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Applications of quantum calorimetry in nuclear physics (25+5)

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Our group at the University of Colorado Boulder (CU Boulder) and the National Institute of Standards and Technology (NIST) has over a decade of experience in developing quantum calorimeters based on the superconducting transition-edge sensor (TES). More recently, we have began exploring the calorimetric capabilities of the kinetic inductance detector (KID), a superconducting resonator technology that can be operated across a broad energy range and is more readily scalable than its TES counterpart. In order to make them suitable for nuclear physics applications, we have developed large-area thermal kinetic inductance detectors (TKIDs) optimized for charged-particle and gamma-ray detection, and we have begun applying these devices for practical measurements in nuclear physics. In particular, we have used our TKIDs to measure the ionizing radiation background inside a cryostat environment representative of that of superconducting qubits in an effort to understand how these radiation effects can impact qubit decoherence. We are also designing large-format TKID arrays to be used at the NIST Center for Neutron Research (NCNR) to improve studies of neutron beta decay, among other potential applications. In this presentation, we discuss both of these research thrusts as well as provide a more general overview of the quantum calorimetry program at CU Boulder/NIST as it relates to nuclear physics (and AMO) research.

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