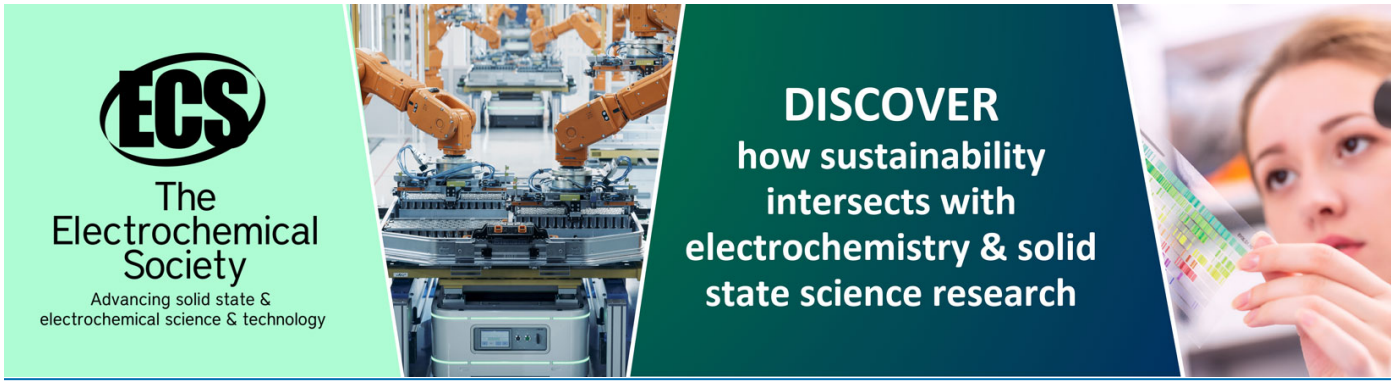
KLL dielectronic recombination resonance strengths in He- to O-like gold ions



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KLL dielectronic recombination resonance strengths in He- to O-like gold ions

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Synopsis We present experimental observation of the dielectronic recombination (DR) in He- to O-like gold ions performed with the Tokyo electron beam ion trap (EBIT). In the experiment, the abundance ratios between adjacent ions in the EBIT have been obtained as a function of electron energy by measuring the number of extracted ions from the EBIT. The DR cross sections are deduced from the degree of the abundance ratio change at the resonance energy. The experimental DR resonance strengths are compared with fully relativistic calculations.

Dielectronic recombination (DR) is a two-step electron-ion collision process [1], which is composed of dielectronic resonant electron capture and radiative stabilization of the doubly excited state produced in the dielectronic capture. It has a large cross section at the resonance energy, and thus strongly affects the ion abundance and the x-ray radiation in hot plasmas. The resonance strengths of DR processes are thus important for the indirect-drive inertially confined fusion, where the x-ray radiation from laser produced gold plasma drives the capsule implosion and influences the resulting fusion yield. To date, DR of highly charged ions has been studied with ion storage rings [2] and electron beam ion traps (EBITs) [3]. However, the DR resonance strength data are still limited especially for heavy elements even though they are also important for the atomic physics [3].

In this paper, the DR resonance strengths of gold ions measured with the Tokyo-EBIT are presented. The DR resonance strengths were obtained by measuring the ion abundance ratios in the Tokyo-EBIT, following the method used by Ali *et al.* for the DR of He-like Ar^{16+} [4]. The abundance was measured by counting the ions extracted from the EBIT, so that the contributions from the different charge states could be clearly separated unlike the x-ray measurements.

The preliminary result for $KL_{12}L_3$ is shown in Fig.1. "KLL" represents the DR process where an electron is captured into the K shell while a K-shell electron is excited to the L shell. "L_{12}" represents the $2s_{1/2}$ and $2p_{1/2}$ levels, while "L_3" represents the $2p_{3/2}$ level. Due to the strong relativistic effect, the KLL DR is separated into the three manifolds $KL_{12}L_{12}$, $KL_{12}L_3$, and KL_3L_3. We present the DR resonance strength for each manifold, and compare it with the fully relativistic calculation which includes the consideration of the generalized Breit interaction effect.

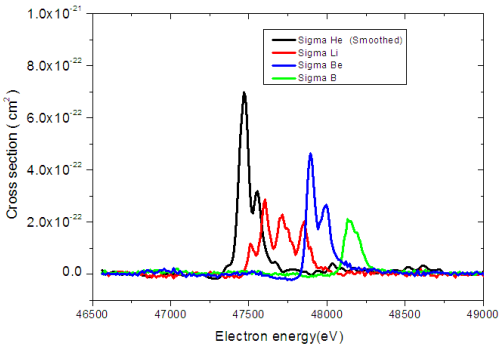

Figure 1. Preliminary experimental cross sections of $KL_{12}L_3$ DR of the He-to B-like gold ions. The absolute value was obtained by normalizing the abundance ratio to the electron impact ionization cross sections obtained by the FAC code.

References

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