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Breaking $\sum m_\nu$ Parameter Degeneracies with Three-point Statistics

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ABSTRACT

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Keywords: cosmology: —

1. INTRODUCTION

talk about the impact of massive active neutrinos on the matter powerspectrum and how that's detectable with CMB and LSS.

one big roadblock is the degerenacy among τ σ_8 and $\sum m_\nu$. short thing about how τ is hard to constrain

2. HADES AND QUIJOTE SIMULATIONS

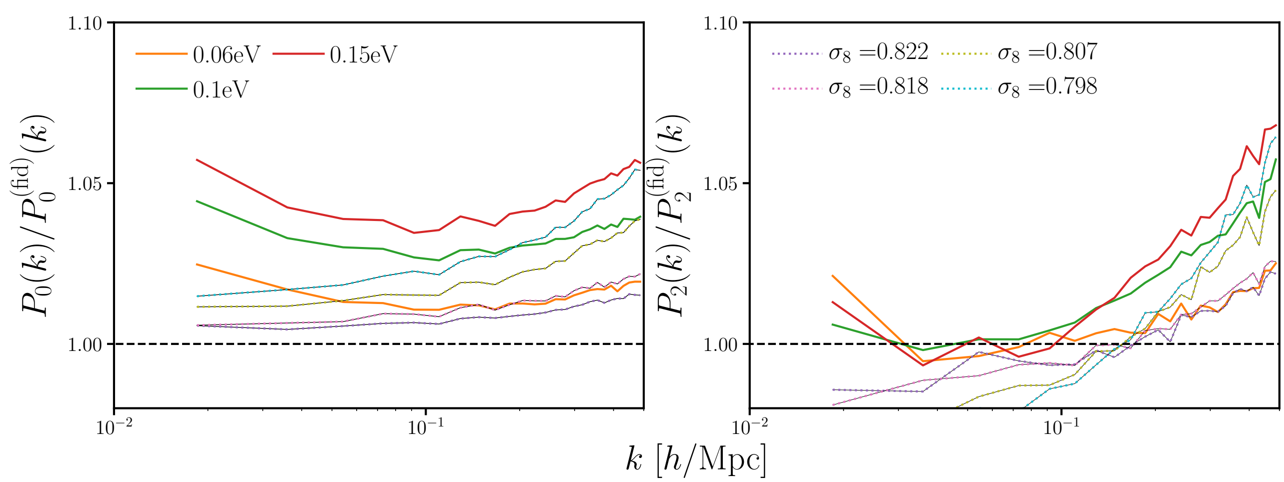

Figure 1. Impact of $\sum m_\nu$ and σ_8 on the redshift-space halo power spectrum monopole and quadrupole. $\sum m_\nu$ and σ_8 produce almost identical effects on halo clustering on small scales ($k > 0.1\,h$/Mpc). This degeneracy can be partially broken through the quadrupole; however, *$\sum m_\nu$ and σ_8 produce, within a few percent, almost the same effect on two-point clustering.*

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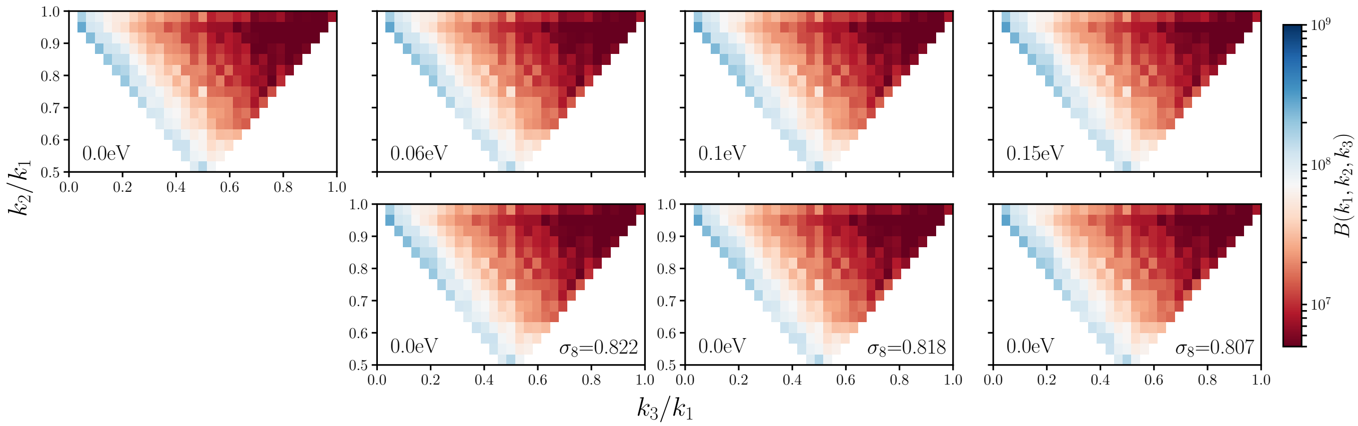


