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Phonon sensitive kinetic inductance device with low-Tc hafnium for light dark matter search

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Searching for light dark matter between 10keV and 100MeV requires noval sub-eV threshold detectors. Superconducting sensors that detects phonons from the crystal substrate is a promising direction. In addition to the mature transition edge sensors (TESs), kinetic inductance devices (KIDs) provide another option, which has the advantage of up-scaling with multiplexed readout.
We work on Low-Tc (200mK) Hafnium KID development for light dark matter search at LBL. With the internal quality factor exceeding 10^5, we demonstrated around 2eV internal energy resolution in Hf KIDs by optical photon and gamma ray calibrations. The resolution is amplifier noise dominated. Progress has been made to 1) improve amplifier noise with kinetic inductance traveling wave parametric amplifiers (KITWPA), and 2) improve phonon collection efficiency with MEMS fabrication techniques to translate the eV level internal resolution to the phonon signal resolution. These efforts provide a tangible path to a eV level threshold KID phonon detector.

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