Nuclear Science and Security Consortium

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Webinar

Cryogenic Ultra-High Energy Resolution Gamma Detection for Scientific and Safeguards Applications

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View the live webcast at:

https://bluejeans.com/353640380

Abstract

Over the last two decades, gamma detectors with operating temperatures below 0.1K have been developed for scientific and national security applications, because they offer 10x higher energy resolution than conventional high-purity germanium (HPGe) detectors. At LLNL, we are developing gamma detectors base don metallic magnetic calorimeters (MCCs). They are made of gold with magnetic erbium dopants, and accurately measure the energy of gamma rays from he change in sensor magnetization upon absorption. The detectors have achieved an energy resolution between -45 and -130 eV FWHM for gamma rays below 100keV, and can detect weak emission lines from e.g. U and Pu that are not visible with HPGe detectors. I will give an introduction to cryogenic detectors in general, discuss he operating principle of MMC gamma detectors, and outline how we operate them in adiabatic demagnetization refrigerators at ultra-low temperatures. As an example, I will discuss recent high-resolution gamma spectra taken by recent UC Berkeley graduate, Cameron Bates, as part of his thesis research, and outline possible follow-on dissertation projects.

About Dr. Stephan Friedrich

Stephan develops superconducting x-ray and gamma-ray detectors that operate at temperatures close to absolute zero to achieve an energy resolution 10× higher than conventional semiconductor detectors. His group builds and optimizes the refrigerators, detectors, and readout systems to increase detector resolution, speed, and sensitivity. They also use these detectors for high-accuracy isotope analysis of nuclear samples at LLNL, and for high-resolution x-ray spectroscopy of novel materials at synchrotrons.