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Every Flare, Everywhere: An All-Sky Untriggered Search for Astrophysical Neutrino Transients Using IceCube Data

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Recent results from IceCube regarding TXS 0506+056 suggest the presence of neutrino flares that are not temporally coincident with a significant corresponding gamma ray flare. Such flares are particularly difficult to identify, as their presence must be inferred from the temporal distribution of neutrino data alone. Here we present the results of using a novel method to search for all such flares across the entire neutrino sky in 10 years of IceCube data, using both gaussian and box-shaped flare hypotheses. Unlike for past searches, that looked for only the most significant neutrino flare in the data at a given direction, here we implement an algorithm to combine information from multiple flares associated with a single source candidate. This represents the most detailed description of the neutrino sky to date, providing the location and intensity of all neutrino cluster candidates in both space and time. These results can be used to further constrain potential populations of transient neutrino sources, serving as a complement to existing time-integrated and time-dependent methods. We additionally present the results of applying this method to a catalog of gamma-ray emitters which has previously been found to contain an excess of neutrinos at the level of 3.3 sigma. Notably, this catalog contains both TXS 0506+056 and NGC 1068, both sources which have also shown elevated emission under previous time-integrated studies.

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Neutrinos; AGN; Statistical Methods; IceCube; Multi-messenger

Collaboration

IceCube

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Subcategory

Experimental Results

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