Electron impact excitation of 4^1P_1 zinc state for 40 eV incidence energy

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Synopsis Coherence analysis version of the electron-photon coincidence technique was used to study the electron impact excitation of 4^1P_1 state of zinc atoms. The first experimental results of the Stokes and Electron Impact Coherence Parameters (EICPs) for 40 eV collision energy are presented.

The electron-photon coincidence studies deliver more complete information on the inelastic electron-atom collisions than any other experimental techniques. Therefore, such data represent a useful probe for both verification and improvement of theoretical models. The data available for Zn are scarce due to experimental problems associated with this atom, which recently has been proposed an interesting target for such studies [1,2,3]. Present work is a continuation of our systematic studies on electron impact excitation of atoms with two valence electrons, from the simplest case He [4,5] to more complicated, heavier elements with closed inner shells: Ca [6,7], Zn [3,8,9] and Cd [10,11,12].

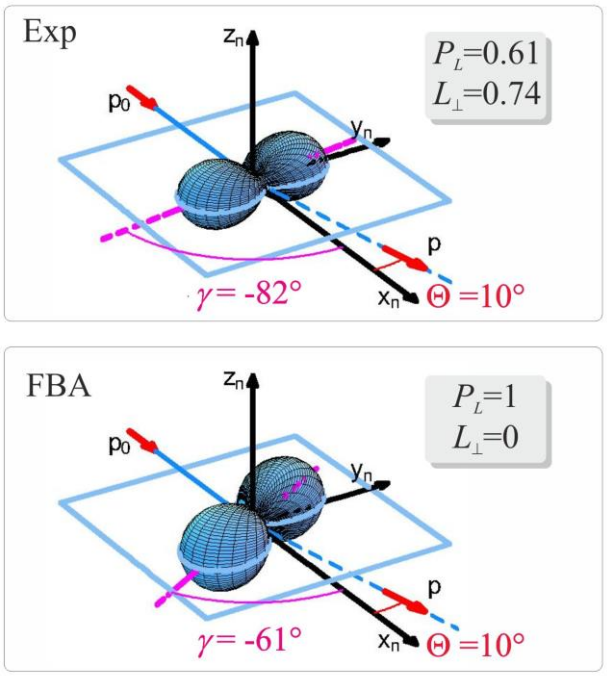

Figure 1. An example of graphical representations of angular electron charge cloud distribution corresponding to the EICP parameters for Zn 4^1P_1 excitation by 40 eV electrons for scattering angle $\Theta = 10°$. (Exp – experimental values, FBA – First Born Approximation predictions)

We present first results of Stokes parameters characterising electronic excitation of 4^1P_1 zinc state for 40 eV collision energy. The experiment was performed using electron-photon coincidence technique in the coherence analysis version. The apparatus and procedures were generally the same as in our previous studies [3].

The obtained raw values of the Stokes parameters were used to calculate the Electron Impact Coherence Parameters P_L, $L_\perp$, γ and P^+ (for details see review by Andersen *et al* [13]). The EICPs determine angular distributions of the electron charge cloud of the excited 4^1P_1 state of Zn. The results are shown in a graphical representation and compared with the First Born Approximation predictions (Figure 1).

The experimental values of Stokes and EICP parameters are analysed together with our previous results for Zn atoms for collision energy 100 eV [3], 80 eV [9] and 60 eV [8].

References

[1] M. Born and M. Strösser 2007 *J. Phys. D: Appl. Phys.* **40**, 3823–3828
[2] T. Das *et al* 2014 *Phys. Lett. A* **378**, 641–643
[3] M. Piwiński *et al* 2012 *Phys. Rev. A* **86**, 052706
[4] Ł. Kłosowski *et al* 2007 *Meas. Sci. Technol.* **18**, 3801–3810
[5] Ł. Kłosowski *et al* 2009 *Phys. Rev. A* **80**, 062709
[6] D. Dyl *et al* 1999 *J. Phys. B: At. Mol. Opt. Phys.* **32**, 837–844
[7] D. Dziczek *et al* 1998 *Acta Phys. Polon. A* **93**, 717–721
[8] M. Piwiński *et al* 2013 *Eur. Phys. J.-Spec. Top.* **222**, 2273–2277
[9] M. Piwiński *et al* 2015 *Phys. Rev. A* in press
[10] M. Piwiński *et al* 2002 *J. Phys. B: At. Mol. Opt. Phys.* **35**, 3821–3827
[11] D. Dziczek *et al* 2003 *Acta Phys. Polon. A* **103**, 3–11
[12] M. Piwiński *et al* 2006 *J. Phys. B: At. Mol. Opt. Phys.* **39**, 1945–1953
[13] N. Andersen *et al* 1988, *Phys. Rep.* **165**, 1–188

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