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Low-Threshold Phonon-Mediated Detectors with Background Discrimination

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We developed a new generation of detectors that combine the Electron Recoil (ER) and Nuclear Recoil (NR) discrimination capability of SuperCDMS ionization and phonon (iZIP) detectors with the low-threshold capabilities of High-Voltage (HV) detectors. Both ionization and phonons are measured in a monolithic crystal divided between a large-volume (low-voltage) region and a small-volume (high-voltage) region, connected via a narrow channel. This restriction makes the two volumes thermally independent, while shaping the electric field allows carriers to pass through the channel.

We fabricated a prototype 100 g Si detector and demonstrated its discrimination performance. Here, we present our progress in achieving unprecedented thresholds and discuss our plans to use the detector for dark matter searches and low-energy (reactor) neutrino coherent scattering experiments.

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