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Electromagnetic fluctuations near thin metallic films[1] LUKE LANGSJOEN, AMRIT POUDEL, MAXIM VAVILOV, ROBERT JOYNT, University of Wisconsin - Madison — We compute the electromagnetic fluctuations due to evanescent-wave Johnson noise in the vicinity of a thin conducting film, such as a metallic gate or a 2-dimensional electron gas. This noise can decohere a nearby qubit and it is also responsible for Casimir forces. We have improved on previous calculations by including the nonlocal dielectric response of the film, which is an important correction at short distances. Remarkably, the fluctuations responsible for decoherence of charge qubits from a thin film are greatly enhanced over the case of a conducting half space. The decoherence times can be reduced by over an order of magnitude by decreasing the film thickness. This appears to be due to the leakage into the vacuum of modes that are well localized in the perpendicular direction. There is no corresponding effect for spin qubits (magnetic field fluctuations). We also show that a nonlocal dielectric function naturally removes the divergence in the Casimir force at vanishing separation between two metallic sheets or halfspaces. We include a treatment of both a Drude conductor and a superconducting material.

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