

Polarization transfer of photoionization in highly charged ions

K Ma, C Z Dong¹ and L Y Xie

Key Laboratory of Atomic and Molecular Physics & Functional Materials of Gansu Province, College of Physics and Electronic Engineering, Northwest Normal University, Lanzhou 730070, China

Synopsis The influence of polarization of incident photon and non-dipole terms which arises from the multipole expansion of electron-photon interaction on properties of subsequent x-ray radiation have been studied with the MCDF method and the density matrix theory. The results show that there is a linear relationship between the degree of linear polarization of the radiative decay and ones of the incident light, which can be used for diagnosing the polarization of light source. In addition, with increasing the photon energies, the non-dipole contribution to the degree of linear polarization of radiative decay following the inner-shell photoionization will also increase.

The information about the polarization transfer in the inner-shell photoionization (PI) is important for diagnosing laboratory and astrophysical plasmas as well as for understanding the PI experiment with polarized light source. In the polarization transfer of photoionization, the polarization properties of radiative decay following inner-shell PI are directly related to the magnetic cross section of PI. So far, theoretical studies of the PI mainly focus on the total cross sections, and there is only a few calculations for magnetic cross sections[1,2].

In this contribution, we apply the multi-configuration Dirac-Fock method[3] and the density matrix theory[4] to studying the magnetic sublevel cross section and related polarization of decay radiation for Mg-like ions.

In the practical calculations, we make use of the new component (PHOTO) of RATIP package[5] and extend it to calculate the present polarization transfer. The initial- and final-state wave functions of the target ions are generated with use of the atomic structure package GRASP [6] based on the MCDF method.

Figure 1 shows the relationship between the degree of linear polarization (DLP) of incident light and the DLP of transition from $2p^{-1}_{3/2}3s^2$ to $2p^63s$ (Ll) line following the inner-shell PI of Mg-like Fe^{14+} , Cd^{36+} , W^{62+} and U^{80+} ions. As seen from this figure, the DLP of incident light intensifies the DLP of the subsequent x-ray emission, it is so-called polarization transfer; On the contrary, the non-dipole terms weaken the DLP of the subsequent Ll x-ray, it is so-called depolarization effects. And then, the linear relationship between the DLP of the incident light and Ll x-ray emission following the inner-shell PI have been found in the present work, and this could be useful for diagnosing the DLP of a light source.

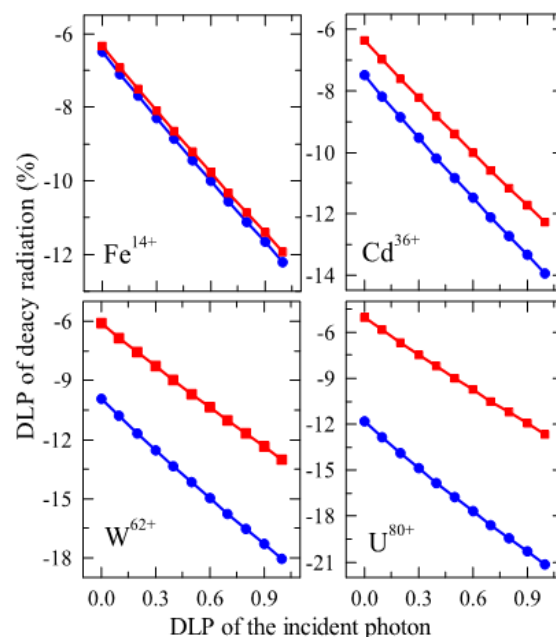


Figure 1. DLP of subsequent Ll line following PI as a function of the DLP of the incident photon. Calculations have been performed with (square) and without (circle) non-dipole contribution.

This work was supported by the National Natural Science Foundation of China (Grant nos.11274254, U1332206 and U1331122).

References

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¹E-mail: dongcz@nwnu.edu.cn

