Second order Born calculations of the coplanar to perpendicular plane ionization cross sections of xenon atoms

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The study of charged particle (electron / positron / ion / proton) impact ionization of atoms, ions and molecules has been of interest, since the early days of atomic and molecular physics. The electron impact ionization of atoms is a three body problem governed by the Coulomb force acting between incident electron, target electron and residual ion. Fundamentally an (e, 2e) process is one where an electron of well defined energy and momentum is incident on a target, ionizes it and the outgoing electrons are detected in coincidence with their energies and angles resolved. With the development of coincident detection techniques of all outgoing particles resulting from the atomic collision, the (e, 2e) process has become an important and powerful tool for investigating the atomic processes. Ionization is a technique which is used as a tool to probe target wave functions. The calculation of triple differential cross section opens up a whole new area of theoretical study and offers a direct insight into the subtleties of spin-dependence and other purely relativistic effects etc. Since the first coincident measurement of (e, 2e) process on atoms by Erhardt et al[1] and Amaldi et al [2] extensive theoretical and experimental investigations have been done to measure the TDCS.

Recently Purohit et al. [3] reported the results of TDCS for the perpendicular plane ionization of Ne and Ar atoms. We report in this communication the differential cross section (DCS) results for the coplanar to perpendicular plane ionization of xenon atoms at incident electron energies 40 eV and 20 eV above ionization potential. The cross sections have been calculated in the modified distorted wave Born approximation formalism including the second order Born (SBA) amplitude. We compare the (e, 2e) TDCS result of our calculation with the very recent measurements of Nixon and Murray [4] and relativistic DWBA-G results of Illarionov and Stauffer [5]. We will discuss the role of second order interaction in the ionization of Xe atoms.

References

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