

Novel substrates and readout systems for crystal-based direct dark matter detection

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Crystal-based detectors like those of SuperCDMS SNOLAB provide the most sensitive searches for a variety of dark matter candidates. Low-noise environments and transition-edge sensors (TES) for phonon detection have enabled the measurement of interaction energies with eV-scale resolution over a large dynamic range. As we approach the fundamental limitations of these detectors, however, there is growing interest in the use of alternative detector substrates, such as diamond and silicon carbide (SiC). Different substrate materials have sensitivity to differing interaction energies and can support higher voltages with lower dark count rates, among other advantages. We report on the performance of the first TES-based SiC detectors, fabricated at Stanford. We also discuss our SQUID-based readout system, recently used at SNOLAB, as well as other technologies being explored, including single-electron readout devices, KIPMs, and SQUATs.

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