The assembly of dusty galaxies at $z > 4$

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Abstract

The existence of high redshift ($z > 4$) dusty galaxies is nowadays confirmed by a robust series of observations demonstrating that dusty, star forming objects are evolving within the Epoch of Reionization (EoR, $z > 6$) when the universe was only 1 Gyr old. As more observations are about to come thanks to ALMA and future observational facilities (e.g. JWST), present theoretical models of galaxy formation and evolution require significant updates in order to predict the properties of the interstellar medium of these objects. In this talk I will discuss the results of a new generation of hydrodynamical simulations performed with the dustyGadget code (Graziani 2020 MNRAS), combined with detailed multi-frequency-band radiative transfer simulations. I will show our predictions on high redshift scaling relations, updated estimates of the mass of dust, the chemical composition of grains, their temperature and charge in different phase of the ISM and how they evolve during the process of galaxy assembly, all the way down to $z=4$ where robust constraints are provided by the recent ALPINE survey. Prediction on the galaxy spectral energy distributions are also discussed and compared with recent observations. Finally, the impact of dust on the process of Reionization and Metal Enrichment of the surrounding Intergalactic medium is addressed by showing the properties of their HII dusty regions at the extragalactic scale.