Gas, metals and dust in star forming galaxies through cosmic time: a new analytic model

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Abstract

I will present a new simple but effective and self-consistent analytic model, describing the evolution of gas, stars, metals and dust in an individual star forming galaxy, hosted within a dark halo of a given mass and formation redshift. I will show how the analytic solutions can be exploited to reproduce the evolution of the most popular classes of star forming galaxies in the Universe, that are Dusty Star Forming Galaxies at high-z (considered to be the star forming progenitors of Early Type Galaxies) and Spiral disk-like galaxies in the local ($z < 1$) Universe. To this aim, the solutions have been supplemented with a couple of additional ingredients, such as specific prescriptions for parameter setting, inspired by in-situ galaxy-black hole co-evolution scenarios, and the estimates of the average halo and stellar mass growth by mergers, computed on the basis of the merger rates from state-of-the-art numerical simulations. In order to reproduce the local Spirals evolution, some other fundamental mechanisms have been taken into consideration, e.g. galactic fountains. Finally, I will show how the analytic solutions allow one to easily disentangle the diverse role of the main physical processes regulating galaxy formation, quickly explore the related parameter space, and make transparent predictions on spatially averaged quantities. As such, they may provide a basis for improving the (subgrid) physical recipes presently implemented in theoretical approaches and numerical simulations and can offer a benchmark for interpreting and forecasting broadband observations of local and high-z star forming galaxies. Reference articles for this talk are Pantoni et al. (2019; 2019ApJ...880..129P) and Lapi et al. (2020; 2020ApJ...897...81L).

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