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Kosmulator: A new MCMC framework for fitting modified and alternative gravity models to cosmological observations

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In this talk, I'll introduce Kosmulator —a new, fast, and transparent MCMC framework for cosmological inference currently in development. Kosmulator allows researchers to swap cosmological models on the fly for fitting theoretical predictions to observational data. Modified-gravity models are implemented as simple Python callables, meaning transitions from Λ CDM to linear or fully non-linear MG variants require only small mathematical changes, with no re-wiring of likelihoods. Under the hood, Kosmulator integrates CLASS, CLIC, and AlterBBN for theory predictions and supports Zeus/EMCEE MCMC engine samplers, vectorised model evaluations, and high-performance MPI parallelisation. It also includes practical tools for modern analysis workflows: dynamic parameter safeguards, automated convergence and autocorrelation checks, and real-time visualisation (trace plots, corner plots, and best-fit overlays).

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