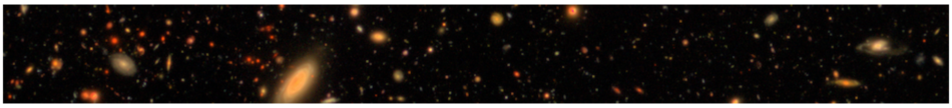

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Probing Axions through Tomography of Anisotropic Cosmic Birefringence

Tuesday, 28 March 2023 15:20 (20 minutes)

Cosmic birefringence is the in-vacuo rotation of the linear polarization plane experienced by photons of the Cosmic Microwave Background (CMB) radiation when theoretically well-motivated parity-violating extensions of Maxwell electromagnetism are considered. If the angle parametrizing such a rotation is dependent on the photon's direction, then this phenomenon is called Anisotropic Cosmic Birefringence (ACB). We have performed for the first time a tomographic treatment of the ACB, by considering photons emitted both at the recombination and reionization epoch. This allows one to extract additional and complementary information about the physical source of cosmic birefringence with respect to the isotropic case. We have focused on the case of an axion-like field, whose coupling with the electromagnetic sector induces such a phenomenon, by using an analytical and numerical approach (which involves a modification of the CLASS code). We have found that the anisotropic component of cosmic birefringence exhibits a peculiar behavior: an increase of the axion mass implies an enhancement of the anisotropic amplitude, allowing to probe a wider range of masses with respect to the purely isotropic case. Moreover, have we shown that at large angular scales, the interplay between the reionization and recombination contributions to ACB is sensitive to the axion mass, so that at sufficiently low multipoles, for sufficiently light masses, the reionization contribution overtakes the recombination one, making the tomographic approach to cosmic birefringence a promising tool for investigating the properties of this axion-like field.

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