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Studying Correlated Charge Fluctuations in Superconducting Qubits in a Low-Background Underground Facility

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Abstract: The search for increasingly low-mass (sub-GeV) dark matter motivates the development of detectors with sub-eV energy thresholds. Quantum sensors such as superconducting qubits have demonstrated great promise in this regime. Particle interactions in the substrate of these devices can generate phonons and liberate charge carriers. Propagation of these events can induce a spatially-correlated response across multiple qubits. In this talk, we will discuss preliminary studies involving an array of weakly charge-sensitive qubits being operated in NEXUS, a low-background facility located 100 meters (225 m.w.e) underground at Fermilab. Here, we map correlated charge fluctuations in the presence of various radiation sources and shielding configurations. We will use this suite of measurements to quantify the effects of potential backgrounds and to inform the design of robust detector schemes and test facilities.

Early Career

No

Primary author: MAGOON, Hannah (Stanford University)

Co-authors: BAXTER, Daniel (Fermilab); BOWRING, Daniel (Fermilab); FIGUEROA-FELICIANO, Enectali (Northwestern University); BRATRUD, Grace (Northwestern University); WAGNER, Grace (Fermilab); YU, Jialin (IIT); ANYANG, Kester (IIT); LEWIS, Samantha (Wellesley College)

Presenter: MAGOON, Hannah (Stanford University)

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