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The Measurement of Galaxy Population properties with Forward-Modelling and Approximate Bayesian Computation

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New methodologies to characterise and model the galaxy population as a function of redshift that allow to overcome biases and systematic effects are becoming increasingly necessary for modern galaxy surveys. In this talk, I'm going to describe a novel method we developed for the measurement of galaxy population properties (Tortorelli+18, Tortorelli+20, Tortorelli+21) that relies on forward-modelling and Approximate Bayesian Computation (ABC, Akeret+15). The method builds upon realistic image and spectra simulators (UFig and Uspec, Bergè+13, Fagioli+20), at the heart of which is a simple yet realistic parametric model for the galaxy population. The model parameters can be constrained through ABC by defining and minimising physically-motivated distance metrics between real and simulated photometric and spectroscopic data. By forward-modelling CFHTLS (Cuillandre+12) and PAUS survey (Martì+14) photometric data and SDSS spectroscopic data, we constrained the model parameters using ABC and measured, for the first time with likelihood-free inference (LFI), astrophysically relevant quantities, such as the B-band galaxy luminosity function and the stellar population of galaxies. With the use of a simple yet realistic generative model and LFI, we show that it's possible to reproduce the diversity of galaxy properties seen in modern wide-field surveys.

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