

Title: Probing the Early Universe: Extending the Mass-Metallicity relation to extremely low-mass galaxies at $z>6$

Abstract: The mass-metallicity relation provides crucial insights into the baryon cycle in galaxies and provides strong constraints on galaxy formation models. I will discuss our findings on the mass-metallicity relation (MZR) in low-mass galaxies. We studied eight galaxies at a redshift of around 7, which were observed as part of the JWST/NIRSpec follow-up of the JWST Cycle 1 program, UNCOVER, targeting the lensing cluster A2744. By combining ultra-deep NIRSpec observations with strong gravitational lensing, we were able to derive the first spectroscopic constraints on the properties of ultra-faint galaxies during the first billion years of the Universe.

We use the strong-lines method, comparing the most recent high-redshift metallicity calibrations, to derive the gas-phase metallicity in galaxies with stellar masses between 10^6 and 10^8 solar masses. Exploring for the first time this low-mass regime at $z>6$ provides us with better constraints on the overall slope of the mass-metallicity relation, and whether metal enrichment is different in low-mass systems. Comparing our results to theoretical models, we find that these low-mass galaxies have slightly higher metallicities than expected from the extrapolation of hydrodynamical simulations, or lower redshift constraints. These results may indicate weaker outflows and a lower efficiency of gas removal. The observed dispersion can also be the consequence of highly stochastic star formation and ISM enrichment, which is expected in these low-mass systems.