Investigating the physical processes driving the evolution of baryons in local and high-redshift low-metallicity galaxies

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Abstract

The chemical enrichment of the interstellar medium (ISM) of galaxies is regulated by several physical processes: star birth and death, grain formation and destruction and galactic inflows and outflows. I will present the results of a recent investigation focused on local low-metallicity galaxies and on Lyman-Break Galaxies, often considered to be their high-redshift counterparts. By performing the spectral energy distribution fitting of these galaxies we derive their dust and stellar mass, age and star formation rate. We find that a peak in the specific mass of dust (sMdust, i.e. the mass of dust over the total stellar mass of the galaxy) is attained after ≈100 Myrs followed by a decrease. In order to interpret such a trend and other observed properties we simulate the chemical evolution of the galaxies under study by including the enrichment from massive and low-mass stars, dust destruction from supernova (SN) shocks, grain growth in the ISM and galactic inflows and outflows. We interpret the observed trend as a fast enrichment in metals and dust from Type II SNe followed by dust removal through galactic outflow and/or grain destruction from SN shocks. In particular (i) a top-heavy initial mass function together with a dust condensation fraction for Type II SNe larger than 25% help to reproduce the observed peak of sMdust; (ii) galactic outflows play a crucial role in reproducing the observed decline of sMdust with age, and they are more efficient than dust destruction from SN shocks; (iii) a star formation efficiency of few percent explains the metallicity of local dwarf galaxies; (iv) dust growth in the ISM is not necessary to reproduce sMdust, and the effect of such a process, if present, would be erased by the effect of galactic outflows.

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