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Quantum simulation of SU(2) 1D dynamics with ions qudits

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Gauge theories are an ubiquitous concept in physics appearing in different fields of research spanning from high energies to condensed matter. Their resolution using Monte Carlo techniques has been very successful over the years but is unable to tackle many important physical regimes occurring at finite density, especially for nonabelian theories such as quantum chromodynamics. Their alternative Hamiltonian formulation on a lattice has opened new possibilities to tackle these problems via quantum simulations. Along these lines, many proposals have been suggested but experimentally only abelian theories have been simulated so far. In this talk, we present a convenient formulation of a 1D SU(2) nonabelian model which is naturally suitable for implementation on six levels ions qudit recently developed in the lab. By choosing a convenient encoding and performing simultaneous Molmer-Sorensen gates we show that a quite shallow circuit is needed to perform a quantum digital simulation of the model.

Abstract category

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