Abstract Submitted
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Keeping it real: revisiting a real-space approach to running ensembles of cosmological N-body simulations[1] CHRIS ORBAN, The Ohio State University — In setting up initial conditions for cosmological N-body simulations there are, fundamentally, two choices: either maximizing the correspondence of the initial density field to the assumed fourier-space clustering or, instead, matching to real-space statistics and allowing the overdensity to vary from box to box as it would in the real universe. Though very few comparisons of these methods exist in the literature, virtually all research groups initialize cosmological N-body simulations using the fourier space approach. As a stringent test of both methods, I perform ensembles of simulations using power law and a "powerlaw times a bump" model inspired by baryon acoustic oscillations, exploiting the self-similarity of these initial conditions to quantify the accuracy of the matter-matter two-point correlation results. The real-space method, which was originally proposed by Pen 1997 and implemented by Sirko 2005, performed well in producing the expected self-similar behavior and corroborated the evolution of the BAO feature observed in conventional simulations, even in the strongly non-linear regime. As a substantial improvement to the real-space approach, I present a "better informed" estimator for the correlation function that achieves precision measurements with fewer simulations.

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