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Cosmic Birefringence by Dark Photon

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We study the kinetic mixing between the cosmic microwave background (CMB) photon and the birefringent dark photon. These birefringent dark photon may exist in parity-violating dark sector, for example, through the coupling to axion field. We show that the birefringence of the dark photon propagates to the CMB photon, but the resulting birefringence may not be isotropic over the sky, but will be anisotropic in general. Moreover, our investigation sheds light on the essential role played by kinetic mixing in the generation of two fundamental characteristics of the CMB: circular polarization and spectral distortion.

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