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Redshift evolution of cosmic birefringence in CMB anisotropies

Thursday, 7 July 2022 11:30 (15 minutes)

We discuss the imprints of a cosmological redshift-dependent pseudoscalar field on the rotation of Cosmic Microwave Background (CMB) linear polarization generated by a coupling $g_\phi \phi F^{\mu\nu}\tilde{F}_{\mu\nu}$.

We show how either phenomenological or theoretically motivated redshift dependence of the pseudoscalar field, such as those in models of Early Dark Energy, Quintessence or axion-like dark matter, lead to CMB polarization and temperature-polarization power spectra which exhibit a multipole dependence which goes beyond the widely adopted approximation in which the redshift dependence of the linear polarization angle is neglected. Because of this multipole dependence, the isotropic birefringence effect due to a general coupling $\phi F^{\mu\nu}\tilde{F}_{\mu\nu}$ is not degenerate with a polarization rotation angle independent on the multipoles, which could be instead connected to a systematic miscalibration angle. By taking the multipole dependence into account, we calculate the parameters of these phenomenological and theoretical redshift dependence of the pseudoscalar field which can be detected by future CMB polarization experiments on the basis of a χ^2 analysis for a Wishart likelihood.
As a final example of our approach, we compute by MCMC the minimal coupling g_ϕ in Early Dark Energy which could be detected by future experiments with or without marginalizing on a constant rotation angle.

In-person participation

Yes

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