Three-body dynamical interference in electron and positron collision with positronium atom

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Abstract
In this project, the Faddeev-Watson-Lovelace (FWL) formalism is generalized to large scattering angles. The angular range includes 0-180 degrees. Using this method, the charge transfer differential cross-sections are calculated, in a second-order approximation, for collision of energetic positrons and electrons with neutral positronium atoms. In this approximation, the rearrangement amplitude contains two first-order and three second-order partial amplitudes. The first first-order term is the Born amplitude in a first-order approximation. The second one corresponds to capturing the transferred particle without perturbing the state of this particle. This term, in fact, describes a knock-on process. Since the masses of the particles and the absolute values of their charges are equal, one expects that the second-order terms be similar in magnitude. This aspect causes the instructive interference of the partial amplitudes in some angles and destructive interference in some others. However, it is predicted that these amplitudes have local maxima in direction of the recoiling of the projectile. In order to investigate this situation, the second-order partial amplitudes are calculated and their relations with the parity of the initial and final states of the scattering system are analyzed. In particular, the role of dynamical interference of these partial amplitudes in creation of the kinematical peak and the peak corresponding to the knock-on scattering in angular distribution of the differential cross sections is investigated.

Keywords: Faddeev formalism, three-body problem, dynamical interference, charge-transfer reaction

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