Contribution ID: **154** Type: **not specified**

Spectral behavior of scalar fluctuations generated by gravity during inflation and reheating

Thursday 29 May 2025 18:20 (20 minutes)

In this talk, we investigate the spectral behavior of scalar fluctuations generated by gravity during inflation and reheating, employing a non-perturbative Bogoliubov treatment within the framework of gravitational reheating. We obtain both long and short-wavelength spectra. It highlights that the spectral index in the IR regime varies depending on the post-inflationary equation of state (EoS) for a wide range of momenta and masses. In the UV regime, we identify high-frequency oscillations in the spectrum due to the inflaton background dynamics during reheating, which leads to interference in generating the modes. Remarkably, we found that for a large range of EoS, the spectral index in the UV is independent of the EoS. We corroborate our results by comparing the Bogoliubov treatment with perturbative methods, solving the Boltzmann equation. We show agreement across all EoS in the UV regime for the two approaches. Finally, we discuss the gravitational reheating scenario and address constraints from primordial gravitational wave overproduction, finding that successful gravitational reheating is achievable for sufficiently high EoS.

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Session Classification: Gravitational Waves and Scalar perturbations