



Contribution ID: 8

Type: **not specified**

New Physics and Primordial Neutrinos Decoupling: a DSMC Approach (17'+3')

Wednesday, October 9, 2024 4:25 PM (20 minutes)

Primordial neutrinos are important messengers from the Early Universe, affecting several key observables such as primordial nuclear abundances and cosmic microwave background. If some new physics existed at the time around neutrino decoupling, it would have left imprints on the neutrino distribution function, which requires solving the neutrino Boltzmann equation. Existing approaches have limitations that prevent using them in a universal way for the cases with new physics particles decaying into neutrinos. Addressing this issue, we present a novel approach to studying the interactions of neutrinos based on Direct Simulation Monte Carlo (DSMC). In particular, we resolve the existing discrepancies between the Boltzmann codes regarding the impact of highly non-thermal neutrinos on N_{eff} , and study the interplay of possible large lepton asymmetries in the neutrino sector and injections of high-energy neutrinos.

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Session Classification: Neutrino physics