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Electroweak Pion and Photon Production from Nuclei in a Chiral Effective Field Theory[1] BRIAN D. SEROT, XILIN ZHANG, Indiana University — The electroweak response of the nuclear many-body system is investigated at intermediate energies, where the Δ resonance becomes important. The theory is applied to pion and photon production from nuclei, which are potential backgrounds in the MiniBooNE experiment. The Lorentz-invariant effective field theory contains nucleons, pions, Deltas, isoscalar scalar (σ) and vector (ω) fields, and isovector vector (ρ) fields. The lagrangian exhibits a nonlinear realization of $SU(2)_L \times SU(2)_R$ chiral symmetry and incorporates vector-meson dominance. Power counting for vertices and diagrams involving the Δ is discussed. To calibrate the axial vector current, pion production from the nucleon is used as a benchmark. For calculations with nuclei, we use a local, relativistic Fermi gas description based on the relativistic mean-field theory ground state. Quasielastic electron scattering and pion electroproduction are used to test the nuclear model and to determine the Δ interactions in the nuclear medium. Final state interactions are ignored. Results for neutrino-induced pion and photon production on ^{12}C, ^{16}O, and ^{56}Fe are shown. The relationship to the excess events seen at low energies at MiniBooNE is discussed.

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Brian D. Serot
Indiana University

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