Contribution ID: **141** Type: **Poster**

# Quantum Acoustic Devices for Dark Matter Direct Detection

The continued absence of a conclusive direct detection of conventional, GeV-scale particle dark matter has recently increased focus on developing low-threshold detector technologies capable of sensing a variety of light (sub-GeV) and ultralight dark matter candidates. Many such detectors rely on athermal phonon sensing, in which meV-scale phonons from a DM scatter are sensed via their ability to break Cooper pairs in superconducting films. While detectors based on such pairbreaking sensors are highly advantageous and scalable, their sensor threshold is ultimately limited by the energy needed to break a Cooper pair, $2\Delta$. We present a novel detector architecture for single phonon detection at the O(10μeV) scale, the qubit-coupled hBAR, that does not share this limitation. This architecture, composed of a superconducting qubit piezoelectrically coupled to a high-overtone bulk acoustic resonator, was originally developed in the context of the quantum acoustics community and has a sensor threshold ultimately limited by thermal noise. In this talk, we present a discussion of the design and expected performance of this architecture in phonon sensing, and briefly highlight the rare physics candidates that may be probed with this architecture.

**Author:** LINEHAN, Ryan (Fermi National Accelerator Laboratory)

**Co-authors:** BAXTER, Daniel (Fermi National Accelerator Laboratory, USA); SHOLAPURKAR, Mukul; TRICKLE, Tanner; LIN, Tongyan

**Presenter:** LINEHAN, Ryan (Fermi National Accelerator Laboratory)