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Thermal Detector Model for Cryogenic Composite Detectors for the Dark Matter Experiments CRESST and EURECA

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Weakly Interacting Massive Particles (WIMPs) are candidates for non-baryonic Dark Matter. WIMPs are supposed to interact with baryonic matter via scattering off nuclei producing a nuclear recoil with energies of a few 10keV with a very low interaction rate of ~10^(-6) events per kg of target material and day in the energy region of interest. The Dark Matter experiments CRESST (Cryogenic Rare Event Search with Superconducting Thermometers) and the EURECA (European Underground Rare Event Calorimeter Array) project are aimed at the direct detection of WIMPs with the help of very sensitive modularised cryogenic detectors that basically consist of a transition edge sensor (TES) in combination with a massive absorber crystal.
The development of these cryogenic detectors and the potential ton scale production are investigated in the Garching group of the CRESST collaboration. To decouple the TES production from the choice of the target material in order to avoid heating cycles of the absorber crystal and to allow pretesting of the TESs, a composite detector design (CDD) for the detector production is developed and studied. On the basis of an existing thermal detector model for cryogenic detectors, an extension of this model, including the CDD, has been developed to further investigate, understand and optimize the performance of composite detectors. This extended model can be expected to provide an enormous help when tailoring composite detectors to the requirements of various experiments.

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