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Studying Compton double ionization of helium atom with COLTRIMS detector

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In the report the recent results of the big international team of theorists and experimenters on the Compton double ionization (CDI) of the helium atom with use of the COLTRIMS (COLd Target Recoil Ion Momentum Spectroscopy) technique is presented. In these experiments, only the momentum of the nucleus of the helium atom and one of the electrons (slow) are measured for coincidence. As a result, the total differential cross section is integrated over the momentum of the final photon at an initial photon energy of 40 KeV. Further, in order to increase the experimental yield, various single scattering cross sections are measured.
The experiment is compared with the theory within the A2 approximation. Various models of the initial and final states of the atom are used, including states with high electron correlation. Unfortunately, in the presented experiments it is not possible to exclude the scattering of the final photon into the front cone, where exchange processes make a large contribution, and where both electrons have relatively low energies. In such a situation, it is not possible to realize kinematics with a large difference in the energies of electrons, which manifested itself in the so-called (e, 3e) impact electron reactions as a method for studying electron correlations in a target. Nevertheless, even in this implementation, single differential cross sections show an obvious dependence on the quality of a pair of initial and final (double continuum) wave functions.

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