Influence of Breit interaction on the linear polarization of radiation following electron impact excitation of B-like ions

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Synopsis The influences of Breit interaction on the total cross section and linear polarization of highly charged Ca^{15+}, Xe^{49+}, and W^{69+} ions in the electron impact excitation process are calculated by fully relativistic distorted-wave program REIE06. It is found that the influence of Breit interaction on the linear polarization is more obvious with the increase of atomic number Z.

The cross section of electron impact excitation(EIE) and the corresponding linear polarization of light emitted after the EIE have widely applied for testing atomic structure theory, revealing collision kinetics, predicting new phenomena and so on [1]. Recently, Holger Jörg *et al.* measured the linear polarization of x rays produced by dielectronic recombination of highly charged B-like xenon ions [2], discussed the influence of Breit interaction on the linear polarization, and they found that the Breit interaction have no effects on it.

In order to test the effects in the similar transitions but formed from the EIE process, the EIE linear polarization of 1s to 2p and 2s to 2p of highly charged Ca^{15+}, Xe^{49+} and W^{69+} ions is investigated by the fully relativistic distorted-wave program REIE06 [3,4]. It is found that the Breit interaction makes the linear polarization of the transitions $[(1s^22s2p_{1/2})_0 2p_{3/2}]_{3/2}$ to $1s^22s^22p_{1/2}$ and $[(1s^22s2p_{3/2})_1 2p_{3/2}]_{5/2}$ to $1s^22s^22p_{3/2}$ decrease, while the linear polarization of the transitions $[(1s2s^22p_{1/2})_0 2p_{3/2}]_{3/2}$ to $1s^22s^22p_{1/2}$ and $[(1s2s^22p_{1/2})_1 2p_{3/2}]_{5/2}$ to $1s^22s^22p_{3/2}$ increase. And the effects from the latter case are more obvious.

Figure 1 shows the linear polarization of the transition 1s to 2p for the highly charged Ca^{15+}, Xe^{49+} and W^{69+} ions in the EIE process. For Ca^{15+} ions, the results of N+N, B+N and B+B increase monotonically by the increase of incident electron energy. For Xe^{49+} and W^{69+} ions, however, the results of B+N and B+B also increase monotonically by the increase of incident electron energy, while the results of N+N decrease at first then increase. This characteristic becomes more obvious with increase of atomic number Z. It is quite different with the case in the dielectronic recombination process [2].

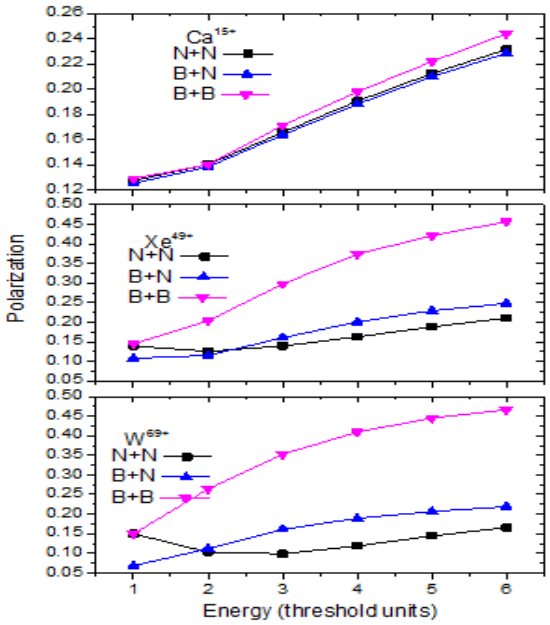

Figure 1. The linear polarization of the transition 1s to 2p of Ca^{15+}, Xe^{49+} and W^{69+} ions. N+N represents without Breit interaction in calculations of the target wave functions and impact matrix element, B+N represents with Breit interaction in calculations of the target wave functions and without Breit interaction in calculations of the impact matrix element, B+B represents with Breit interaction in calculations of the target wave functions and impact matrix element.

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