Contribution ID: **458** Type: **Parallel talk**

Developing Qubit-Based Detectors for Low-Threshold Dark Matter Searches at Fermilab

Thursday 31 August 2023 16:45 (15 minutes)

Developments over the last decade have pushed the search for particle dark matter (DM) to new frontiers, including the keV-scale lower mass limit for thermally-produced DM. Galactic DM at this mass is kinematically matched with the energy needed to break a Cooper pair in common superconductors (˜meV). Quantum sensors such as superconducting qubits are sensitive to these broken Cooper pairs, and can potentially be exploited as low-threshold detectors for particle-like DM scattering. The Quantum Science Center group at Fermilab is using two test facilities to pursue development of such sensors for DM detection. A surface facility, LOUD, has been commissioned and is being operated to explore the capabilities of a variety of quantum sensors as elements of novel low-mass DM detection schemes. A dedicated underground partner facility, QUIET, is currently being commissioned and will be used for operation of select devices in a low-background environment. This talk will discuss recent progress on these facilities and devices tested, and the plans to leverage them for DM detection down to the keV-scale.

Submitted on behalf of a Collaboration?

No

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Session Classification: Dark matter and its detection

Track Classification: Dark matter and its detection