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TES based x-ray spectroscopy at the NIST EBIT[1]

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A broad-band, high energy-resolution x-ray microcalorimeter has recently been installed on the electron beam ion trap (EBIT) of the National Institute of Standards and Technology (NIST). The transition-edge-sensor based instrument covers photon energies between 300 eV to 15 keV and provides an energy resolution of around 4 eV across this range. The new, state-of-the-art NIST EBIT X-ray Transition-edge-sensor (NEXT) spectrometer is built upon 192 sub-kelvin detector elements, which have both high spectral resolution and high collection efficiencies. These characteristics make NEXT a powerful tool for x-ray spectroscopy of highly charged ions due to the low photon flux inherent to the EBIT. The first measurements with NEXT allowed us to record and identify dozens of spectral lines from up to about 70 times ionized heavy elements. Radiative transitions in these ions can be calculated with high theoretical precision, therefore the NEXT data provide unique benchmarks for testing the most sophisticated atomic theories including relativistic and quantum electrodynamics contributions in multi-electron highly-charged and highly-excited ions. The first experimental results will be presented and compared with a large-sale collisional radiative model of the EBIT plasma emission. The capabilities of the new instrument will be addressed showing that it is ideally suited for high x-ray energy resolution studies of static and transient highly charged ion plasmas.

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