Contribution ID: **46** Type: **not specified**

Renormalizing UV Divergences in the Early Universe – What can go wrong?

Wednesday 30 October 2024 09:15 (45 minutes)

In this talk, we examine some of the challenges that can arise when renormalizing UV divergences in cosmological settings. One fundamental step of renormalization is regularization. Hence, we start by introducing two of the most commonly used regularization schemes: hard cutoffs and dimensional regularization. Specifically, we demonstrate that in the case of finite inflationary background evolution, physical "preferred" scales corresponding to the beginning and end of inflation do not regulate UV divergences. We show that dimensional regularization can be used to regulate these UV divergences, and is, in general, preferable to hard cutoffs, since it allows divergences to be absorbed by counterterms that preserve the symmetries of the background. Furthermore, we discuss how the potential errors can arise when UV divergences are not carefully managed, focusing on the example of the energy density of primordial vacuum gravitational waves, $\rho_{\rm gw}$. In particular, in the literature, constraints on primordial vacuum gravitational waves – the tensorial counterpart of scalar quantum fluctuations that seed galaxies – are derived by connecting $\rho_{\rm gw}$ to the effective number of species, $N_{\rm eff}$. We examine this derivation and illustrate how careful renormalization of UV divergences is crucial for drawing accurate conclusions.
This talk is based on: AN and S. P. Patil, Riv.Nuovo Cim. 47 (2024) 3, 179-228

Primary author: NEGRO, Anna

Presenter: NEGRO, Anna