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Phonon-Light Detectors for the CRESST dark matter search

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CRESST-II is a cryogenic direct dark matter search aiming for the detection of WIMPs via elastic scattering off nuclei in CaWO₄ target crystals. CRESST detectors are optimized for low thresholds and a precise energy reconstruction in order to measure tiny nuclear recoils (<1keV), which are expected for light WIMPs ($O(1\text{GeV}/c^2)$).

Phonons induced by particle interactions in the target crystal are detected by a transition edge sensor (TES) on the scintillating CaWO₄ crystal. The TES consists of a thin tungsten film which is stabilized very precisely in a point in its superconducting transition at mK temperatures over the whole measurement period. For an active background discrimination we use an additional light detector which detects the scintillation light of the CaWO₄ crystal. It consists of a light absorber also equipped with a tungsten TES. In the ongoing run of CRESST-II one of the phonon detectors provides a threshold of 0.60keV and a resolution of 0.090keV (at 2.60keV). The light detectors are sensitive enough to detect energy depositions down to 5keV.

For the next phase of the CRESST experiment we will use new detector modules optimized to measure even lower recoil energies (0.1keV) to further enhance the sensitivity for low WIMP masses.

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