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Euclid Emulator

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Upcoming weak lensing large scale structure surveys such as Euclid, DES, LSST, WFIRST will measure the result of billions of years of evolution from the linear fluctuations observed in the CMB. On the very largest scales these fluctuations are still evolving linearly, but most of the leverage on cosmological parameters from these surveys comes from smaller, highly non-linear scales. While the number of modes of information available to such surveys is in principle much larger than for CMB experiments, there is no analytic theory for how matter clusters non-linearly under the influence of gravity. Only numerical N-body simulations have the required precision. These are, however, far too expensive to be used for maximum likelihood searches over the fundamental cosmological input parameters. Highly precise and rapid matter power spectrum emulation is of paramount importance to these surveys. In my talk I will present a new tool to emulate the non-linear correction (called „boost factor“) of the dark matter power spectrum. A Matlab-based software called UQLab allows us to use state-of-the-art uncertainty quantification techniques to perform sensitivity analyses and error predictions on the cosmological observables and their dependence on the cosmological parameters. This emulator is based on a suite of 100 N-body simulations carried out with pkdgrav3 on the small UZH-based supercomputer zBox4 using 200’000 node hours of computation. To reproduce the matter power spectrum for any set of cosmological parameters requires only fractions of a second, making rapid forward modelling of the observations possible.

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