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Underdamped Axionic Blue Isocurvature Perturbations

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Previous computations of strongly blue tilted axionic isocurvature spectra were computed in the parametric region in which the lightest time-dependent mass is smaller than the Hubble expansion rate during inflation, leading to an overdamped time evolution. Here, we present the strongly blue tilted axionic isocurvature spectrum in an underdamped time evolution parametric regime. Somewhat surprisingly, there exist parametric regions with a strong resonant spectral behavior that leads to rich isocurvature spectral shapes and large amplitude enhancements. We focus on computing this resonant spectrum analytically in parametric regions amenable to such computations. Because the spectrum is sensitive to nonperturbative classical field dynamics, we will discuss a wide variety of analytic techniques that are used like decoupling, nonlinear field redefinition, a time-space effective potential obtained by integrating out high-frequency fluctuations, and a piecewise mass-model.

Authors: Prof. CHUNG, Daniel J H; TADEPALLI, SAI CHAITANYA

Presenter: TADEPALLI, SAI CHAITANYA

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