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EBIT spectroscopy of highly charged heavy ions relevant to hot plasmas¹

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An electron beam ion trap (EBIT) is a versatile device for studying highly charged ions. We have been using two types of EBITs for the spectroscopic studies of highly charged ions. One is a high-energy device called the Tokyo-EBIT, and another is a compact low-energy device called CoBIT. Complementary use of them enables us to obtain spectroscopic data for ions over a wide charge-state range interacting with electrons over a wide energy range. In this talk, we present EBIT spectra of highly charged ions for tungsten, iron, bismuth, etc., which are relevant to hot plasmas. Tungsten is considered to be the main impurity in the ITER (the next generation nuclear fusion reactor) plasma, and thus its emission lines are important for diagnosing and controlling the ITER plasma. We have observed many previously unreported lines to supply the lack of spectroscopic data of tungsten ions. Iron is one of the main components of the solar corona, and its spectra are used to diagnose temperature, density, etc. The diagnostics is usually done by comparing observed spectra with model calculations. An EBIT can provide spectra under a well-defined condition; they are thus useful to test the model calculations. Laser-produced bismuth plasma is one of the candidates for a soft x-ray source in the water window region. An EBIT has a narrow charge state distribution; it is thus useful to disentangle the spectra of laser-produced plasma containing ions with a wide charge-state range.

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