

Atomic Quantum Simulation of Dynamical Gauge Fields coupled to Fermionic Matter: From String Breaking to Evolution after a Quench

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Using a Fermi-Bose mixture of ultra-cold atoms in an optical lattice, we construct a quantum simulator for a U(1) gauge theory coupled to fermionic matter. The construction is based on quantum links which realize continuous gauge symmetry with discrete quantum variables. At low energies, quantum link models with staggered fermions emerge from a Hubbard-type model which can be quantum simulated. This allows us to investigate string breaking as well as the real-time evolution after a quench in gauge theories, which are inaccessible to classical simulation methods.

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