

Search for Astrophysical Tau Neutrinos in IceCube

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The IceCube Neutrino Observatory has observed a diffuse astrophysical neutrino flux, consistent with equal mixture of neutrino flavors. Regardless of the production mechanism at the source, an appreciable amount of tau neutrinos is expected via mixing over astronomical distances. Identification of tau neutrinos is essential for the precise measurement of the astrophysical neutrino flavor content, which in turn helps test neutrino oscillation paradigms over extremely long baselines and possibly shed light on new physics beyond the Standard Model. A tau neutrino undergoing charged current interaction in IceCube will produce two subsequent energy losses: one from the neutrino-hadron interaction, and the other from the decay of the secondary tau lepton. Such double depositions of energy can appear as a causally connected “double bang” topology for high neutrino energies ($> \text{PeV}$) or as double pulses in the waveforms of photon sensors at lower neutrino energies ($> 100 \text{ TeV}$). I will present a recent search for astrophysical tau neutrinos creating double pulses using three years of IceCube data, and overview the ongoing effort to improve the double pulse waveform identification techniques for future analyses.

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