3 - 4 Single Electron Capture in 30 keV and 100 keV He^+-He Collisions*

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Using the reaction microscope technique, we have performed kinematically complete measurements for single capture in He^+ collisions with He at 30 and 100 keV[1]. The state-selective and the angular-differential cross sections were extracted from the experimental data and compared with our theoretical calculations based on the dynamic-screening classical trajectory Monte Carlo method (dCTMC).

The measured recoil-ion longitudinal momentum distributions are shown in Fig. 1. As can be seen, all distributions are mainly composed of a distinguishable two-peak structure. The left overwhelming dominant peak corresponds to the ground-state transfer process, while the right peak corresponds to the excited-states transfer process. The transfer excitation process has only a minor contribution to the total cross section. The state-selective cross sections can be obtained by fitting the distributions using Gaussian functions as shown in Fig. 1. A comparison of the present experimental results with our dCTMC calculations shows a reasonable agreement (not shown here).

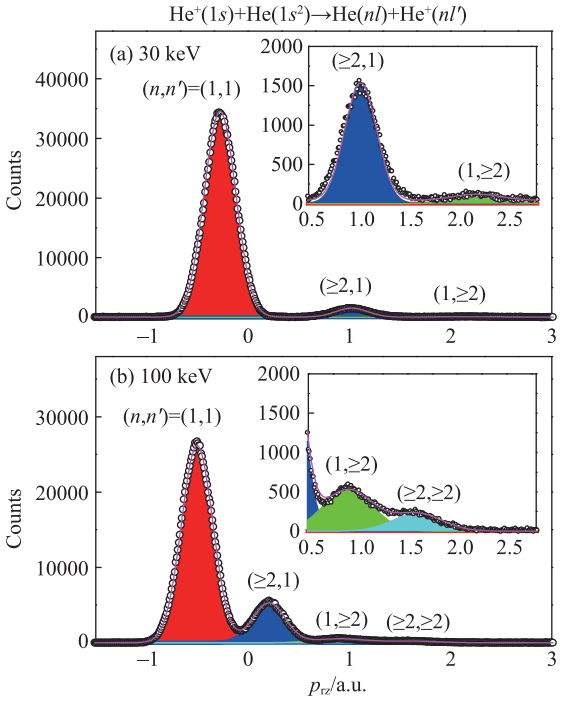

Fig. 1 (color online) Recoil-ion longitudinal momentum distributions at (a) 30 keV and (b) 100 keV impact energy. Open circles: present measurements. Solid lines: Gaussian fittings.

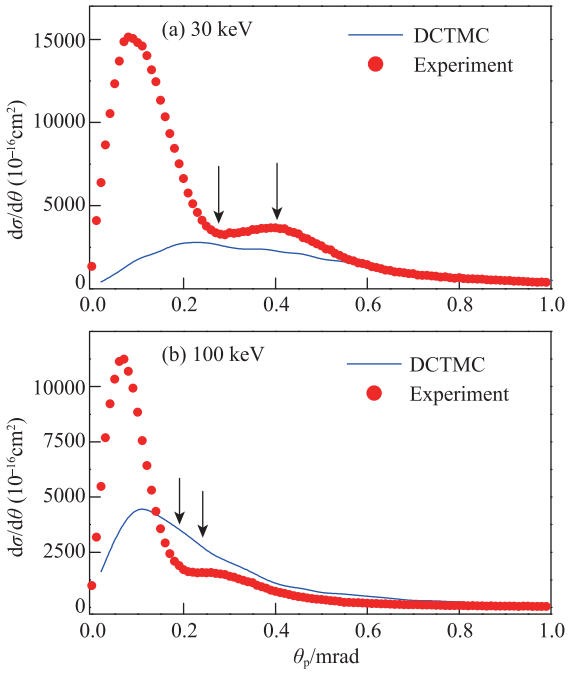

Fig. 2 (color online) Angular-differential cross sections at (a) 30 keV and (b) 100 keV impact energy. Open circles: present measurements; solid lines: present dCTMC results.

The angle distributions of this work are shown in Fig. 2. At both the two impact energies, the angle distribution displays an oscillation structure. With the impact parameter distribution derived from the dCTMC calculations the positions of the first dark and the first bright fringes expected from the Fraunhofer-type diffraction theory were deduced and shown by vertical arrows in Fig. 2. A strikingly good agreement between the experimental data and those based on Fraunhofer-type diffraction theory support our interpretation of the origin of the observed structure.

Reference

[1] D. L. Guo, X. Ma, S. F. Zhang, et al., Rhys. Rev. A, 95(2017)012707.

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