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Detectable signatures of non-Bunch-Davies 3-point correlation from primordial magnetic fields: CMB μT spectrum

We investigate the non-Gaussian three-point cross-correlation function between the primordial curvature perturbation and the primordial magnetic field generated via direct gauge-inflaton coupling, for generic non-standard initial vacua. Among the possible triangular configurations of the resulting cross-bispectrum, we find that the squeezed limit leads to a product form decomposition in terms of the scalar and magnetic power spectra, which is a general result independent of any specific choice of the non-Bunch-Davies initial states. We subsequently explore the prospects of such a primordial cross-correlator in sourcing a detectable CMB correlation between μ-type spectral distortions and temperature anisotropies prior to recombination. Our forecast analysis for various next-generation CMB missions reveals that compared to the standard Bunch-Davies case, the signal-to-noise ratio (SNR) of the μT cross-power spectrum can be enhanced significantly for specific combinations of the Bogolyubov coefficients, which correspond to particular choices of initial vacua.

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