Contribution ID: **52** Type: **not specified**

Charge Exchange Cross Section Measurement in Fudan University

Wednesday, 31 March 2021 10:15 (30 minutes)

Cross section, being amongst the most important parameter in describing atomic collision processes, can point towards the relevant reaction mechanisms and also have been used as key physical quantities for checking many-body theories [1]. On the other hand, cross sections for the interaction between ions and atoms play an important role in understanding astrophysical plasmas and fusion plasma diagnostics. However, due to the complicated collisional processes and high costs involved in experimental measurements, cross sections for highly charge ions interacting with atoms/molecules are still limited.
Recently, the absolute electron capture cross sections for single and double charge exchanges between the highly charged ions O6+ and CO2, CH4, H2, N2, the dominant collision processes in the solar wind, have been measured in the energy from 7 keV•q (2.63 keV/u) to 52 keV•q (19.5 keV/u). These measurements were carried out in the new experimental instrument set up at Fudan University, and the error of cross sections for single and double charge exchanges at the 1σ confidence level are about 11% and 16%, respectively [2].
At the same time, Base on time-dependent density functional theory non-adiabatically coupling with molecular dynamics, we investigated the ion-atom/molecule collision processes. Aiming at many-electron systems with large spacial scale, we proposed an approximate method to extract the electron capture cross sections, avoiding explicit dependence on the final scattering wave functions. To demonstrate the reliability of the method, we reconstructed the electron capture and ionization cross sections in the Ne2+ and He collision [3]. The results agree reasonably well with the experimental data and semi-empirical results in the keV energies.
In this report, I will first introduce the experimental facilities for highly charged ion colliding with atoms and molecules, then present some new results.

References

[1] J.W. Gao, Y. Wu, J. G. Wang, et al, Phys. Rev. Lett. 122, 093402 (2019);
[2] J. Han, L. Wei, B. Wang, B. Ren, W. Yu, Y. Zhang , Y. Zou, L. Chen, J. Xiao , and B. Wei, Astrophys. J. Supp. Series (2021) 253:6
[3] Wandong Yu, Cong-Zhang Gao, Shunsuke A. Sato, Alberto Castro, Angel Rubio, and Baoren Wei, Phys. Rev. A (in press).

Primary author: Prof. WEI, Baoren (Fudan University)

Presenter: Prof. WEI, Baoren (Fudan University)

Session Classification: EXP/2 A+M data