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Hadronic tensor with lattice QCD and elastic form factors

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We propose to study the hadronic tensor with lattice QCD, which works in all the energy ranges (from elastic scattering to inelastic scattering and on to deep inelastic scattering) and is related to many important physical problems. A challenge of this approach in the study of PDFs is to access high momentum and energy transfers, and numerical tests show that small lattice spacings are essential for this purpose. The need of fine lattices appear to be a common problem faced by the lattice PDF community. On the other hand, before lattices with very fine spacing are available, the hadronic tensor can be used to study the nucleon elastic form factors and low-energy scatterings such as the neutrino-nucleon scattering which is of significant physical importance. Numerically, the nucleon electric form factors (connected insertions only) calculated by means of 3-point functions for both u and d quarks are found to be consistent within errors with those deduced from the hadronic tensor.

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