Phenomenology 2025 Symposium



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Global Extraction of the Electromagnetic Response Functions (

cal R_L and

cal R_T) for ¹²C, ⁴⁰Ca and ⁵⁶Fe and Comparisons to Nuclear Theory and Neutrino/Electron Monte Carlo Generators

Tuesday 20 May 2025 18:15 (15 minutes)

We perform a global extraction of the ¹²C, ⁴⁰Ca and ⁵⁶Fe longitudinal ($calR_L$) and transverse ($calR_T$) nuclear electromagnetic response functions from an analysis of all available electron scattering data on these nuclei. The response functions are extracted for energy transfer ν , spanning the nuclear excitation, quasielastic (QE) scattering with one nucleon (1p1h) and two nucleon (2p2h) final states, and the resonance and inelastic continuum. We extract $calR_L$ and $calR_T$ as functions of ν for both fixed values of Q^2 and also for fixed values of 3-momentum transfer **q**. Given the nuclear physics common to both electron and neutrino scattering from nuclei, extracted response functions from electron scattering spanning a large range of Q^2 and ν also provide a powerful tool for validation and tuning of neutrino Monte Carlo (MC) generators. For ¹²C we compare the measurements to theoretical predictions including Energy Dependent-Relativistic Mean Field(ED-RMF), Green's Function Monte Carlo (GFMC), Short Time Approximation Quantum Monte Carlo(STA-QMC), an improved superscaling model (SuSAv2), Correlated Fermi Gas"(CFG), as well as the Nuwro and Achilles generators. For ¹²C we find that combining the ED-RMF-QE-1p1h predictions with the SuSAv2-MEC-2p2h predictions provides a good description of $calR_L$ and $calR_T$ for both single nucleon (from QE and nuclear excitations) and two nucleon final states over the entire kinematic range. For ⁴⁰Ca and ⁵⁶Fe we focus on comparisons of the measurements to the predictions of ED-RMF and SuSAv2.

Mini Symposia (Invited Talks Only)

Plenary (Invited talks only)

Author: BODEK, Arie (University of Rochester (US))Presenter: BODEK, Arie (University of Rochester (US))Session Classification: Neutrino

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