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Explaining the MiniBooNE Excess Through a Mixed Model of Oscillation and Decay

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This talk presents a model of the electron-like excess observed by the MiniBooNE experiment comprising of oscillations involving two new mass states: ν_4, at $\mathcal{O}(1)$ eV, that participates in oscillations, and $\mathcal{N}$, at $\mathcal{O}(100)$ MeV, that decays to $\nu + \gamma$ via a dipole interaction.
Short-baseline oscillation data sets, omitting MiniBooNE appearance data, are used to predict the oscillation parameters. We simulate the production of $\mathcal{N}$ along the Booster Neutrino Beamline via both Primakoff up-scattering ($\nu A \to \mathcal{N} A$) and Dalitz-like neutral pion decays ($\pi^0 \to \mathcal{N}\nu\gamma$).
The simulated events are fit to the MiniBooNE neutrino energy and visible scattering angle data separately to find a joint allowed region at 95\% CL.
A point in this region with a coupling of 3.6×10^{-7} GeV^{-1}, $\mathcal{N}$ mass of 394 MeV, oscillation mixing angle of 6×10^{-4} and mass splitting of 1.3 eV^2 has $\Delta\chi^2/dof$ for the energy fit of 15.23/2 and 37.80/2. This model represents a significant improvement over the traditional single neutrino oscillation model.

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