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Quantum Calorimetry for Nonproliferation[1] B. L. ZINK, NIST, J. N. ULLOM, J. A. BEALL, K. D. IRWIN, W. B. DORIESE, R HORANSKY, W. DUNCAN, G. C. HILTON, C. D. REINTSEMA, D. R. SCHMIDT, L. R. VALE, NIST Quantum Sensors Project, Boulder CO — High resolution γ-ray spectroscopy is an important tool for non-destructive analysis of nuclear materials and is often used by safeguards inspectors to help verify the inventories of nuclear materials held around the world. The energy spectrum of photons emitted from isotopes of uranium or plutonium in the $40 - 1000$ keV energy range give unique signatures that, if accurately measured, give inspectors important information about the age and enrichment of the material and therefore its intended purpose. In this talk I will describe our recent demonstration of a γ-ray spectrometer based on a superconducting transition-edge sensor microcalorimeter detector. This device has more than an order of magnitude better energy resolution than standard high resolution γ-ray detectors. We present high-resolution γ-ray spectra of Pu isotopic mixtures, describe the physics of the microcalorimeter and overview our plans for a realistic spectrometer for meeting real-world challenges such as measuring the mass of plutonium in spent nuclear fuel.

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