

**Modelling the SEDs of galaxies at high redshift:
recent progress and future challenges**

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Abstract

The spectral energy distributions (SEDs) of galaxies contain important signatures of the physical processes that shape their evolution. Multi-wavelength observations spanning the full ultraviolet to radio spectral range are becoming available not only for local galaxies, but also for samples of increasingly high redshift galaxies, thanks to deep observations with e.g. HST, Spitzer, Herschel and ALMA. In order to understand these observations in the context of galaxy evolution theories, we use SED models that translate the observed light into physical properties such as stellar mass, star formation rate, metallicity, and dust content. While these models have been extensively calibrated and applied to local galaxy samples, they are only now starting to be used to understand galaxies in the young Universe. In this talk I will review the main ingredients of spectral energy distribution models and I will describe recent and ongoing developments that are implemented to make the models applicable at high redshifts, in particular in the context of the MAGPHYS code. I will focus on specifically on: (i) recent updates on the spectral evolution of young stellar populations; (ii) self-consistent modelling of the nebular emission of galaxies, and how this affects the broad-band SEDs; (iii) challenges in parameterizing the star formation histories of galaxies, and why they matter; (iv) progress in modelling the contamination by active galactic nuclei (AGN); and (v) how to account for ‘cosmological effects’ when modelling galaxy SEDs at high redshifts.