Contribution ID: **5** Type: **not specified**

The Inflationary Butterfly Effect: non-perturbative dynamics from small-scale features

Monday, 17 June 2024 16:30 (20 minutes)

I will present the first non-perturbative study of a single-field model of inflation with a localized departure from slow-roll. Using lattice simulations, we find that small-scale oscillatory features in the potential can lead to drastic changes in the evolution of the inflationary Universe, with profound phenomenological implications. In certain cases, the entire Universe gets trapped in an eternal de Sitter state. In others, some regions get stuck in a false vacuum within the oscillatory feature, offering an alternative channel for primordial black hole (PBH) formation. Notably, these drastic non-perturbative effects occur when linear perturbation theory predicts $P_\zeta \simeq 10^{-2}$, demonstrating the importance of a fully nonlinear treatment in the regime relevant for PBH formation. Additionally, we compare our fully nonlinear lattice power spectra with perturbative 1-loop calculations.

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Session Classification: Session 4