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Analysis of Dark Radiation Abundance in Axion-Gauge Fields Models

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In the axion-gauge fields model, the nontrivial configuration and dynamics of the axion and hidden gauge fields during inflation induce gravitational wave background. In particular, the energy density of the axion needs to be sufficiently large to generate observable gravitational waves. After inflation ends, the axion decays into gauge fields, and they behave as dark radiation, which modifies the neutrino effective degrees of freedom $N_{\rm eff}$. Therefore, the model can be constrained from precise measurements of $N_{\rm eff}$. In this study, we investigate the testability of this model from future observations of $\Delta N_{\rm eff}$, in the parameter region where the ratio of tensor fluctuations from the vacuum to those from the gauge fields is $\mathcal{O}(10^{-1})$.

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