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An x-ray TES spectrometer for the NIST electron beam ion trap

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An Electron Beam Ion Trap (EBIT) is a powerful tool for studying highly charged ions. Understanding highly charged ions is critical to understanding plasmas encountered in stars, other astrophysical phenomena, and fusion energy facilities. The extreme electric fields and small atomic radii of highly charged ions also make them an ideal system for tests of quantum field theory. Highly charged ions emit x-rays whose energy reveals the electronic level structure, temperature, and other properties of the ions. Often these complex x-ray fingerprints are difficult to exploit due to low fluxes inherent to the technique. We installed a transition edge sensor microcalorimeter array x-ray spectrometer on the NIST EBIT. This spectrometer provides a unique combination of high quantum efficiency, broadband spectral response, high resolving power, and microsecond time resolution. These capabilities enable simultaneous multi-line measurements, the detection of extremely faint lines, and the potential to study lifetimes and other time-dependent physics. We discuss first-light results including measurements of high-resolution x-ray spectra from a number of high-Z ions of the Nickle isoelectronic sequence (high-Z atoms ionized to have 28 electrons, and thus a comparable electronic structure to neutral Nickle), and from several highly-charged ions of Iridium, and prospects for future measurements of phenomena such as dielectronic recombination.

Less than 5 years of experience since completion of Ph.D

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