# Dynamics of transfer ionization process in *p*-He collisions at intermediate energies

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**Synopsis** Using the reaction microscope technique, we have performed a kinematically complete experiment on transfer ionization in 50 to 100 keV proton-helium collisions. A careful inspect on the momentum balance provides insight into the dynamics of the transfer ionization process.

Studies of the dynamics of transfer ionization for collisions of charged particles, in particular proton with helium have been the subject of many experimental and theoretical works for a long time [1]. Despite the impressive progress in both slow and fast *p*-He collisions, the understanding of the transfer ionization at intermediate energies is far from satisfactory. Using the reaction microscope in Lanzhou, we performed a kinematically complete experiment to study the transfer ionization in *p*-He collisions.

In the present experiment [2], events are recorded with double coincidence between recoil ion and scattered projectile. From the time of flight and the impact position on the detectors, the momentum vectors of the recoil ion and the electron can be reconstructed. The momentum change of the projectile could be deduced from the momentum conservation.

The scattering plane is defined by the incoming projectile momentum (z-coordinate) and the transverse momentum of either the recoil ion or the scattered projectile (x-coordinate). The azimuthal plane is perpendicular to the scattering plane [3]. Fig.1 shows the electron momentum distribution projected onto the two different azimuthal planes for 50keV *p*-He collisions. The x-coordinates are given by the transverse momentum of recoil ion and scattered projectile, respectively. Thus the arrows in Fig.1 indicate the direction of recoil ion and scattered projectile, respectively. The distribution in Fig.1(a) displays an almost symmetrical shape with respect to the origin demonstrating the weak momentum exchange between recoil ion and electron. On the other hand, a quite different behavior is observed in Fig.1(b) where most of the electrons are emitted opposite to the projectile, which can be attributed to the binary interaction between the projectile and the target electron. In addition, from projectile momentum distribution projected onto the scattering plane determined by the initial projectile and the recoil ion, the projectile is found mostly scattered opposite to the recoil ion (not shown here). This implies that there is a strong correlation between the recoil ion and projectile. Thus our results indicate that the momentum exchanges between the projectile and both the recoil ion and electron dominate in this process. This might be a signature of two step mechanism involving a binary encounter of projectile and target electron which gives rise of the electron emission, followed by a kinematical capture of the second electron. A further investigation is desirable to clarify the dynamics in *p*-He collisions at intermediate energies.

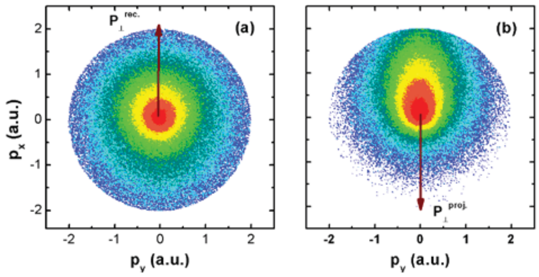


**Figure 1.** The electron momentum projected onto the azimuthal planes defined by the incoming projectile momentum and the transverse momentum of (a) recoil ion and (b) outgoing projectile.

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## References

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