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SU(2) lattice gauge theory on a quantum annealer

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Lattice gauge theory is an indispensible tool for non-Abelian fields, such as those in quantum chromodynamics where lattice results have been of central importance for several decades. Recent studies suggest that quantum computers could extend the reach of lattice gauge theory in dramatic
ways, but the usefulness of quantum annealing hardware for lattice gauge theory has not yet been explored. In this work, we implement SU(2) pure gauge theory on a quantum annealer for lattices comprising a few plaquettes in a row with a periodic boundary condition. Numerical results are obtained from calculations on D-Wave Advantage hardware for eigenvalues, eigenvectors, vacuum expectation values, and time evolution. The success of this initial exploration indicates that the quantum annealer might become a useful hardware platform for some aspects of lattice gauge
theories.

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