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Stress Induced Backgrounds in Cryogenic Crystal Calorimeters

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A number of low mass dark matter direct detection experiments have observed an excess rate of events, rising sharply below energies of around 100 eV. A similar source of background energy has been observed to shorten the coherence time of superconducting quantum bits by creating excess quasiparticles in the qubit circuit. The relaxation of stress in detector materials has been shown to cause low energy backgrounds in previous dark matter experiments, and has been proposed as a source of the current “low energy excess.” By comparing detectors in high and low stress states, we have shown that stressing silicon detectors can cause excess event rates of over 80 Hz/gram below 20 eV, compared to a rate of under 0.5 Hz per gram in a low stress calorimeter. Measurements of the background rate as a function of time will be described, as well as implication for the design and operation of future cryogenic low threshold calorimeters.

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