Figure 2. The redshift-space halo bispectrum, $B(k_1, k_2, k_3)$ as a function of triangle configuration shape for $\sum m_\nu = 0.0, 0.06, 0.10$, and $0.15\,\mathrm{eV}$ (top panels) and $\sigma_8 = 0.822, 0.818, 0.807$, and 0.798 (lower panels). **CH:** details on the triangle configurations and the colormap. We describe the estimator used to calculate $B(k_1, k_2, k_3)$ in Section 3.

brief description of the hades simulation and the halo catalogs

3. BISPECTRUM

Brief description of the Scoccimarro et al. bispectrum estimator here

4. RESULTS

5. SUMMARY

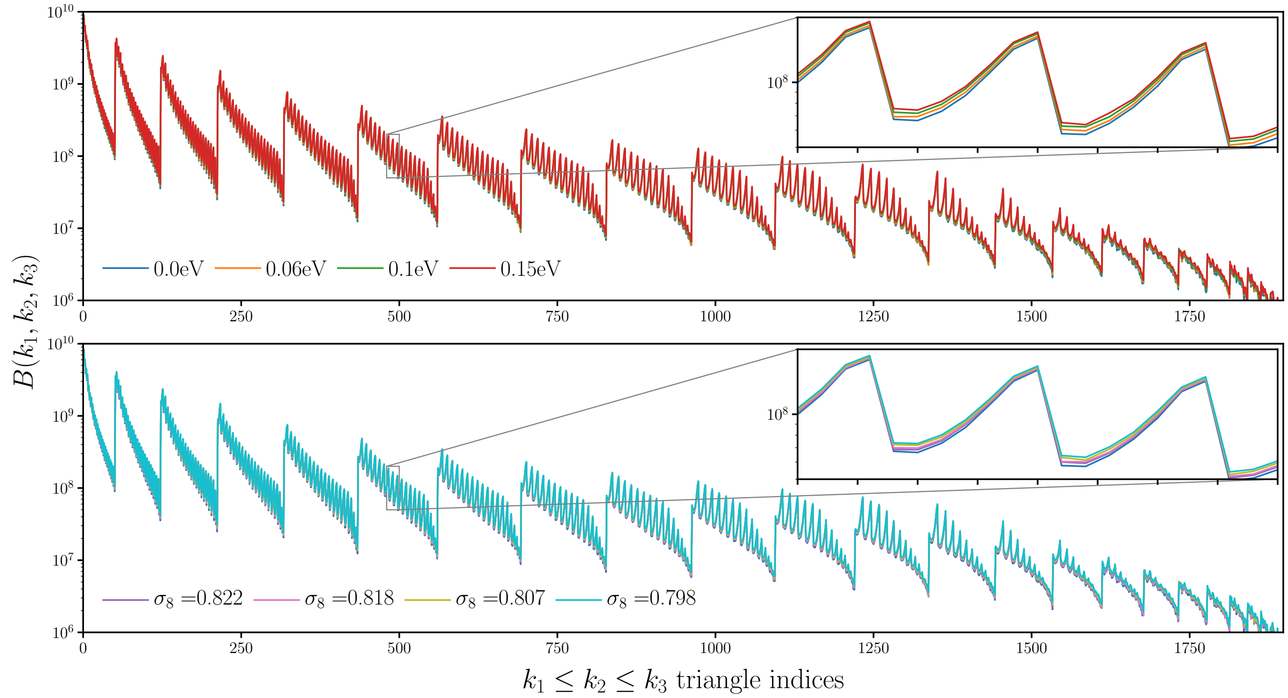


Figure 3. The redshift-space halo bispectrum, $B(k_1, k_2, k_3)$, as a function of all triangle configurations for $\sum m_\nu = 0.0, 0.06, 0.10$, and $0.15\,\mathrm{eV}$ (top panel) and $\sigma_8 = 0.822, 0.818, 0.807$, and 0.798 (lower panel). **CH:** details on the ordering of the triangle configurations; also mention how it's roughly scale dependence. We describe the estimator used to calculate $B(k_1, k_2, k_3)$ in Section 3.

