## 10th International Conference on Gravitation and Cosmology: New Horizons and Singularities in Gravity (ICGC 2023)



Contribution ID: 301

Type: Oral

## Precision Weak Lensing Analysis In CMB Observations For Upcoming Missions

The Cosmic Microwave Background continues to be a cornerstone of precision cosmology. It has provided the most accurate parameter constraints for the widely used  $\Lambda$  cosmological constant and Cold Dark Matter ( $\Lambda$ CDM) model, via missions like COBE, WMAP, and Planck. In precision regimes, accounting for the weak lensing of the CMB photons by the large structure gravitational potential, is a critical challenge. Lensing of the CMB is both a source of information as well a contamination to resolve, in light of unbiased and precise parameter estimation. Therefore in light of upcoming high precision CMB cosmology missions (Simons Observatory, CMB-S4), updated estimators that include higher order lensing corrections at higher precision, are necessary. We discuss the standard minimum variance quadratic estimators used in lensing reconstruction, and promising approaches that improve estimator variance and accuracy with respect to parameter inference and primordial B-mode hunting. We also discuss lensing effects in the context of model independent inflationary power spectra reconstruction and the role delensing plays in improving accuracy for novel estimators.

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Session Classification: Cosmology

Track Classification: Cosmology