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Search for Neutrino Induced Double Tracks as an Exotic Physics Signature in IceCube

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Physics theories beyond the Standard Model like Supersymmetry and models with extra dimensions often invoke \mathbb{Z}_2 -symmetries in order to avoid new couplings that lead to unobserved new physics like unnaturally fast proton decay. This gives rise to the possibility of heavy, new particles being produced in pairs with the lightest of them being (meta-) stable. Thus, under favorable conditions, neutrinos in the PeV range - like those observed by IceCube - can produce pairs of exotic, charged particles that can be seen in a km³-sized detector as two parallel, muon-like tracks with a track separation a few hundred meters. We discuss the methods of reconstructing double tracks and how to separate them from other air shower or neutrino-induced (coincident) muon events in a model independent way. The results of the first search for such events with the IceCube detector in its 79-string configuration and how to interpret them in the context of more explicit beyond the Standard Model frameworks, like Supersymmetry, is shown.

Collaboration

IceCube

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Primary author: KOPPER, Sandro (BU Wuppertal)**Presenter:** KOPPER, Sandro (BU Wuppertal)**Session Classification:** Poster 3 DM and NU**Track Classification:** NU-EX