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JLab spectral functions of argon in NuWro and their implications for MicroBooNE

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The Short-Baseline Neutrino program in Fermilab aims to resolve the nature of the low-energy excess events observed in LSND and MiniBooNE, and analyze with unprecedented precision neutrino interactions with argon. These studies require reliable estimate of neutrino cross sections, in particular for charged current quasielastic scattering (CCQE). In arxiv:2312.13369 (to be published in Phys. Rev. D), we report updates of the NuWro Monte Carlo generator that, most notably, bring the state-of-the-art spectral functions to model the ground state properties of the argon nucleus, and improve the accuracy of the cross sections at low energies by accounting for the effects of the nuclear Coulomb potential. We discuss these developments in the context of electron and neutrino interactions, by comparing updated NuWro predictions to experimental data from Jefferson Laboratory Hall A and MicroBooNE. The MicroBooNE CCQE-dominated data are described with the χ^2 per degree of freedom of 0.7, compared with 1.0 in the local Fermi gas model. The largest improvement is observed for the angular distributions of the produced protons, where the χ^2 reduces nearly by half. Being obtained using the axial form factor parametrization from MINERvA, our results indicate a~consistency between the CCQE measurements in MINERvA and MicroBooNE.

Poster prize

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