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Phase Diagram of the Schwinger Model by Adiabatic Preparation of States on a Quantum Simulator

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We demonstrate a method to study the phase diagram of a quantum system on quantum devices via adiabatic preparation of states. The method is a direct application of the adiabatic theorem due to M. Born and V. Fock, Z. Phys. 51, 165 (1928). The key idea of the method is to individually evolve the ground state and the first-excited state using a Hamiltonian whose parameters are time-dependent. We successfully test the method in application to the Schwinger model with a topological θ-term. We recover the first-order-phase-transition and the transition-free regions of the corresponding phase diagram. We demonstrate the advantages of the method in some scenarios over another method from the literature that also uses adiabatic state preparation.

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