PATH INTEGRAL METHODS FOR PRIMORDIAL DENSITY PERTURBATIONS

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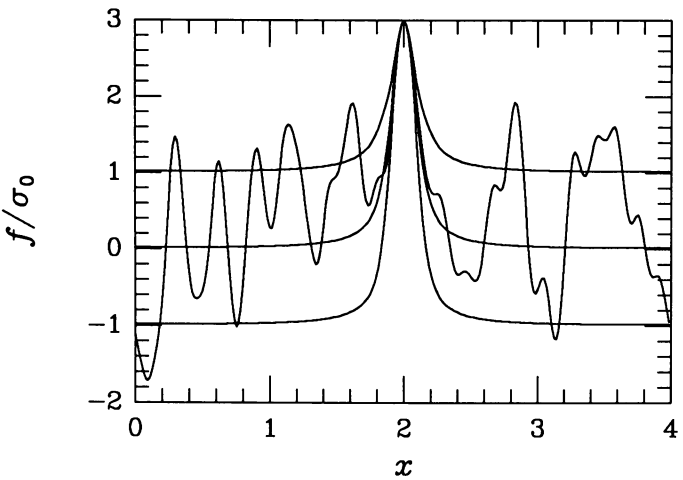
ABSTRACT. Path integrals may be used to describe the statistical properties of a random field such as the primordial density perturbation field. In this framework the probability distribution is given for a Gaussian random field subjected to constraints such as the presence of a peak of given curvature at a specific location in the initial conditions. An algorithm has been constructed for generating samples of a constrained Gaussian random field on a lattice using Monte Carlo techniques. The algorithm is equivalent to, but much faster than, generating unconstrained random samples repeatedly until a sample is found satisfying the desired constraints to arbitrary precision. The method makes possible a systematic study of the density field around peaks or other constrained regions in the biased galaxy formation scenario and it is effective for generating initial conditions for N-body simulations with rare objects in the computational volume.



A random sample of a one-dimensional Gaussian random field constrained to have a peak of specified height and curvature at $x = 2$. The "mean" and ± 1 "standard deviation" profiles are shown for comparison. The power spectrum is band-limited flicker noise. The mean density profile is a poor approximation beyond one correlation length from the peak.

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