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Preparing Ground States of Many-Body Systems by Simulated Cooling DVIR KAFRI, University of Maryland, College Park, Department of Physics, JACOB TAYLOR, University of Maryland, College Park, Department of Physics; National Institute of Standards and Technology, Gaithersburg, MD —
Computational problems, such as satisfiability, can be rephrased in terms of the preparation of the ground state of a many-body Hamiltonian. More generally, a quantum simulator could provide information on many-body systems if the ground state can be appropriately prepared. Adiabatic preparation is a common technique for obtaining the ground state of a quantum mechanical system, by slowly varying the system Hamiltonian. A principle disadvantage is that its timing scales with the gap energy of the intermediate Hamiltonian, for which a gap may not be promised, rather than the final Hamiltonian which may be known to be gapped. We present an alternative approach, in which an arbitrary system of qubits is cooled to an effective many-body ground state, through the algorithmic interaction with a small number of "bath" qubits. We specify bounds for the parameters of the algorithm, show that cooling time scales with the system's gap, and present simulated results on a frustrated few-spin system. We further discuss possible experimental applications.

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