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Andrea Lapi - GalaPy, the highly optimised C++/Python spectral modelling tool for galaxies

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A key issue in galaxy formation and evolution is to deepen our understanding of the complex (astro)physical processes that govern the properties of galaxies on different spatial and time scales. One powerful method for achieving this task is to model the spectral energy distribution (SED) observed from galaxies at different stages of their evolution along cosmic history. To this purpose, we have developed GalaPy, a new library for modelling and fitting galactic SEDs from the X-ray to the radio band, as well as the evolution of their components and dust attenuation/reradiation. On the physical side, GalaPy incorporates both empirical and physically-motivated star formation histories, state-of-the-art single stellar population synthesis libraries, a two-component dust model for extinction, an age-dependent energy conservation algorithm to compute dust reradiation, and additional sources of stellar continuum such as synchrotron, nebular/free-free and X-ray emission from low and high mass binary stars. On the computational side, GalaPy implements a hybrid approach that combines the high performance of C++ with the user-friendly flexibility of Python, and exploits an object-oriented design via new-generation programming techniques. GalaPy is the fastest SED generation tool of its kind, with a peak performance of almost 1000 SEDs per second. It exploits fully Bayesian parameter space sampling, which allows for the inference of parameter posteriors and thus facilitates the study of the correlations between the free parameters and the other physical quantities that can be derived from modelling. The API and functions of GalaPy are under continuous development, with planned extensions in the near future. In this talk, I will introduce the project and showcase the photometric SED fitting tools that are already available to users, with particular focus on the performance on local and high-z dusty star-forming galaxies featuring prominent emission in the mm band.