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Bispectrum analysis of the unresolved gamma-ray background

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In recent years, properties of the unresolved gamma ray background (UGRB) have been constrained by measuring the anisotropy in the form of the angular power spectrum (APS). The energy dependence of the anisotropy has been found to be consistent with a broken power law, suggesting the existence of two distinct source classes above and below $\sim$2 GeV. In this work, we aim to go beyond the angular power spectrum, and use the bispectrum to further constrain the source classes that contribute to the UGRB. As in the case of the APS, for a skymap consisting of unresolved, randomly distributed point sources, we expect the bispectrum to be independent of multipole and therefore to be fully characterised by a single amplitude b_{src}. We adapt the formalism developed in the context of CMB research and apply the resulting analysis pipeline to Fermi-LAT data in the energy range 0.7 GeV −1 TeV. We verify the robustness of our analysis pipeline by applying it to simulated realizations with a predetermined value of the bispectrum amplitude. Additionally, bispectrum amplitudes obtained from the UGRB data are compared to simulated, purely isotropic realizations of the UGRB in order to test for deviations from Poissonianity across the entire energy range. Finally, we check if the energy-dependence of the bispectrum amplitude is consistent with the same broken power-law is in the case of the APS.

Keywords

bispectrum;IGRB;UGRB;anisotropy;skewness;unresolved gamma-ray background;

Collaboration

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