Observational constraints and modeling of the formation and early destruction of the first dust grains in galaxies at $5 < z < 10$

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Abstract

The first generation of stars were born a few hundred million years after the big bang. These stars synthesise elements heavier than H and He, which are later expelled into the interstellar medium, initiating the rise of metals. Within this enriched medium, the first dust grains were formed. This event is cosmologically crucial for molecule formation, as dust plays a major role by cooling low-metallicity star-forming clouds, which can fragment to create lower mass stars. Collecting information on these first dust grains is difficult because of the negative alliance of large distances and low dust masses.
In this work, we aim to combine the observational information from galaxies at redshifts 5 z 10 to constrain their dust emission and theoretically understand the first evolutionary phases of the dust cycle. Spectral energy distributions (SEDs) are fitted with CIGALE and the physical parameters and their evolution are modelled. From this SED fitting, we built a dust-emission template for this population of galaxies in the reionisation epoch.
In this presentation, we will show that our new models explain why some early galaxies are observed and others are not. We follow in time the formation of the first grains by supernovae later destroyed by other supernova blasts and expelled in the circumgalactic and intergalactic media. We also find evidence for the first dust grains formed in the universe. But above all, this work underlines the need to collect more data and to develop new facilities to further constrain the dust cycle in galaxies in the reionisation epoch.

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