Day 3

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Title:Adiabatic theorem for unbounded Hamiltonians of superconducting circuits

Abstract:
We present a new quantum adiabatic theorem that allows one to rigorously bound the adiabatic timescale for a variety of systems, including those described by unbounded Hamiltonians. Our bound is geared towards the qubit approximation of superconducting circuits, and presents a sufficient condition for remaining within the qubit subspace of a circuit model of n qubits. The novelty of this adiabatic theorem is that unlike previous rigorous results, it does not contain exp(n) factors in the adiabatic timescale, and it allows one to obtain an expression for the adiabatic timescale independent of the cutoff of the infinite-dimensional Hilbert space of the circuit Hamiltonian. As an application, we present an explicit dependence of this timescale on circuit parameters for a superconducting flux qubit, and demonstrate that leakage out of the qubit subspace is inevitable as the tunneling barrier is raised towards the end of a quantum anneal. We also discuss a method of obtaining a qubit effective Hamiltonian that best approximates the true dynamics induced by slowly changing circuit control parameters.