

The target effect in transfer ionization in proton-helium and neon collisions at intermediate energies

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Synopsis The velocity distribution of emitted electrons in the transfer ionization (TI) in p-He and p-Ne collisions had been measured at projectile velocity $V_p=2$ a.u. The characteristics of electrons emission in the scattering plane is significant different from that observed in the TI of He^{2+} -He collision (L. Schmidt *et al* 2007 *Phys. Rev. A* 76 012703-1). The mechanism leading to the ejection of electrons has still not been completely understood.

The transfer ionization (TI) in ion-atom collision has been studied for more than half a century, but the mechanisms of TI at intermediate impact energies are still controversial [1, 2] till now. And it is very important for understanding the many-particle quantum mechanics in ion-atom collision.

In this work, the velocity vectors of emitted electrons for TI in p-He and Ne collisions at projectile velocity $V_p=2$ a.u. were obtained using a reaction microscope [3] at Institute of Modern Physics, CAS. The emitted electrons of energies less than 55 eV could be completely collected. The projections of the velocity of the ejected electrons in the scattering plane (topview) [4] were plotted in Figure 1(a) and (b), respectively. Figure 1(a) shows that the emitted electrons are found mainly in the forward direction with the velocities between 0 and V_p . Meanwhile, the velocity distribution of emitted electrons are asymmetric around the inter-nuclear axis. In Figure 1(b), the emitted electrons are mainly found around the target nuclear with the velocity near to 0, which is different with the Figure 1(a).

The characteristic of emitted electrons in TI of p-He and p-Ne collision are significantly different from that observed in He^{2+} -He collision [1]. The difference may be caused by several factors in the following. Firstly, the V_p of p is more higher than He^{2+} , the interaction time of p with target is shorter than He^{2+} . Then, p is neutral after capturing an electron, so the Post Collision Interaction (PCI) of H atom is weaker than He^+ . And it is easier for Ne to lose two electrons at large impact parameter than He. However, the mechanism leading to the ejection of electrons is still

not been completely understood. The further experimental data analysis is in progress. On the theoretical side, no model can explain the distribution of emitted electrons so far.

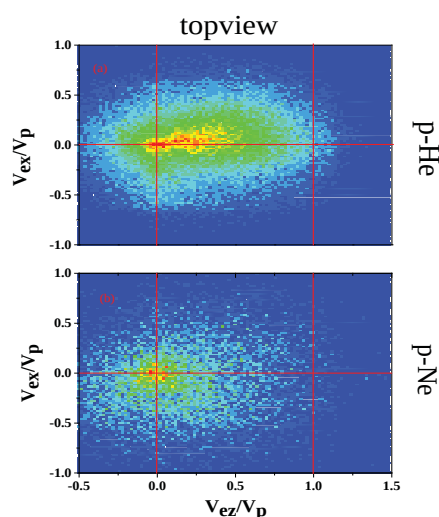


Figure 1. The emitted electron velocity distributions in the scattering plane for TI in p-He (a) and p-Ne (b) collisions at $V_p = 2$ a.u., respectively.

This work was partially supported by the NSFC Grants No.10979007 and 11004202.

References

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