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Quasielastic interactions of monoenergetic kaon decay-at-rest neutrinos

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Monoenergetic muon neutrinos with an energy of 236 MeV are readily produced in intense medium-energy proton facilities at Fermilab and J-PARC when a positive kaon decays at rest ($K^+ \to \mu^+ \nu_\mu$) in the beamline absorber.
These kaon decay-at-rest (KDAR) neutrinos offer a distinctive opportunity to study neutrino-nucleus interactions without having to deal with the complications raised by pion decay-in-flight neutrinos with broad energy-distributions.
These monoenergetic neutrinos carry the key to a better understanding of the role of e.g. initial and final-state interactions, and correlations in the nuclear medium, and they will help to reduce experimental and theoretical uncertainties and ambiguities in an unprecedented way.

The charged-current interaction KDAR muon neutrinos occur in a kinematic region that is strongly affected by nuclear effects such as Pauli-blocking and long-range correlations.
We present cross sections of electron- and neutrino-nucleus scattering in the kinematic region probed by KDAR neutrinos, paying special attention to the low-energy aspects of the scattering process.
Our model takes the description of the nucleus in a mean-field (MF) approach as the starting point, where we solve Hartree-Fock (HF) equations using a Skyrme (SkE2) nucleon-nucleon interaction.
We introduce long-range nuclear correlations by means of the continuum random phase approximation (CRPA) framework where we solve the RPA equations using a Green's function method in configuration space.
We discuss the relevance of a precise determination of KDAR ν_μ-nucleus cross sections for neutrino oscillation experiments. In particular for the MiniBooNE experiment that observes a large excess of electron-like events in a ν_μ beam in the (reconstructed) energy bins that overlap with the KDAR ν_μ energy.

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