

Overview of the SuperCDMS-HVeV Program

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The SuperCDMS-HVeV (High-Voltage with eV resolution) program is an R&D project focused on developing detectors with high energy resolution to search for low-mass dark matter ($\lesssim 1 \text{ GeV}/c^2$), study charge-transport in cryogenically-cooled crystals, and probe unclassified backgrounds at low energy. The program utilizes gram-scale silicon detectors instrumented with TES (transition-edge sensor)-based phonon sensors. A high-voltage bias can be applied to the crystal to amplify phonon signals from ionizing interactions via the Neganov-Trofimov-Luke effect. In 2022, a dark matter search was conducted using HVeV detectors near surface (225 w.m.e. overburden) at Northwestern's EXperimental Underground Site (NEXUS) at Fermilab in Batavia, IL which demonstrated competitive sensitivities to dark matter at masses $\gtrsim 1 \text{ MeV}/c^2$ and sub-single-electron-hole pair thresholds. Since then, a detector using a modified HVeV design has been operated at the Cryogenic Underground TEst (CUTE) facility at SNOLAB (Sudbury, ON) to classify and mitigate backgrounds which are the main limitation to sensitivity across the community of experiments searching for low-mass dark matter.

This talk will provide an overview of the SuperCDMS HVeV program, results of the dark matter search at Fermilab, and key findings in the background studies at CUTE which further improve sensitivity to low-mass dark matter.

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