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On the flavor composition of the high-energy neutrino events in IceCube

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The IceCube experiment has recently reported the observation of 28 high-energy (> 30 TeV) neutrino events, separated into 21 showers and 7 muon tracks, consistent with an extraterrestrial origin. In this talk we discuss the compatibility of such an observation with possible combinations of neutrino flavors with relative proportion (alpha_e:alpha_mu:alpha_tau). Although the 7:21 track-to-shower ratio is naively favored for the canonical (1:1:1) at Earth, this is not true once the atmospheric muon and neutrino backgrounds are properly accounted for. We find that, for an astrophysical neutrino E^(-2) energy spectrum, (1:1:1) at Earth from hadronic sources is disfavored at 79% CL. If this proportion does not change, six more years of data would be needed to exclude (1:1:1) at Earth at 3 sigma CL. Indeed, with the recently-released preliminary 3-year data, that flavor composition is excluded at 91% CL. The best-fit is obtained for (1:0:0) at Earth, which cannot be achieved from any flavor ratio at sources with averaged oscillations during propagation. If confirmed, this result would suggest either a misunderstanding of the expected background events, or a misidentification of tracks as showers, or even more compellingly, some exotic physics which deviates from the standard scenario.

Summary

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