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Exploring the Dark Sector in MicroBooNE Through e+e- Final States

MicroBooNE is a neutrino experiment at Fermilab that ran from 2015 to 2020. It uses a liquid Argon time projection chamber (LArTPC) to detect neutrino events from a flux of predominantly muon neutrinos. In 2018, its predecessor MiniBooNE published results showing the detection of a significant excess of electromagnetic events in its data compared to expectation. The MiniBooNE anomaly defied traditional models of three-neutrino oscillations, and MicroBooNE was designed to explore various explanations. Some dark sector theories posit the production of e^+e^- pairs through a heavy neutrino intermediary. These would be indistinguishable from single electrons or photons in MiniBooNE if produced with sufficiently low opening angle. MicroBooNE has the potential to distinguish between such events because it spatially resolves the entire path of ionizing particles. This talk/poster describes two methods of calculating the opening angle of e^+e^- pairs: traditional line-fitting and a graph neural network based on PointNet++. By utilizing these methods, MicroBooNE has the potential to shed light on the nature of the dark sector and its influence on neutrino interactions.

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