Contribution ID: **49** Type: **not specified**

X-ray spectroscopy of exotic atoms using TES microcalorimeters

Friday, 20 June 2025 10:00 (30 minutes)

Multi-pixel arrays of TES microcalorimeters have significant potential for various scientific applications, taking advantage of their excellent energy resolution and relatively large collecting area. We are exploring a TES application at the charged-particle beamline, with a focus on X-ray spectroscopy of exotic atoms.
Exotic atoms refer to Coulomb-bound systems of a positively charged atomic nucleus and a negatively charged particle other than electrons. They can be produced by stopping negative particles in a target sample. Because of their heavier mass than an electron, ~200 times and 1000 times in the case of muons and kaons, respectively, the negative particle has a smaller orbital radius. In the innermost states, they are close to the atomic nucleus so as to feel quite a strong electric field, the nuclear size effect, and the strong force in the case of hadrons such as kaons. One difficulty in the exotic-atom experiments is the beam's limited quality, which results in a low X-ray counting rate. Thus, a TES microcalorimeter array is a good option for precision X-ray measurement.

So far, we have performed the X-ray spectroscopy of pionic, kaonic, and muonic atoms using NIST-developed TES spectrometers equipped with 20 keV, 50 keV, and 100 keV arrays. The obtained science results range from nuclear physics to fundamental physics, atomic and molecular physics.
In this contribution, I aim to provide an overview of our project and discuss the challenges and future directions for these microcalorimeter applications in accelerator facilities.

Primary author: HASHIMOTO, Tadashi

Presenter: HASHIMOTO, Tadashi

Session Classification: Detectors and Detection Techniques