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Implementation of CRPA in GENIE and comparisons of 1p1h models

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Building on Phys. Rev. D 106, 073001 (2022), we present the implementation and validation of the Hartree-Fock continuum random phase approximation (HF-CRPA) model in the GENIE neutrino-nucleus interaction event generator and a comparison of the subsequent predictions to experimental measurements of lepton kinematics from interactions with no mesons in the final state. These predictions are also compared to those of other models available in GENIE. It is shown that, with respect to these models, HF-CRPA predicts a significantly different evolution of the cross section when moving between different interaction targets, when considering incoming anti-neutrinos compared to neutrinos and when changing neutrino energies. These differences are most apparent for interactions with low energy and momentum transfer. It is also clear that the impact of nucleon correlations within the HF-CRPA framework is very different than in GENIE's standard implementation of RPA corrections. Since many neutrino oscillation experiments rely on their input model to extrapolate between targets, flavours, and neutrino energies, the newly implemented HF-CRPA model provides a useful means to verify that such differences between models are appropriately covered in oscillation analysis systematic error budgets.

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