

X37a Complex, massive galaxy formation in the core of a galaxy protocluster 650 million years after the Big Bang

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Investigating galaxy over-density is crucial for understanding early, massive (e.g., $M_* > 10^9 - 10^{10} M_\odot$) galaxy growth because dense environments accelerate galaxy evolution via multiple processes, such as galaxy-galaxy interactions and gas infalls. To study galaxy evolution in over-dense environments, a panchromatic approach is essential, and this is now possible thanks to the unprecedented synergy between JWST and ALMA. Recently, a massive galaxy over-density at $z = 7.88$ was reported behind the lensing cluster Abell 2744 (Morishita+22). Further, accelerated galaxy growth in the most dense $\sim 3'' \times 3''$ ($\sim 11 \text{ kpc} \times 11 \text{ kpc}$) region of the over-density, where five galaxies are merging, was reported (a.k.a “the Quintet”; Hashimoto+23). In this talk, we update our last year’s presentation in 2025 Spring ASJ meeting. Our cycle-10, deep ALMA observations of luminous ($L_{\text{[CII]}} \gtrsim 10^9 L_\odot$) [CII] $158\mu\text{m}$ lines from “the Quintet” revealed an extreme complex spatial and velocity structure of neutral gas between galaxies. By combining deep JWST data, the panchromatic observations strongly suggest that the merger induced gas stripping, condensation, re-distribution changed modes of star-formation of galaxies in this system, rapidly progressing environment-induced galaxy evolution.