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Unconventional permittivity noise and dielectric loss from tunneling systems A. N. RAMANAYAKA, B. S. SARABI, S. GLADCHENKO, K. D. OSBORN, Laboratory of Physical Sciences, College Park, MD — The performance of phase-coherent superconducting devices, e.g. resonators and qubits, are limited by tunneling two-level-systems (TLSs) contained within their dielectric layers. We have measured the power loss and 1/f permittivity noise of deposited dielectrics at microwave frequencies over a range of millikelvin temperatures. The experiments were carried out with a uniform microwave field amplitude applied throughout the dielectric as the center layer of a trilayer capacitor contained within a resonator circuit. Measurements of silicon nitride show deviations from the standard model of TLSs. The film absorption shows an unusual temperature dependence. In addition the 1/f permittivity noise increases as the temperature decreases, and also shows a decrease in 1/f noise above a particular electric field amplitude. The results will be compared to recent strong-interaction theories.

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