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Investigating the blazar-neutrino connection with public IceCube data

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The IceCube collaboration has recently found evidence for connecting the blazar TXS 0506+056 to high-energy neutrino events. Several other studies have independently investigated the hypothesis of blazars and specific subclasses thereof as neutrino emitters with mixed results, including constraints on the contribution of these sources to the observed astrophysical neutrino flux. As such, open questions remain regarding the proposed neutrino production mechanisms, connection to multi-messenger signals, and population properties. Motivated by these challenges, we present an open-source statistical analysis framework to investigate possible sources with publicly available IceCube data. Complementary to existing methods we employ a Bayesian hierarchical model, allowing for more complex modelling and a unique perspective on source discovery. We showcase results of fits to simulated neutrino data of generic source populations, highlighting the benefit of possible inputs from multi-messenger studies as priors. In light of recent developments in multi-messenger modelling of source candidates, we go beyond simple power-law models and analyse 10 years of public Ice-Cube data for possible point source contributions.

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