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Exponential Improvement in Quantum-Simulation Cost of Lattice Quantum Chromodynamics using Product Formulas

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We discuss how a systematic partitioning of the terms in a lattice gauge theory Hamiltonian, with regard to electric-basis discretization, can be done so as to dramatically reduce the number of terms to be simulated in product-formula-based quantum simulation protocols (including Trotterization). Compared to another frequently cited proposal, this simple regrouping can immediately drop at least a factor of one billion from the gate cost of simulating magnetic interactions in the fault-tolerant regime. We estimate about 13 overall orders of magnitude reduction in overall gate cost when other aspects of the cost are taken into consideration. Our findings indicate the maximum potential for product-formula methods is not a settled matter and warrants continued investigation.

Parallel Session (for talks only)

Quantum computing and quantum information

Authors: STRYKER, Jesse (Lawrence Berkeley National Laboratory); Prof. DAVOUDI, Zohreh (University of Maryland)

Presenter: STRYKER, Jesse (Lawrence Berkeley National Laboratory)

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