

Prospects of Neutrino Physics



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Exotic Physics Searches at Neutrino Detectors

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The MiniBooNE experiment has recently reported an anomalous 4.5σ excess of electron-like events consistent with ν_e appearance from a ν_μ beam at short-baseline. Given the lack of corresponding ν_μ

disappearance observations, required in the case of oscillations involving a sterile flavor, there is strong motivation for alternative explanations of this anomaly. We consider the possibility that the observed electron-like signal may

actually be due to hypothetical new particles, which do not involve new sources of neutrino production or oscillations. We find that the electron-like event energy and angular distributions in the full MiniBooNE data-set, including

neutrino mode, antineutrino mode, and beam dump mode, severely limit, and in some cases rule out, new physics scenarios as an explanation for the observed neutrino and antineutrino mode excesses. Specifically, scenarios in which the new particle decays (visibly or semi-visibly) or scatters elastically in the detector are strongly disfavored. Using generic kinematic arguments, this paper extends the existing MiniBooNE results and interpretations to exhaustively

constrain previously unconsidered new physics signatures and emphasizes the power of the MiniBooNE beam dump search to further constrain models for the excess.

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