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Upper bounds on the mass of fields from vacuum zero point energy fluctuations during inflation

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We study the fluctuations in the vacuum zero point energy associated to quantum fields and their statistical distributions during inflation. We show that the perturbations in the vacuum zero point energy have large amplitudes and are highly non-Gaussian. The effects of vacuum zero point fluctuations can be interpreted as the loop corrections in primordial power spectrum and bispectrum. Requiring that the primordial curvature perturbation to remain nearly scale-invariant and Gaussian imposes strong upper bounds on the mass of fundamental fields during inflation. We show that the fundamental fields can not be much heavier than the Hubble scale during inflation, otherwise their vacuum zero point fluctuations induce large non-Gaussianities and scale-dependence in primordial perturbations. Imposing the observational upper bound on tensor to scalar ratio, we conclude that all fundamental fields are lighter than 10^{14} GeV.

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