# CORRELATION FUNCTIONS OF CMB ANISOTROPY AND POLARIZATION

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## 1. Introduction

While the temperature anisotropy of the cosmic microwave background is proved to be a promising tool for probing the early Universe, the CMB polarization is another important clue for extracting more cosmic information. We give a full analysis of the auto- and cross-correlations between the CMB Stokes parameters. In particular, we derive the windowing function for an antenna with Gaussian response in polarization experiment, and construct correlation function estimators corrected for instrumental noise. They are applied to calculate the signal to noise ratios for future MAP and Planck anisotropy and polarization measurements.

## 2. Results and Conclusions

We have calculated the ensemble average of each correlation estimator, $C_X(\theta) \equiv \left\langle \hat{C_X} \right\rangle$, and its variance, $\Delta C_X(\theta) \equiv \left[ \left\langle \left( C_X - \left\langle \hat{C_X} \right\rangle \right)^2 \right\rangle \right]^{1/2}$, where $X = T, +, -, C$ represent the four independent power spectra. The theoretical expectation of the rms polarization signal, $[C_+(0)]^{\frac{1}{2}}$, is at a level of $1\mu K$. For MAP, the polarization signal to noise ratio S/N is about $1 \sim 2$. The S/N ratio of the temperature-polarization correlation is about $3 \sim 4$. Those S/N ratios for Planck would be much bigger. A rather model independent method for the detection of tensor mode could be achieved by performing the standard maximum likelihood method. For example, the likelihood function can be taken as $\mathcal{L}(C_{E2}, C_{B2})$ with the covariance matrix constructed from $\hat{C_+}$ and $\hat{C_-}$. The central value of $C_{B2}$ in a confidence-level plot different from zero would indicate the presence of tensor mode.



*K. Sato (ed.), Cosmological Parameters and the Evolution of the Universe,* 104.