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Wide-angle effects in full-sky surveys

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Current and upcoming redshift surveys will measure the galaxy distribution over an increasing volume, probing interesting physical effects that become important on large physical scales. In particular, the local primordial non-Gaussianity $f_{\rm NL}$ will be measured to $\mathcal{O}(1)$ precision with SPHEREx, which will allow us to distinguish between multi-field and single-field models of inflation. However, the curved nature of the sky becomes more apparent on large angular scales, and any effects that depend on the line-of-sight (LOS) of the observer must be accurately modeled to compute n-point statistics. In this work we quantify the importance of wide-angle effects - corrections to the approximation that all LOS's in the survey are parallel - in the context of $f_{\rm NL}$ constraints from the galaxy power spectrum and bispectrum. We show using a perturbative framework that these effects can mimic an $f_{\rm NL\sim 5}$ signal in the power spectrum multipoles measured by SPHEREx. We confront the perturbative modeling with dedicated simulations to ultimately recommend using exact methods based on spherical Fourier-Bessel (SFB) modes to fully account for the curved sky. Finally, for the first time we compute the bispectrum in the SFB basis and study its key features.

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