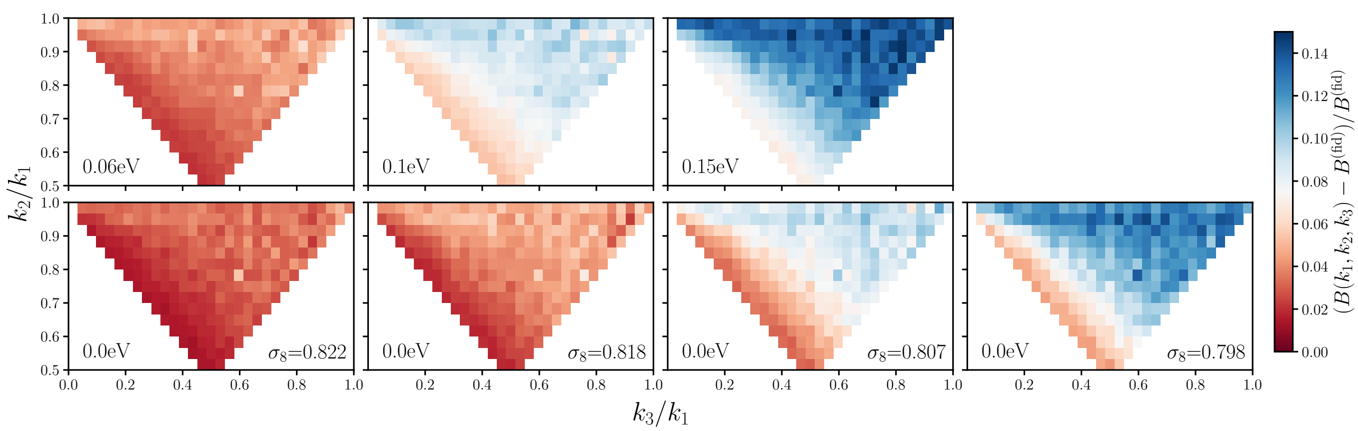


Figure 4. The shape depdence of the $\sum m_\nu$ and σ_8 impact on the redshift-space halo bispectrum, $\Delta B/B^{(\mathrm{fid})}$. $\sum m_\nu = 0.06, 0.10$, and $0.15\,\mathrm{eV}$ (top panels; left to right) are aligned with $\sigma_8 = 0.822, 0.818$, and $0.807\,\mathrm{eV}$ (bottom planes; left to right), which produce mostly degenerate imprints on the redshift-space power spectrum. **CH:** Details on the shape dependence. The difference between the top and bottom panels illustrate that $\sum m_\nu$ *induces a sigificantly different impact on the shape-dependence of the halo bispectrum than* σ_8.

