Relativistic Descriptions of Quasielastic Charged-Current Neutrino-Nucleus Scattering

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A study of the cross section for neutrino (antineutrino) charged-current quasielastic (CCQE) scattering on nuclei has been performed using a description of nuclear dynamics based on the SuperScaling Approximation (SuSA) [1] and the Relativistic Fermi Gas model (RFG). The role played by different parameterizations for the weak nucleon form factors [2] is analyzed taking into account the relevance of the axial mass value [3]. A deep study of the scaling phenomenon and its application to neutrino (antineutrino) nucleus scattering processes will also be considered for very different kinematical situations.

Our results are compared with the recent data for neutrino (antineutrino) cross section measured by the MiniBooNE Collaboration [4]. Moreover, we enlarge this study to higher energies (10-100 GeV) to investigate NOMAD data [5] and the relevance of other effects beyond the Impulse Approximation (IA). Our analysis is also extended to other models based on microscopic dynamic descriptions, such as the Relativistic Mean Field approach (RMF) that includes final state interactions within the framework of a fully relativistic description.

Based on the IA, a larger axial mass value is shown to improve the comparison between theoretical models and MiniBooNE data, what should be taken as an indication of incompleteness of the theoretical description of the MiniBooNE data. Recent studies [1] have shown that 2p-2h MEC contributions lead to a significant enhancement of the cross section. Additional effects related to final-state interactions, correlations, nucleonic resonances and deep inelastic scattering are surely needed to explain experimental data at larger energies (> 10 GeV).

References

[1] J.E. Amaro et al., *Phys. Rev D* **84** (2011) 033004.

[2] R. González-Jiménez et al., *Phys. Rep.* **524** (2013) 1-35.

[3] J. Nieves et al., *Phys. Lett. B* **707** (2012) 72-75.

[4] A.A. Aguilar-Arevalo et al. (MiniBooNE Collaboration), *Phys. Rev. D* **81** (2010) 092005; arXiv:1301.7067v1 [hep-ex] (2013).

[5] V. Lyubushkin et al., *Eur. Phys. J. C* **63**, 3 (2009) 355-381.