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Probing the cosmic sterile-neutrino background with IceCube

Tuesday, September 30, 2025 7:00 PM (1 hour)

In this talk, we take a close look at the interaction between the TeV-PeV energy astrophysical neutrinos and a hypothetical cosmic sterile-neutrino background. These interactions yield absorption features, also called “dips”, in the astrophysical neutrino spectrum, which are studied using the deposited energy distribution of high-energy starting events (HESE) in the IceCube detector. We improve upon the previous analysis by including the effects of regeneration and a realistic source distribution on the propagation of astrophysical neutrinos. We use the latest 7.5-year HESE dataset and include the observation of Glashow resonance in our analysis. We evaluate the impact of these dips on the inferred spectral index and overall normalization of the astrophysical neutrinos. We find a mild preference for dips in the 300–800 TeV range, and the best-fit parameters for the mass of sterile-neutrino and the mediator are 0.5 eV and 23 MeV, respectively. We find that the inclusion of these absorption features lowers the spectral index of astrophysical neutrinos to $2.60^{+0.19}_{-0.16}$. We show qualitatively that the lower spectral index from HESE sample can reduce the disagreement with the Northern Tracks sample. We also forecast the event spectrum for IceCube-Gen2 for the two different fits. Although preliminary, this work is one of the early attempts at searching for new physics across IceCube datasets.

Neutrino Properties

Non-oscillation searches for light sterile neutrinos

Neutrino Telescopes & Multi-messenger

NA

Neutrino Theory & Cosmology

NA

Data Science and Detector R&D

NA

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Session Classification: Poster Session (with cocktail)

