

From standard to constrained cosmological simulations

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To understand dark matter and energy, large cosmological surveys are designed to reach a few percent precision on cosmological parameter measurements. To be fully exploited, this large quantity of data needs to be analyzed in light of cosmological simulations. Such preliminary analyses brought out tensions between the standard cosmological model and observations. For instance, the local Hubble constant value differs by more than 3σ from that inferred with the cosmological microwave background. Are the tensions due to systematic errors induced by our cosmic environment, survey and tool specificities? Analyses need to be fueled with a new type of cosmological simulations constrained to reproduce our environment. Such simulations, that I named CLONES (Constrained LOcal & Nesting Environment Simulations), provide a robust methodological framework to minimize the systematics. After presenting briefly standard cosmological simulations, I will introduce the CLONES giving a few study examples that promise to tremendously increase our capacity to evade systematics in future survey analyses. I will conclude with opening remarks on required impending actions to face the new challenges in order to produce CLONES2.0: accuracy, speed and scaling.