KLL-dielectronic recombination and polarization of X-ray emissions of H-like to B-like barium ions

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Synopsis KLL dielectronic recombination processes and linear polarization degree of emitted x-rays are investigated for the H-like to B-like barium ions in the framework of Multi-configuration Dirac-Fock (MCDF) method and the density matrix theory. The present theoretical results are compared with the experimental measurements of electron beam ion trap, good consistency is obtained.

Dielectronic recombination (DR) is an important process for high-temperature laboratory and astrophysical plasmas [1,2], it strongly affects both the charge-state distribution and the x-ray spectrum. The x-ray radiations from the DR process can provide informations on the directionality of the electron currents and the orientation of the magnetic-field lines, and anisotropy of the electron energy distributions in plasmas, and can also be used as a diagnostic tool [3]

In this report, we calculated the resonance energies, resonance width, and corresponding radiative and auger transition rates for all of individual KLL resonance states of the highly charged H-like to B-like barium ions and obtained the DR resonance strengths and linear polarization degree of X-ray emissions[4] for each of the ions mentioned above. In the calculations, the electron correlation effects, QED effects, and Breit interactions are well considered. The influence of Breit interactions on Auger rates, DR resonance strengths and polarization of X-ray are analyzed and discussed. Partly of the present results for the differential cross sections and a comparison with the EBIT experimental measurements [5] are plotted in Fig.1 and 2, good consistency is obtained.

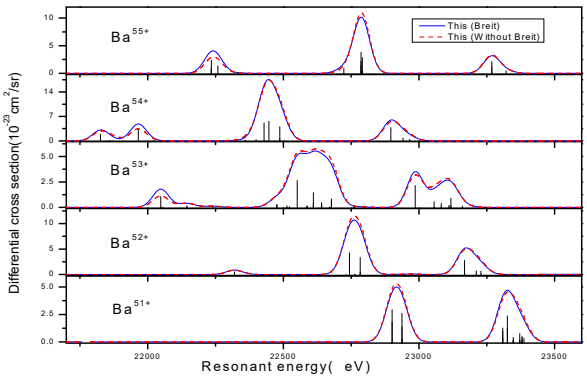

Fig. 1. Resonance strengths and differential cross sections (convolved with a Gaussian of FWHM=70eV） for the H-like to B-like barium ions .

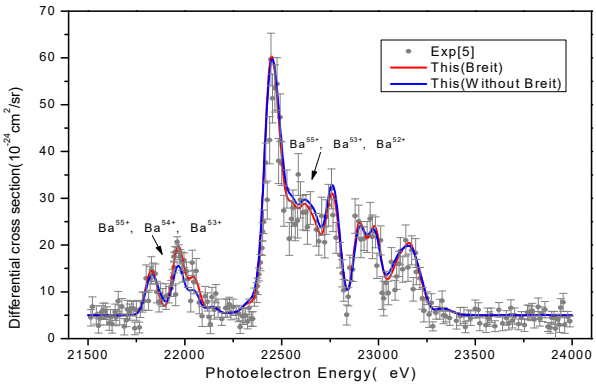

Fig. 2. The calculated differential cross section (convolved with a Gaussian of FWHM=70eV) with considering Breit interactions (red line) and without Breit interactions (blue line) for H-like to B-like Barium ions (the ratio of the relative proportion of-Ba^{54+}:Ba^{53+}:Ba^{52+}:B^{51+}=30.11%:42.99%:23.76%:3.14 %), and compared with EBIT results [5].

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