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Parton structure from Hamiltonian lattice gauge theory

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Calculating parton functions from first principles remains a major challenge: they require matrix elements with a Wilson line along a light-like direction, which are not directly accessible in the Euclidean lattice formulation underlying conventional Monte Carlo simulations. In contrast, the Hamiltonian formalism allows for a direct treatment of light-cone dynamics, complementing indirect Euclidean methods. Recent developments in quantum computing and tensor network approaches enable efficient representations of states in Hilbert space. We developed a framework to extract light-cone matrix elements from a time evolution in Minkowski space and demonstrate the approach in a tensor-network calculation in the massive Schwinger model. We present PDFs and LCDAs of the Schwinger model with different fermion masses with controlled uncertainties.

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