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Fidelity of the ground state in adiabatic quantum computation QIANG DENG, DMITRI AVERIN, Department of Physics and Astronomy, Stony Brook University, MOHAMMAD AMIN, PETER SMITH, D-Wave Systems Inc.,Canada — The energy gap between the ground and excited states of a qubit register performing an adiabatic quantum computation (AQC) algorithm is expected to provide additional stability against decoherence by environmental noise. However, the precise quantitative magnitude of this effect is still an open question. In this work, we show that fidelity of the ground state provides the ultimate quantitative measure of the AQC stability against decoherence. Even if the qubit register is not driven out of the ground state by the time evolution of the algorithm, the ground state is deformed by the qubit-environment interaction. The extent of this deformation can be characterized by the same noise correlators that determine the relaxation rates in the gate-model QC. We derive finite-temperature expression for the ground-state fidelity and calculate it numerically for the 16-qubit instances of adiabatic quantum optimization.

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