

H α as a tracer of galaxy star formation and burstiness in the first billion years

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Abstract

The pace at which galaxies form stars is known to vary throughout cosmic history. Even at short timescales, early galaxies experience variations in their star formation rates, leading to sequences of bursts followed by more quiescent phases. The H α emission line is among the most reliable methods to probe star formation on short timescales. However, H α was not accessible spectroscopically at $z > 3$ before JWST, as it is redshifted beyond the K-band, leading previous studies to derive it from broad-band photometry or use different estimators. Here, we use JWST observations to study the H α emission line as a tracer of galactic star formation and its evolution throughout cosmic history. We present spectroscopic measurements of $\sim 1\,000$ H α -emitting galaxies at $3.8 < z < 6.7$ with the FRESCO and CONGRESS surveys, which observed the GOODS fields with NIRCcam/grism spectroscopy. We obtain the first H α luminosity functions at $z \sim 4, 5$, and 6 based purely on spectroscopic data. We derive the star formation rate density and “burstiness” of these galaxies. By combining these results with previous studies at different redshifts, we present the cosmic evolution of star-forming galaxies. Our work shows the power of JWST to obtain complete emission-line-selected galaxy samples to provide unprecedented constraints on galaxy formation models.

My poster in zenodo.org can be found here