Observational Strategies of CMB Temperature and Polarization Interferometry Experiments

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We have simulated the interferometric observation of the Cosmic Microwave Background (CMB) temperature and polarization fluctuations. We have constructed data pipelines from the time-ordered raw visibility samples to the CMB power spectra which utilize the methods of data compression, maximum likelihood analysis, and optimal subspace filtering. They are customized for three observational strategies, such as the single pointing, the mosaicking, and the drift-scanning. For each strategy, derived are the optimal strategy parameters that yield band power estimates with minimum uncertainty. The results are general and can be applied to any close-packed array on a single platform such as the CBI and the forthcoming AMiBA experiments.

We have also studied the effect of rotation of the array platform on the band power correlation by simulating the CBI single pointing observation. It is found that the band power anti-correlations can be reduced by rotating the platform and thus densely sampling the visibility plane. This enables us to increase the resolution of the power spectrum in the l-space down to the limit of the sampling theorem (Delta l = 226 = pi / theta), which is narrower by a factor of about sqrt(2) than the resolution limit (Delta l = 300) used in the recent CBI single pointing observation. The validity of this idea is demonstrated for a two-element interferometer that samples visibilities uniformly in the uv-annulus.