Contribution ID: **15** Type: **not specified**

Curvature fluctuations from disorder during inflation

Tuesday 24 March 2020 17:05 (25 minutes)

Although it is commonly assumed that the physics of inflation and the subsequent reheating epoch can be understood by means of simple effective field theories, there is no guarantee that this reductionist point of view is realized. In fact, some UV completions of inflation tend to involve many fields, with complicated interactions that can lead to significant elements of randomness in the dynamics. Nevertheless, in the limit of many fields/interactions, emergent universal properties may arise.

In this talk I will describe the effect of the repeated and non-adiabatic excitation of spectator fields on the primordial curvature power spectrum. In the absence of detailed information of the nature of spectator field interactions, we consider an ensemble of models with temporal locations and strengths of the interactions which are drawn from simple probabilistic distributions. I will show that the spectator fields evolve following geometric random walks, which on average source scale-dependent power spectra in spite of there being no preferred scale in the underlying model. Moreover, each member of the ensemble of spectra show rich structure with many features, susceptible of being probed by CMB and LSS observations. They can also have implications for primordial black hole formation and CMB spectral distortions.

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Session Classification: Short talks