

A First Look at Sky Anisotropies of High-Energy Neutrino Flavours

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Lorentz invariance is a pillar symmetry of the Standard Model. Yet, it may be violated in proposed extensions, inducing preference for particular directions in the propagation of particles. This type of Lorentz-invariance violation (LIV) is difficult to test. Fortunately, high-energy astrophysical neutrinos, with TeV–PeV energies and cosmological-scale baselines, provide us with a unique opportunity to do so; by looking for the differences in the distribution of arrival directions of neutrinos of different flavours. Using 7.5 years of IceCube High Energy Starting Events, we model a flavour-dependent spherical harmonic expansion of the neutrino flux and ground our predictions in realistic detector simulations. Further, we forecast the near-future reach of current and upcoming neutrino telescopes to constrain and detect these flavour anisotropies. Our work reaffirms the power of high-energy astrophysical neutrinos to probe fundamental physics, and stresses the need to do so while accounting for theoretical and experimental nuance.

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yes

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