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Phonon-mediated kinetic inductance detectors for sub-GeV dark matter searches

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Kinetic inductance detectors (KIDs) as low mass dark matter detectors are interesting for two reasons: 1) their massive multiplexability and concomitant position resolution enable NR/ER discrimination down to 500eV recoil energy, allowing for neutrino-limited NRDM searches from 0.5GeV-5GeV, and 2) a variety of RF-based and KID-specific improvements chart an attainable path forward to sub-eV recoil energy resolutions. To date, a prototype 1 gram 20-KID device has demonstrated <1mm position resolution and 0.55keV resolution at 30keV. We report on the progress of two different KID architectures that highlight our two main thrusts of demonstrating multiplexability and sub-eV resolutions: 1) a 9 gram 80-KID device has shown scalability issues that we believe can be solved with improved RF engineering, and 2) a 1 gram single KID device has shown an inferred baseline energy resolution of 20eV, with 5eV resolution immediately possible with minor modifications.

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