EBIT Spectroscopy of Highly Charged Heavy Ions Relevant to Hot Plasmas

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Abstract. 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 for elements relevant to hot plasmas, such as tungsten, iron, gadolinium, etc., after introducing the devices. Tungsten is considered to be the main impurity in the ITER plasma, and thus its emission lines are important for diagnosing and controlling the ITER plasma. We present many previously unreported lines of moderately charged tungsten. 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 gadolinium plasma is a candidate of the 6.7 nm light source for the future EUV lithography. 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.