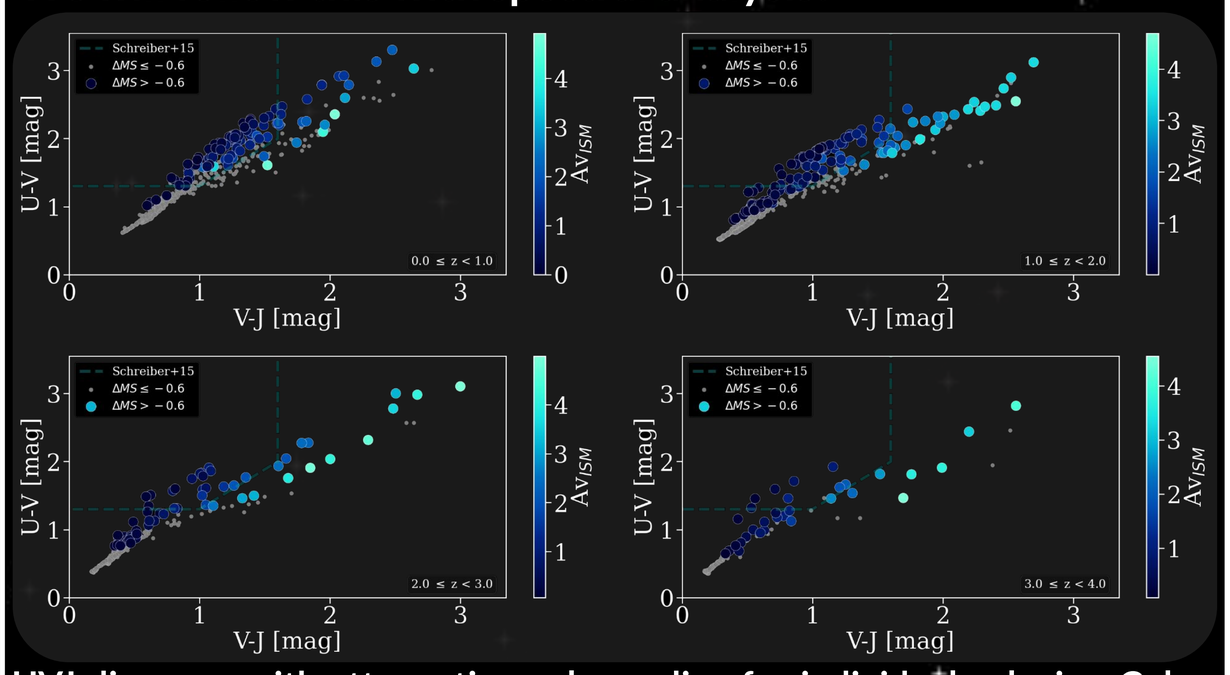
Study shows that AGN feedback is the most important quenching mechanism in case of influencing dust-gas evolution in high-z galaxies [2]!



Sketch of the evolution of specific dust mass with stellar age within the quenched phase. The red cloud represents the position of fast quenchers. Cyan cloud show the position of dust-poor and dust-rich slow quenchers.

Modeling attenuation

We perform multiwavelength SED modeling for 15,000 galaxies in deep JWST field to statistically understand the connection between dust and quenching mechanisms[3]! We will follow this with spectral analysis!



UVJ diagrams with attenuation color coding for individual galaxies. Color coding is applied only for quiescent galaxies according to main sequence.

Conclusion

- Dust fraction doesn't change before quenching phase.
- Galaxies, despite being slow or fast quenchers, lose dust quickly if they have het dominated AGN.
- We found the sign of dust re-growth during quenching phase, in some slow quenchers.
- Up to now we found ~350 sources with MIRI detection, with low sSFR (QGs).
- ~150 of them with V band attenuation larger than 1!

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