Contribution ID: **163** Type: **01** - 分会报告

Gravitational waves from inflaton decay: an effective field theory approach

Wednesday 8 May 2024 15:40 (20 minutes)

The concept of early Universe inflation resolves several problems of hot Big Bang theory and quantitatively explains the origin of the inhomogeneities in the present Universe. However, it is not possible to arrange inflation in a scalar field model with renormalizable potential, such that it would not contradict the recent Planck data. For this reason, an effective field theory approach must be used, which means that inflaton has higher derivative couplings suppressed at least by the Planck scale. I show that these couplings may be relevant during reheating and lead to non-negligible production of gravitons. I consider the possibility that the unitarity breaking scale for the model of inflation is lower than the Planck scale and compute the production of gravitons during reheating, due to the inflaton decay to two gravitons and graviton bremsstrahlung process. The spectrum of produced gravitons is crucially dependent on reheating temperature and inflaton mass. I find that for low reheating temperatures decay to gravitons leads to a significant amount of dark radiation. Confronting this result with CMB constraints, I find reheating-dependent bounds on the unitarity breaking scale. I also compare the obtained gravitational wave signals with the projected limits of future high-frequency gravitational wave experiments.

Collaboration (if any)

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Session Classification: 06 - 引力波理论与实验

Track Classification: 05 - 引力波理论