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Quantum algorithm for simulation of an SU(2) lattice gauge theory with fermions

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We present a complete and scalable quantum algorithm for the simulation of SU(2) gauge bosons coupled to fermionic matter in one spatial dimension. To represent the gauge fields, we find it is more practical to start from their Schwinger boson formulation, rather than the more conventional Kogut-Susskind rigid rotor formulation. Within this framework, and taking Trotter-Suzuki decomposition as the time evolution scheme, we then construct explicit circuits for the simulation of the three types of terms found in the Hamiltonian: electric energy, fermion mass energy, and the gauge-matter interaction. We comment on the similarities and differences relative to simulating the U(1) analogue of this theory, the Schwinger model, which is discussed in another talk by A.F. Shaw.

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