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2p-2h excitations in neutrino scattering: angular distribution and frozen approximation

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We study the phase-space dependence of 2p-2h excitations in neutrino scattering using the relativistic Fermi gas model \cite{Rui14}. We follow a similar approach to Refs. \cite{Pace03,Ama10}, but focusing in the phase-space properties, comparing with the non-relativistic model of \cite{Van81}. A careful mathematical analysis of the angular distribution function for the outgoing nucleons is performed. Our goals are to optimize the CPU time of the 7D integral to compute the hadronic tensor in neutrino scattering, and to conciliate the different relativistic and non relativistic models by describing general properties independently of the two-body current. For some emission angles the angular distribution becomes infinite in the Lab system, and we derive a method to integrate analytically around the divergence. Our angular distribution is the same as the one obtained in the Monte Carlo generators by a boost from the CM isotropical distribution. Our formalism is applied to neutrino scattering from C-12, in the particular case of the seagull MEC diagrams. Our results show that the frozen approximation, obtained by neglecting the momenta of the two initial nucleons inside the integral of the hadronic tensor, reproduces fairly the exact response functions.

\begin{thebibliography}{expo92}

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No

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WG4: Muon Physics (Yes/No)

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WG1: Neutrino Oscillation Physics (Yes/No)

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