

Project Title: The critical role of dust and stars in the cosmic baryon cycle

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Project Description:

Albeit representing less than 1% of the inter-stellar-medium by mass, dust is a key ingredient governing its physical and chemical evolution. Only very recently, however, attempts have been made to include a treatment for dust in cosmological models of galaxy formation. The field is now sufficiently mature and in strong need for such a development, as it represents a necessary step to turn the exceptional mass of data we are collecting into a real benchmark for our theoretical models. In turn, the proposed research will provide valuable and timely tools for the interpretation of data coming from current and forthcoming facilities (JWST, ALMA, SKA and its precursors).

The goal of this PhD project is to build the first self-consistent description of molecular hydrogen, metal, and dust content in a full cosmological framework. This goal will be achieved by updating the state-of-the-art GALaxy Evolution and Assembly (GAEA - Hirschmann et al. 2016; Xie et al. 2017) model to include an explicit and sophisticated treatment for (i) dust formation, growth and destruction, accounting for its grain size distribution and (ii) H₂ formation on dust grains as well as H₂ photo-dissociation.

The PhD fellow will acquire skills in modelling the above physical processes, and on the more general subject of galaxy formation and evolution. He/she will carry out the proposed project within a young and active group including experts in both semi-analytic models and hydro-dynamical simulations, as well as researchers with significant expertise in data analysis. A network

of international collaborations will allow the student to acquire skills also in using model predictions to guide the conception of proposed observational programs at major international facilities.