The Relativistic Green's Function Model for Quasielastic Neutrino-Nucleus Scattering

C. Giusti

Dipartimento di Fisica, Università degli Studi di di Pavia, and Istituto Nazionale di Fisica Nucleare, Sezione di Pavia, Pavia, Italy

A deep understanding of neutrino-nucleus cross sections is very important for the determination of neutrino oscillation parameters. Reliable models are required where all nuclear effects are well under control. Within the quasielastic (QE) kinematic domain, the treatment of the final-state interactions (FSI) between the emitted nucleon and the residual nucleus is an essential ingredient for the comparison with data. In the relativistic Green's function (RGF) model FSI are described in the inclusive lepton-nucleus scattering consistently with the exclusive scattering by the same complex optical potential, but the imaginary part is used in the two cases in a different way and in the inclusive process it is responsible for the redistribution of the flux in all the channels and the total flux is conserved. The RGF model was originally developed for QE electron scattering, successfully tested in comparison with electron-scattering data, and then extended to neutrino-nucleus scattering. A crucial ingredient is the imaginary part of the optical potential, which includes the overall effect of all the inelastic channels and recovers in the RGF model contributions of reaction processes that are not included in other models based on the impulse approximation. The RGF results are usually larger than the results of other models based on the impulse approximation and are in better agreement with the MiniBooNE cross sections for charged-current quasielastic (CCQE) and neutral-current elastic (NCE) scattering. However, the results are affected by uncertainties in the determination of the phenomenological optical potential. Different optical potentials, obtained through a fit of elastic proton-nucleus scattering data, can produce different results. In this contribution the role of the optical potential in the RGF model is discussed. The numerical predictions of different optical potentials are presented and compared in different situations for QE electron and neutrino-nucleus scattering. In particular, the results are compared with the CCQE and NCE MiniBooNE data.