

Connecting gamma-rays and high-energy neutrinos via hierarchical modeling

Gamma-rays and high-energy neutrinos offer complementary ways to study particle acceleration in energetic astrophysical sources. However, analysing these observations together is challenged by possible explanations from a range of complex models, with many uncertainties and observational effects to take into account. We present a coherent data analysis framework based on hierarchical modeling that tackles these challenges. Our framework can be used to uncover weak neutrino sources based on a proposed gamma-ray–neutrino connection and place constraints on the hadronic contribution to the gamma-ray signal from neutrino observations. We demonstrate the potential of this approach on simulated data, considering both individual sources and populations of similar objects. We find that our approach complements existing techniques and offers increased sensitivity, flexibility, and directly interpretable results.

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