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Investigation of the fully differential cross section of helium atom single ionization by fast protons impact with three and four-body formalism

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Abstract

In the present work, the fully differential cross section of atomic helium ionization by protons impact at high energy ranges is calculated. The calculations of the fully differential cross section have been performed by using the three-body formalism in the first order Born-Faddeev approximation with an active electron model and four body formalism with the first Born approximation. In order to investigate the collision dynamics accurately, the first order Born-Faddeev approximation has been performed by using the single parameter and Hartree Fock as single-electron wave functions and in the first order Born approximation, the two-electron wave functions of Hylleraas and Silverman are used with considering the electron correlation. The fully differential cross sections at different ejected electron energies and momentum transfers are compared with the available experiment and theoretical results. The results show that the effects of electronic correlation are considerable at high impact energy range and ionization process.

keywords: ionization, three body Born-Faddeev approximation, four body Born approximation, electronic correlation, fully differential cross section

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