Superscaling Analysis of Inclusive (Anti)Neutrino Scattering within the Coherent Density Fluctuation Model

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We investigate the quasielastic (anti)neutrino scattering on the ^{12}C nucleus utilizing a novel scaling variable, ψ^*. This variable is derived from the interacting relativistic Fermi gas model, which incorporates both scalar and vector interactions, leading to a relativistic effective mass for the interacting nucleons. For inclusive lepton scattering from nuclei, we develop a new scaling function, denoted as $f^{\rm QE}(\psi^*)$, based on the coherent density fluctuation model (CDFM). This model serves as a natural extension of the relativistic Fermi gas (RFG) model applicable to finite nuclei. The theoretical results obtained in the present paper are compared with experimental data from MiniBooNE, Minerνa, and T2K for inclusive (anti)neutrino cross sections. The scaling function is derived within the CDFM framework, employing a relativistic effective mass of $m_N^* = 0.8m_N$. The findings demonstrate a high degree of consistency with experimental data across all (anti)neutrino energy ranges [1–3].

References

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