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Cosmic birefringence and p-form fields

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A tantalizing hint of beyond Standard Model (SM) physics lies in the polarization structure of the CMB. Joint analysis of WMAP, Planck, and ACT data suggests that the linear polarization plane of CMB photons has, since the surface of last scattering, rotated by an angle $\beta \sim 0.3$ degrees at over 4.5 σ significance. This is a parity violating phenomenon that can't be described using SM degrees of freedom. An axion-like coupling to the Chern-Simons term predicts a nonzero β, but it is not the only explanation. In this talk, we will overview the essential physics of cosmic birefringence and the role an axion may play. Then, we will explore two alternatives, namely, the possible explanation of cosmic birefringence coming from 2-form dark matter or 3-form dark energy.

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