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Curvature Perturbations From Stochastic Particle Production During Inflation

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There is no guarantee that the reductionist point of view championed by simple effective field theories is realized during inflation and the subsequent (p)reheating. In fact, many supersymmetric and string-inspired UV completions of inflation involve a myriad of fields with complicated interactions. This may lead to a random, chaotic evolution as a function of the initial conditions and values of the model parameters. Nevertheless, in the limit of many fields/interactions, emergent universal properties may arise.

In this talk I will present a statistical framework to characterize the evolution of scalar spectator fields in a de Sitter universe, with non-adiabatic, time-dependent effective masses sourced stochastically by complicated background dynamics. I will show how the non-trivial evolution of coarse-grained quantities, such as particle occupation numbers, can be derived from a Fokker-Planck equation. As the main result, I will demonstrate that the field magnitude describes a geometric (Brownian) random walk in cosmic time *independently of the details of the disorder*, and I will discuss the imprints of this evolution on density perturbations from the early universe. Specifically, the stochastic sourcing of the amplitude and tilt of the curvature power spectrum as functions of the disorder strength.

Primary author: GARCIA GARCIA, Marcos A. (Rice University)

Presenter: GARCIA GARCIA, Marcos A. (Rice University)

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