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Evanescent-Wave Johnson Noise in Small devices[1] VICKRAM PREMAKUMAR, ROBERT JOYNT, MAXIM VAVILOV, Univ of Wisconsin, Madison — In many quantum computer architectures, the qubits are in close proximity to metallic device elements. The fluctuating currents in the metal give rise to noisy electromagnetic fields that leak out into the surrounding region. These fields are known as evanescent-wave Johnson noise. The noise can decohere the qubits. A novel mapping of the quantum-mechanical problem onto a problem in classical electrodynamics simplifies the calculations. We present the general theory of this effect for charge qubits subject to electric noise and for spin and magnetic qubits subject to magnetic noise. New results are presented for the local noise spectral density in the vicinity of cylindrical conductors such as small antennae, noise from objects that can be treated as dipoles, and noise correlation functions for several geometries. We summarize the current state of the comparison of theory with experimental results on decoherence times of qubits.

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Vickram Premakumar
Univ of Wisconsin, Madison

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