Study on *KLL* dielectronic recombination for highly charged tungsten ions at Shanghai EBIT

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Synopsis This work reported both experimental and theoretical study on *KLL* dielectronic recombination for He-like up to O-like tungsten ions, including resonance levels, resonance strengths and interference effect.

Dielectronic recombination (DR) is an important process in hot plasma physics as well as in atomic structure and collision theory. It significantly affects the plasma temperature, the charge state distribution, and the ion level population. The radiative processes in DR often cause unresolvable satellites, which may disturb the main line shape, line intensity, and line width, while the resolved satellite lines are often used for electron temperature diagnostics. Furthermore, DR of highly charged ions contributes significantly to radiation energy loss in fusion plasmas, and thus leading to the flameout of fusion.

The electron beam ion trap (EBIT) has an advantage on high energy investigation; researches on DR processes which involve a *K*-shell electron excitation have been performed for many medium heavy elements and for a few high Z elements. In these researches, resonance energy and strength of DR, Breit interaction, polarization and interference effect between DR and RR have been studied [1-6].

In this presentation, we reported the recent study on *KLL* dielectronic recombination processes of He- up to O-like W ions through both experiment and calculation. The measurement was performed on Shanghai electron beam ion trap [7] by employing a fast electron beam-energy scanning technique. During the experiment, $W(CO)_6$ was continuously injected into the EBIT, and the electron beam energy was fast scanned through the resonant energies of *KLL* DR of He-like up to O-like W ions, while the X ray photons were detected by a HPGe detector. A fully relativistic configuration interaction method implemented in the flexible atomic code was employed to calculate DR process and also radiative recombination (RR).

The interference effect between DR and RR were analyzed in experiment and a dual Fano and Lorentzian line profile properties in an autoionizing state was demonstrated via selecting the DR resonances which go through an intermediate state with decay channels to both the final states with no excited electrons and the final states with two excited electrons. In addition, the *KLL* DR resonance strengths for W were determined with uncertainty below 11% in this work. Our experimental results show good agreements with the calculations. The comparison between two experimental results (analysis with or without the consideration of interference effect) indicates that the interference effect between DR and RR is revealed to be necessary to determine the resonance strength.

References

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