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Stochastic Dynamics during Inflation

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Quantum fluctuations during inflation in the very early universe inevitably generate inhomogeneities and anisotropies across all observable scales and beyond. In the stochastic approach to modeling inflationary dynamics, these quantum fluctuations are incorporated as stochastic noise. We employ the formalism of stochastic inflation to examine the role of quantum diffusion during inflation. This provides a non-perturbative framework to study the origin of large cosmological fluctuations during inflation, relevant for calculations of primordial black hole abundance. Using the numerical code PyFPT, we investigate the occurrence of extremely rare, large fluctuations in slow-roll inflation models, which may exhibit a highly non-Gaussian distribution. We contrast the case of inflation driven by a simple quadratic scalar field potential with alpha-attractor models favoured by current CMB data. We also compare the results obtained from stochastic inflation with those obtained from the traditional (classical) δN formalism used to describe nonlinear evolution on the super-Hubble scales.

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