SINGLE IONIZATION OF HELIUM ATOM BY PROTONS IN THE PARABOLIC QUASI-STURMIAN APPROACH

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Singly ionizing ion-atom collisions are investigated theoretically. A parabolic quasi-Sturmian approach [1,2] is applied to the single ionization of helium atom by intermediate- and high-energy protons. The fully differential cross sections (FDCSs) are calculated for 1 MeV and for 75 keV protons.

In the framework of the approach, the transition amplitude is extracted directly from the asymptotic behavior of the solution of an inhomogeneous driven Schrödinger equation for the Coulomb three-body system (e^-,He^+,p^+). This equation is solved numerically by expanding the wave-function in terms of convolutions of the parabolic quasi-Sturmians for the two-body subsystems (p^+,He^+) and (e^-,He^+). This basis is referred to as the convoluted quasi-Sturmian (CQS) basis.

CQS calculations showed that at high energies of the incident proton (0.5, 1 and 2 MeV), the pe-potential can be treated as perturbation. Switching-on this interaction slightly influences the angular distribution of electrons, scarcely affecting the magnitude of the FDCSs. On the other hand, with a decrease in the energy of incident protons (up to 75 keV), the role of the pe-potential expectedly increases. For example, the capture *ep* - channel becomes important especially when the velocities of the ejected electron and scattered proton are comparable (capture into continuum).

The results for the cross sections obtained within the CQS model are shown in Fig.1 in comparison with experiment [3]. Taking into account the importance of the pe-potential, we plan to modify the CQS approach in such a way that the electron capture into continuum is treated properly.

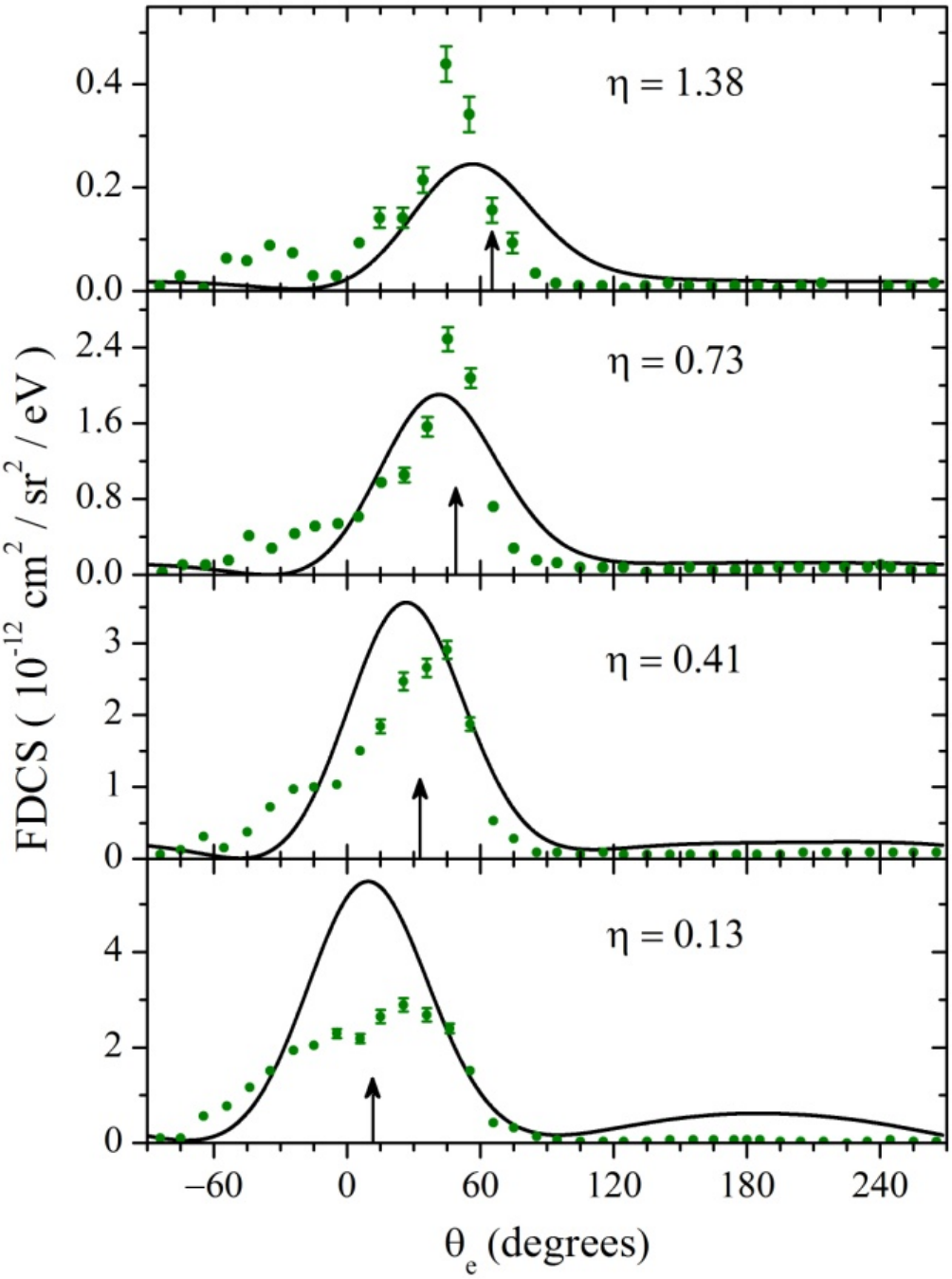

Figure 1. Our calculated FDCSs [2] (solid line) are compared to experimental data [3] for single ionization of helium by 75 keV protons in the collision plane, for different transverse momenta η. The ejected electron energy is $E_e = 5.4$ eV.

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