

4 - 11 Nucleus-nucleus Interactions in Transfer Ionization of He^{2+} -He Collisions*

Feng Wentian, Ma Xinwen, Zhu Xiaolong, Yan Shuncheng, Zhang Ruitian, Guo Dalong and Gao Yong

The transfer ionization of atom by ion impact offers a very suitable test ground of quantum many-body problem^[1], because the final state involves three particles (the projectile, the emitted electron and the recoil ion). The experimental techniques are available to perform kinematically complete measurements on these processes now.

The experiment was performed using a reaction microscope at the Institute of Modern Physics, CAS^[2]. The data was analyzed in terms of Dalitz spectrum which is presented in Fig. 1. In this figure, the Dalitz plot is similar

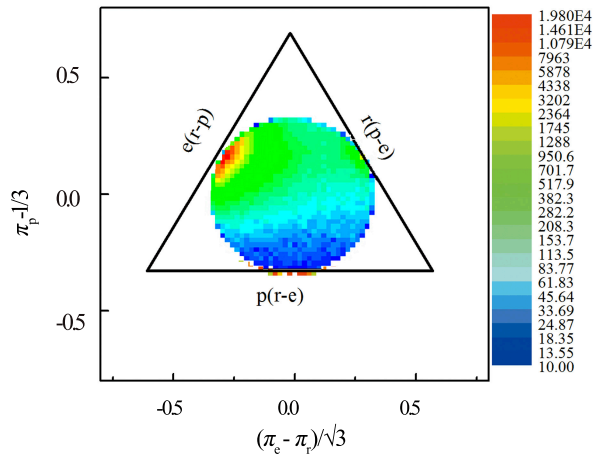


Fig. 1 (color online) The Dalitz plot in transfer ionization of helium by 50 keV/u He^{2+} impact.

to Ref. [3], instead of the relative energy in original Dalitz plot, the relative squared momenta $\pi_i = p_i^2 / \sum p_i^2$ (i denotes the projectiles, the emitted electrons and the recoil ions) of the three collision fragments were plotted. For the projectile, the momentum transfer q was used instead of its final state momentum p_p . With this notation, in our Dalitz plot, the projectile is represented by the lower triangle side, the emitted electron by the left triangle side, the recoil ion by the right triangle side. It should be noted that all the data points were inside an equilateral triangle inner circle, since the area outside that circle does not satisfy the momentum conservation.

As shown in Fig. 1, a maximum peak at the contact point of the internal circle with the emitted electrons triangle side $e(r-p)$ clearly shows that a large momentum exchange in the collision occurs between the projectiles and the recoil ions. At the recoil triangle side $r(p-e)$, a secondary maximum is seen, illustrating important con-

tribution from binary interactions between the projectiles and the emitted electrons. However, few data points near the lower triangle side indicate a weak momentum correlation between the emitted electrons and the residual target in the collision. A preliminary conclusion is that the nucleus-nucleus high order interaction could not be overlooked in transfer ionization collision dynamics of helium by intermediate energy He^{2+} impact.

References

- [1] M. Schulz, T. Ferger, D. Fischer, et al., Phys. Rev. A, 74(2006)042705.
- [2] X. Ma, X. Zhu, H. Liu, et al., Sci. China. Ser G, 51(2008)755.
- [3] M. Schulz, R. Moshhammer, D. Fischer, et al., J. Phys. B. At. Mol. Opt. Phys, 37(2004)4055.

* Foundation item: National Natural Science Foundation of China(11004202)