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Quasielastic neutrino-nucleus scattering in a continuum random phase approximation approach

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We present a detailed description of a continuum random phase approximation approach to inclusive quasielastic electron and neutrino-nucleus scattering. The description of the nucleus starts from a mean field (MF) potential, where long-range correlations are added by means of a continuum random phase approximation (CRPA) based on a Green's function approach using an effective Skyrme interaction as residual interaction. The formalism is validated
by confronting our cross-section predictions with inclusive electron-scattering data for a variety of nuclear targets (^{12}C, ^{16}O, ^{40}Ca), in the kinematic region where quasi-elastic scattering is expected to be the dominant process. We report on cross sections calculations for charged-current quasielastic (anti)neutrino scattering off ^{12}C in the energy range of interest for the MiniBooNE experiment and compare our results with the MiniBooNE (anti)neutrino cross-section measurements. The CRPA predictions reproduce the gross features of the measured double-differential cross sections. We pay special attention to the low-energy excitations which can account for non-negligible contributions in the MiniBooNE, T2K and other similar experiments, and require a microscopic nuclear investigation beyond the Fermi gas model.

WG3: Accelerator Physics (Yes/No)

No

WG2: Neutrino Scattering Physics (Yes/No)

Yes

WG4: Muon Physics (Yes/No)

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WG1: Neutrino Oscillation Physics (Yes/No)

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