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# Exploring the Non-Gaussianity of the Cosmic Infrared Background and Its Weak Gravitational Lensing

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Gravitational lensing deflects the paths of photons, altering the statistics of cosmic backgrounds and distorting their information content. We take the Cosmic Infrared Background (CIB), which provides a wealth of information about galaxy formation and evolution, as an example to probe the effect of gravitational lensing on non-Gaussian statistics. Using the Websky simulations, we first quantify the non-Gaussianity of the CIB, revealing additional detail on top of its well-measured power spectrum. To achieve this, we use needlet-like multipole-band-filters to calculate the variance and higher-point correlations. We show the 3-point and 4-point spectra, and compare our calculated bispectra to Planck values. We then lens the CIB, shell-by-shell with corresponding convergence maps, to capture the broad redshift extent of both the CIB and its lensing convergence. Using our simulations, we show that the lensed CIB power spectrum and bispectrum agree with observations: the lensing of the CIB changes the 3-point and 4-point functions by a few tens of percent at large scales, unlike with the power spectrum, which changes by less than two percent. We expand our analyses to encompass the full intensity probability distribution functions (PDFs) involving all n-point correlations as a function of scale. In particular we use the relative entropy between lensed and unlensed PDFs to create a spectrum of templates that can allow estimation of lensing. The underlying CIB model has uncertainties, in particular missing the important role of star-bursting, which has a larger effect on higher point correlations than on the variance. We test this by adding a stochastic log-normal term to the intensity distributions. The novel aspects of our filtering and lensing pipeline should prove useful for not just CIB applications, but for any radiant background, including line intensity maps.

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