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Quantum Simulations of Nuclear Dynamics in First Quantization

Thursday 2 October 2025 14:00 (20 minutes)

Real-time simulations of nuclear reactions are classically intractable due to exponential scaling. By adopting a first-quantized formulation of pionless effective field theory, we show that quantum computers can simulate such dynamics efficiently, with costs that grow only polynomially in nucleon number and logarithmically with basis size. The approach demonstrates an exponential saving over previous methods and suggests that simple scattering problems could be tackled on early fault-tolerant devices, bringing ab initio reaction dynamics within reach of near-term quantum hardware.

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