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Non-local bias in the halo bispectrum with primordial non-Gaussianity

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Primordial non-Gaussianity can lead to a scale-dependent bias in the density of collapsed halos relative to the underlying matter density. The galaxy power spectrum already provides constraints on local-type primordial non-Gaussianity complementary those from the cosmic microwave background (CMB), while the bispectrum contains additional shape information and has the potential to outperform CMB constraints in future. We develop the bias model for the halo density contrast in the presence of local-type primordial non-Gaussianity, deriving a bivariate expansion up to second order in terms of the local linear matter density contrast and the local gravitational potential in Lagrangian coordinates. Nonlinear evolution of the matter density introduces a non-local tidal term in the halo model. Furthermore, the presence of local-type non-Gaussianity in the Lagrangian frame leads to a novel non-local convective term in the Eulerian frame, that is proportional to the displacement field when going beyond the spherical collapse approximation. We use an extended Press-Schechter approach to evaluate the halo mass function and thus the halo bispectrum. We show that including these non-local terms in the halo bispectra can lead to corrections of up to 25% for some configurations, on large scales or at high redshift.

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