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Antineutrino-CH QE-Like Scattering at MINERvA: Two Views

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Quasi-elastic (QE) interactions are important to model well because they are a large component of the total antineutrino cross section at low momentum transfer and a great way to reconstruct antineutrino energy in principle. In practice, final state interactions (FSI) on heavy nuclei complicate selecting QE interactions, and neutron production by antineutrino QE interactions complicates calorimetry. Integrating measurements of QE interactions, FSI, and neutron production into the next generation of antineutrino interaction models is needed to help drive down systematic uncertainties for long baseline oscillation experiments.

This presentation opens with a new double-differential QE-like antineutrino cross section measurement on CH from MINERvA. Differential cross sections are shown in muon momentum components and Q^2_{QE}. This result has greatly enhanced statistical power and improved sensitivity to DUNE's high energy tail relative to MINERvA's low energy (LE) antineutrino QE-like result. The antineutrino QE-like differential cross section is compared to MINERvA's 2020 Medium Energy neutrino QE-like cross section measurement and several leading models. MINERvA's first foray into reconstructing neutrons from LE antineutrino interactions is also described. Energy deposit, timing, and distance distributions can be shown because MINERvA is sensitive to neutron inelastic interactions. Neutron candidate multiplicity is explored as a handle on interactions with correlated nucleon pairs.

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