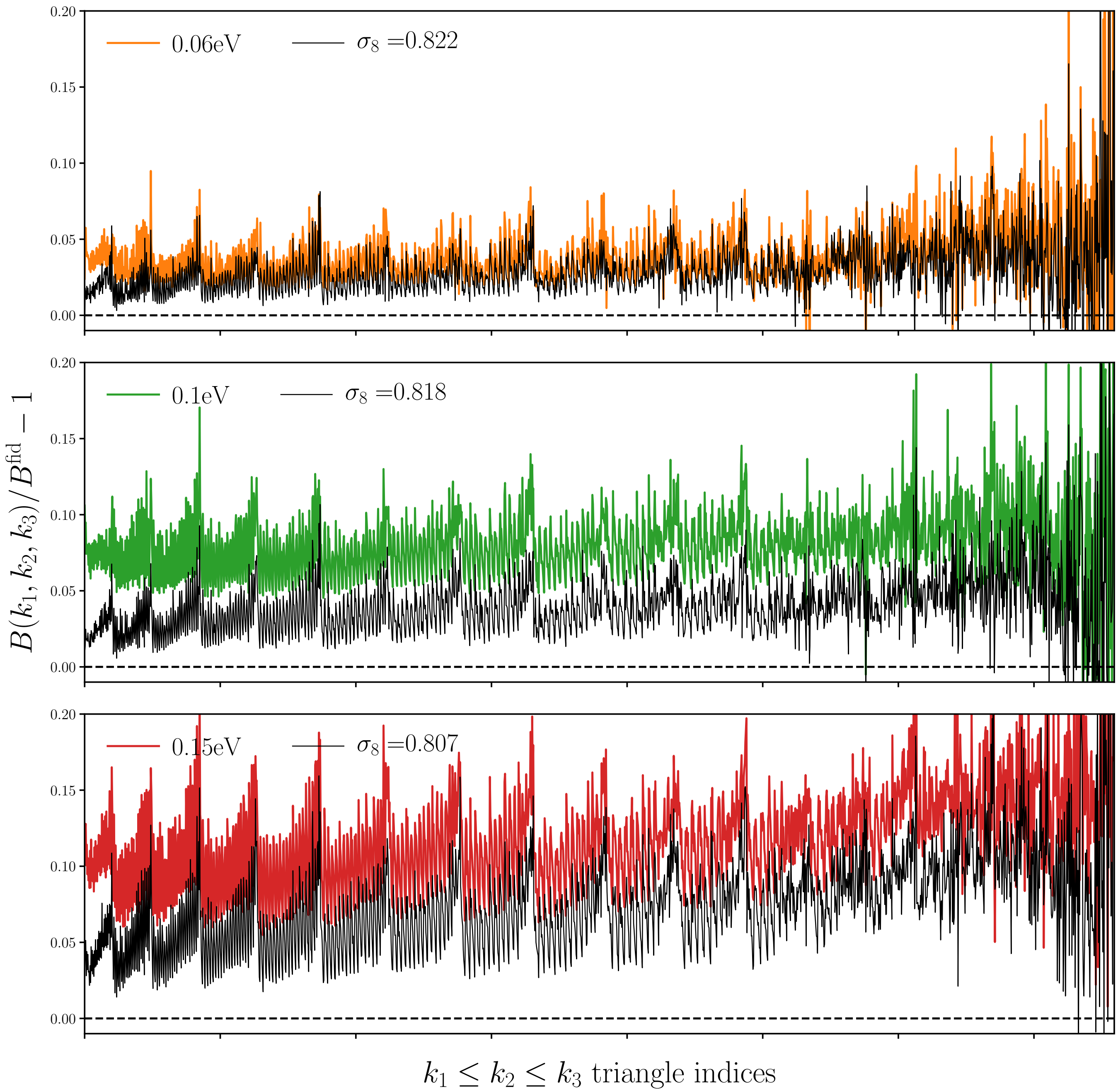
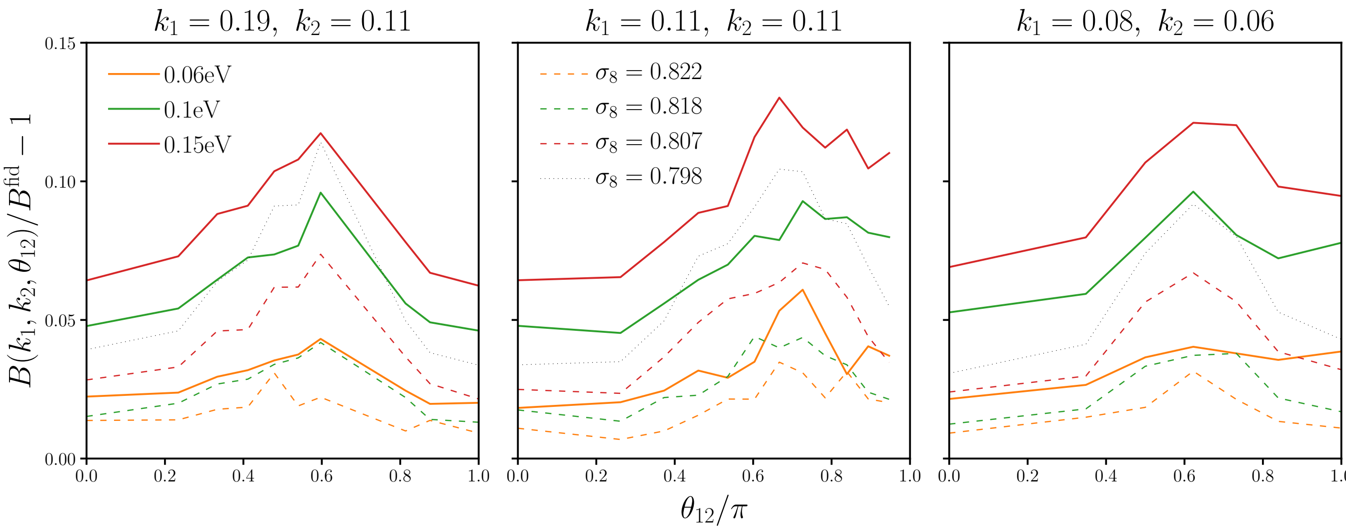


Figure 5. The impact of $\sum m_\nu$ and σ_8 on the redshift-space halo bispectrum for all triangle configurations: $\Delta B/B^{(\rm fid)}$. The impact of $\sum m_\nu$ differs significantly from the impact of σ_8 both in amplitude and scale dependence. For instance, $\sum m_\nu = 0.15\,\rm eV$ (red) has a $\sim 5\%$ stronger impact on the bispectrum than $\sigma_8 = 0.798$ (cyan dotted), which has little difference in the power spectrum (Figure 1). Combined with the shape-dependence of Figure 4, *the contrasting impact of $\sum m_\nu$ and σ_8 on the redshift-space halo bispectrum illustrate that the bispectrum break the degeneracy between $\sum m_\nu$ and σ_8 that degrade constraints from two-point analyses.*



$k_1 = 0.19,\ k_2 = 0.11$
$k_1 = 0.11,\ k_2 = 0.11$
$k_1 = 0.08,\ k_2 = 0.06$
0.06eV
0.1eV
0.15eV
$\sigma_8 = 0.822$
$\sigma_8 = 0.818$
$\sigma_8 = 0.807$
$\sigma_8 = 0.798$
$B(k_1, k_2, \theta_{12})/B^{\rm fid} - 1$
θ_{12}/π

Figure 6.