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Low-frequency Flux Noise in SQUIDs and Superconducting Qubits STEVEN SENDELBACH, DAVID HOVER, ACHIM KITTEL, MICHAEL MUECK, ROBERT MCDERMOTT, UW-MADISON DEPARTMENT OF PHYSICS COLLABORATION, INSTITUT FÜR ANGEWANDTE PHYSIK, JUSTUS-LEIBIG-UNIVERSITÄT GIEßEN COLLABORATION — Superconducting qubits are a leading candidate for scalable quantum information processing. In order to realize the full potential of these qubits, it is necessary to develop a more complete understanding of the microscopic physics that governs dissipation and dephasing of the quantum state. In the case of the Josephson phase and flux qubits, the dominant dephasing mechanism is an apparent low-frequency magnetic flux noise with a 1/f spectrum. The origin of this excess noise is not understood. We report the results of SQUID measurements that explore the dependence of the excess low-frequency flux noise on SQUID inductance, geometry, materials, and temperature. We discuss contributions to the measured noise from temperature fluctuations, trapped vortices in the superconducting films, and surface magnetic states in the native oxides of the superconductors. We discuss implications of our measurements for qubit dephasing.

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