



Contribution ID: 164

Type: **Parallel Presentation**

Non-equilibrium energy accumulation as a source of backgrounds in low threshold detectors

Wednesday, November 20, 2024 4:15 PM (15 minutes)

Quantum fluctuations or equilibrium thermal fluctuations cannot explain the single photons and small light pulses coming out of the scintillator detector in between interactions with external particles or residual radioactivity events. The processes of energy accumulation and delayed release may explain these effects. Similar arguments can be built for other detectors, including solid-state low-temperature detectors. Two-level Systems (TLS) can be present and participate in such excessive energy accumulation, interact with each other and other energy-bearing states and defects, and be involved in energy releases. Still, it is the processes of energy accumulation and release that are essential for excess and delayed backgrounds in detectors, and the same process should lead to quantum errors and decoherence in qubits. As such a process was not considered in previous extensive studies of material sources of non-thermal noise and decoherence, joint research efforts in high-energy physics, material science, and quantum information science would be beneficial.

This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344. LLNL-ABS-870100

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Session Classification: Joint RDC 03 & 07 & 08

Track Classification: RDC Parallel Sessions: RDC8: Quantum and Superconducting Sensors