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Neutrino energy distributions of astrophysical sources: the GRB example.

Currently, the identification of neutrino sources relies on joint observations with electromagnetic telescopes. This method has led to some successes, but is constrained by the field of view, availability, and observational limitations of traditional telescopes. The ongoing development of neutrino detectors around the world suggests that future datasets will allow for precise source analysis based solely on neutrino observations.
Our objective is to provide the scientific community with theoretical predictions of neutrino emissions that can be compared with observational data from neutrino detectors, and eventually, to develop an identification method using only neutrino observations.
Our work focuses on the example of GRBs. We aim to construct the neutrino energy distribution of such events by combining several theoretical neutrino emission models spanning different energy ranges, which are sensitive to key GRB parameters such as the Lorentz factor and baryonic loading. Then, we use the effective area, angular response and energy response of the IceCube Neutrino Observatory to convert this theoretical energy spectrum to a set of simulated neutrino events that we could expect from a given GRB. Our prospect is to use these results to train machine learning models to search for signature emissions of GRBs in both archival and future data.

Collaboration(s)

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