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Quasiparticle Effects in Superconducting Qubits

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Abstract:

Superconducting qubits based on Josephson junctions are a promising platform for quantum computation, reaching quality factors of over one million. Such high quality factors enable the investigation of decoherence mechanisms with high accuracy. An intrinsic decoherence process originates from the coupling between the qubit degree of freedom and the quasiparticles that tunnel across Josephson junctions. Here I summarize the general theory of quasiparticle-induced decoherence, valid both for equilibrium and non-equilibrium quasiparticles. I also present theoretical results for the single-junction transmon, and discuss experimental measurements of quasiparticle effects in this type of qubit.