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Toward a Dark Matter Search with Phonon-Mediated MKID Devices at NEXUS

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To continue the search for dark matter (DM) into the sub-GeV mass range, the development and characterization of new detectors with sub-eV thresholds is critical. Microwave Kinetic Inductance Detectors (MKIDs) offer an attractive architecture for novel microcalorimeters with the requisite energy resolution and threshold for probing DM down to the fermionic thermal relic mass limit of a few keV. A phonon-sensitive MKID device featuring an aluminum resonator patterned onto a silicon substrate has been operating at the NEXUS low-background facility at Fermilab for characterization and evaluation of its efficacy for a dark matter search. Currently, our estimate of the energy resolution of this device is limited by the efficiency for phonons produced via particle interactions in the substrate to propagate to the superconductor and break Cooper pairs. In this poster, I will present our constraints on the substrate-superconductor coupling and the progress on an absolute energy calibration performed by exposing the rear of the substrate to a pulsed source of 470 nm photons. I will also review the current status and next steps of the phonon-mediated MKID effort at Fermilab.

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