JOINT TUFTS/MIT COSMOLOGY SEMINAR

CMB Signatures of Standard Model Higgs Effects during Reheating

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I will describe a new way of studying the Higgs potential at extremely high energies. The Standard Model (SM) Higgs boson, as a light spectator field during inflation in the early Universe, can acquire large field values from its quantum fluctuations which vary among different causal (Hubble) patches. Such a space dependence of the Higgs after the end of inflation leads to space-dependent SM particle masses and hence variable efficiency of reheating, when the inflaton decays to Higgsed SM particles. Inhomogeneous reheating results in (observable) temperature anisotropies.

I will discuss both perturbative and resonant decay of the inflaton to SM particles. For the case of perturbative decay from coherent oscillations of the inflaton after high scale inflation, I will demonstrate the existence of strong constraints on the reheat temperature for the inflaton decay into heavy SM particles. For the case of resonant particle production (preheating) to (Higgsed) SM gauge bosons, resulting temperature fluctuations are larger than the ones observed in the CMB for a range of gauge coupling that includes those found in the SM and hence such preheating cannot be the main source of reheating the Universe after inflation.

Further, due to the non-linear relation between the Higgs value and the reheating efficiency, the resulting temperature spectrum acquires a significant non-Gaussian component, which is constrained by Planck observations of the CMB and is potentially detectable in next-generation experiments. Constraints from non-Gaussianity are stronger than the ones due to the amplitude temperature anisotropies alone. Hence, in principle, observational searches for non-Gaussianity in the CMB can be used to constrain the dynamics of the Higgs boson at very high (inflationary) energies.

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Zoom link will be distributed to joint cosmology seminar mailing list. If not subscribed see https://cosmos.phy.tufts.edu/mailman/listinfo/cosmology-seminar

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