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Nucleon elastic and resonance structures from hadronic tensor in lattice QCD: implications for neutrino-nucleon scattering

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The excitation of nucleons to resonance structures via electromagnetic interactions is crucial for enhancing our comprehension of strong interactions within the realm of quark confinement. Additionally, accurate knowledge of neutrino-nucleon scattering is vital for neutrino oscillation experiments. In this study, we present determinations of the nucleon electric form factor ($G_E(Q^2)$), the nucleon-to-Roper transition form factor ($G_E^*(Q^2)$), and the associated longitudinal helicity amplitude ($S_{1/2}(Q^2)$) utilizing the hadronic tensor for the first time. We outline future prospects to extend this formalism for determining the nucleon's magnetic and axial structures in the elastic and resonance regions, which will provide theoretical constraints for investigating resonance structures and neutrino-nucleus scattering experiments.

Topical area

Structure of Hadrons and Nuclei

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