4 - 14 Observation of Double Scattering of Relatively High-energy Electrons in He^{2+}-argon Collisions*

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We have investigated the single capture with simultaneous single ionization in He^{2+} collisions with argon by means of reaction microscopes[1]. Here, we report the dependence of the azimuth angle (φ_e) of the relatively high-energy electrons (kinetic energy > 20 eV) on the transversal recoil momentum ($p_{r\perp}$) in single capture with double ionization process for 30 keV/u He^{2+} collisions with Ar. It is noted that the relatively high-energy electrons mainly result from binary encounter (BE) between the target electrons and the projectiles for the present reaction channel.

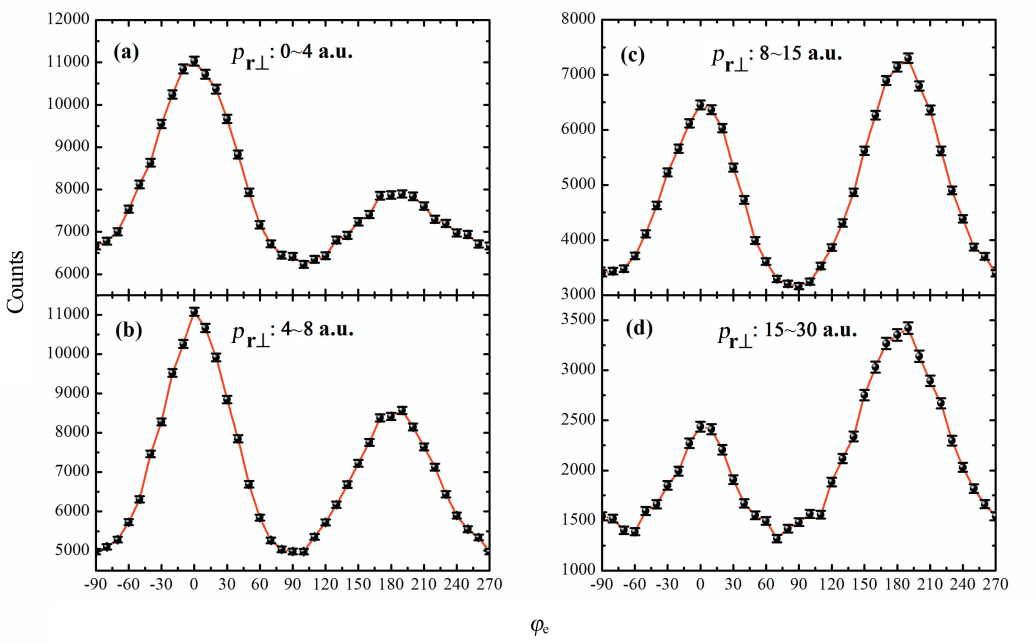

Fig. 1 (color online) Azimuth angle distributions of the relatively high-energy electrons for the transverse recoil momentum range of 0∼4, 4∼8, 8∼15, 15∼30 a.u., respectively. Only statistical errors are presented. The lines are guides for the eyes.

Fig. 1 shows that the azimuth angle distributions of the relatively high-energy electrons which first hit the electron detector in a single collision for the transverse recoil momentum ranges of 0∼4, 4∼8, 8∼15 and 15∼30 a.u., respectively. The azimuth angle is defined by the transversal momentum of the recoil ion and the emitted electron. In the presentations, the recoil ions are located at 0 °. It is found that the relative intensity of peak at 180 ° strongly increased while the one at 0 ° decreased rapidly with $p_{r\perp}$increasing. This is because that the trajectories of most of the relatively high-energy electrons are close to the target cores and parts of relatively high-energy electrons undergo the rescattering on the target cores at large $p_{r\perp}$, like the observation in[2]. The rescattering causes that the relatively high-energy electrons emitted initially at near 0 ° are emitted at near 180 ° and the probabilities of the rescattering increase with $p_{r\perp}$. In Fig. 1(d), the intensity of the peak at 180 ° is much more than that at 0 °. It demonstrates that the rescattering by the target core plays an important role in BE electron emission process at large $p_{r\perp}$ for the present reaction.

References

[1] X. Ma, R. T. Zhang, S. F. Zhang, et al., Phys. Rev. A, 83(2011)052707

[2] U. Bechthold, S. Hagmann, J. Ullrich, et al., Phys. Rev. Lett, 79(1997)2034.

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