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Laura Sommovigo - Fast and Furious: the dust enrichment of the early Universe

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The recent ALMA large program REBELS has provided us with the first statistical sample of dusty galaxies at the Epoch of Reionization (EoR). Despite REBELS sources being selected as UV bright, we found that some are strongly dust-obscured (obscured SFR \sim 90%) and surprisingly dust-rich (Md/Mstar \sim 1e-2). These results have led us to question whether short-lived Supernovae alone are efficient enough to enrich the earliest, massive galaxies in our Universe. Now enters the JWST tentative discovery of a population of super-early (z>10), relatively massive and evolved galaxies, which nevertheless show blue (β <−2.6) spectra and little to no dust attenuation. A possible explanation is that these super early galaxies are in fact relatively dusty, but they exhibit a multi-phase, spatially-segregated ISM, where unattenuated UV and IR continuum emission can co-exist. Such ISM morphology has already been inferred for some peculiar z=5-7 sources within the REBELS and ALPINE samples. This spatially-segregated scenario is partially questioned by the lack of any dust continuum detection where ALMA follow-up of the z>10 candidates has been attempted. Thus, our favoured explanation is that in these bursty sources, dust is produced but shortly after ejected due to strong radiation pressure. Future ALMA and JWST observations, including spectroscopic confirmation of these z>10 candidates, will help us investigate this further, probing whether the dust/metal enrichment of the Universe skyrockets within the little time span of \sim 200 Myr (between z=10 and z=7). The unprecedentedly detailed observations possible with JWST and ALMA synergy urge us to improve our modelling of dust obscuration processes and the dust/metals build-up at high-z. Only then we can produce a cohesive picture of the earliest, tumultuous phases of galaxy evolution.

Session Classification: Cosmology, high-z Universe, galaxy clusters