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# First Measurement of Correlated Charge Noise in Superconducting Qubits at an Underground Facility

Recent work indicates that non-equilibrium quasiparticles can contribute to decoherence effects in superconducting qubits. Ionizing radiation, for example, has been shown to create errors in qubit arrays that are correlated in both space and time. For quantum computing, such correlated errors create problems for standard error-correcting codes. For quantum sensing, these same phenomena can represent a possible measurement channel (sensing particle interactions in the qubit substrate) or a possible background (increasing quasiparticle-induced decoherence). We present results from measurements of an array of weakly charge-sensitive superconducting qubits exposed to a range of radiation fluxes. These experiments were done at the NEXUS low-background test stand 100 meters (225 m.w.e.) underground at Fermilab's MINOS experimental area, allowing for greater control over radiation fluxes than is typically available in above-ground lab environments. We discuss correlations between radiation flux and the stability of qubit gate charge, as well as the implications of these observations for future qubit-based dark matter experiments.

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