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Extending the Reach of Real-Time Lattice Gauge Theory Evolution on Near-Term Quantum Devices[1] ANDREW SHAW, ZOHREH DAVOUDI, University of Maryland, College Park — Certain computational problems in physics are estimated to require more classical computing resources than next-generation Exascale hardware will provide. A notable example is the calculation of real-time dynamics, as the time-complexity of classical evolution algorithms scales super-polynomially with the system size. Quantum computing algorithms may offer a relative speedup, and present an exciting alternative to study the evolution of lattice gauge theories. However, calculations on near-term quantum devices are limited by noise accumulation, setting a limit on the range of real-time dynamics that can be accessed. We present a new hybrid algorithm called segmented trotterization that extends the range of evolution through the use of quantum tomography (QT), which enables one to determine an unknown quantum state. In this algorithm, a quantum state is extracted with QT before the characteristic time-scale of the noise, so the state can be determined with only perturbative corruption due to decoherence. Subsequently reinitializing the state on fresh qubits allows one to continue the evolution. We demonstrate on the publicly available IBMQ-14 device that the evolution of the two-site Schwinger Model can be extended by a factor of $\sim \mathcal{O}(\infty/)$.

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