

# Systematics diagnostics and self-calibration of CMB B-mode measurements with distortion fields for BICEP/Keck and LiteBIRD

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Distortions in the primordial cosmic microwave background polarization can correspond to real or conjectured cosmological signals such as gravitational lensing, patchy reionization, and cosmic birefringence, but they can also arise from instrumental systematics such as detector gain fluctuation, differential gain, differential pointing, polarization angle rotation. The distortion fields generate  $E$  to  $B$  or  $T$  to  $B$  leakage that contaminates the primordial  $B$ -mode signal. These  $B$ -modes have unique  $\langle EB \rangle$  and  $\langle TB \rangle$  correlations that are zero in the primordial  $B$ -mode, which can be used to reconstruct the distortion fields. We demonstrate the method and sensitivity with realistic BICEP3 and Keck Array simulations and data, and show that the distortion fields, if existing, can be detected with  $EB$  and  $TB$  quadratic estimators before any spurious signal shows up in  $B$ -mode power spectra. We also give an outlook on applying this method to future space missions such as LiteBIRD.

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