Positronium formation in positron-lithium collisions with Debye potentials

Yuancheng Wang[†1], Jia Ma[*2], Liguang Jiao[‡], and Yajun Zhou[§]

[†] College of Physics Science and Technology, Shenyang Normal University, Shenyang, 110034, China
[*] College of Science, Shenyang Aerospace University, Shenyang, 110136, China
[‡] College of Physics, Jilin University, Changchun, 130012, China
[§] Institute of Atomic and Molecular Physics, Jilin University, Changchun, 130012, China

Synopsis Positronium (Ps) formation processes in positron-lithium collisions in Debye plasma environments are investigated using the screening approximation model. We present the Ps(1s) formation cross sections in the incident energy range 2-40eV for screening parameters μ=0.00-0.25.

Recent years, atomic collision processes in plasma environments have received considerable attention[1]. The interactions among the charged particles in weakly coupled plasmas have been reduced to Debye-Huckel potentials. The ambient plasma temperature and its density are related to the screening parameter μ. The eigen energies and wave functions of the atomic systems are modified depending on the plasma screening parameter. Under the influence of no external environment, a number of studies have been conducted on the problem of positron-lithium collisions. However, in plasma environments such calculations are limited.[2]

We are reporting the Ps formation cross sections in positron-lithium collisions of the screening approximation model, which has been used in studying of positron-hydrogen collisons[3]. A complex polarization potential has been derived in describing the Ps formation in positron-lithium system. We have considered modified bound-state energies and wave functions for lithium due to Coulomb screening determined by the parameter μ.

In Figure 1 Ps(1s) formation cross sections for incident positron energies in the range 2-40eV are presented, for different values of the screening parameter μ=0.00-0.25. The Ps formation cross section decreased at larger values of the screening parameter μ, in this incident energy range. The screening effect on the electron capture probability decreases as the projectile energy increases.

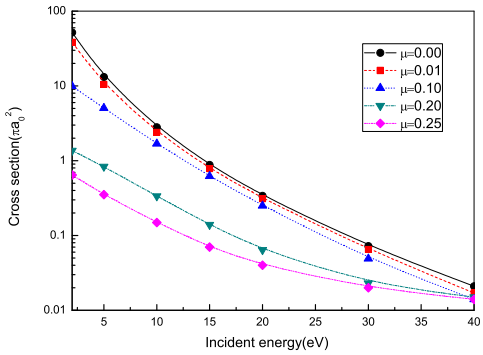

Figure 1. Positronium formation(1s) cross sections under different screening parameters. solid lines, μ=0.00; dash lines, μ=0.01; dot lines, μ=0.10; dash dot lines, μ=0.20; dash dot dot lines, μ=0.25.

So far, the core polarization term has not been include in these calculations. We are planning to include this term to determine the effect on low energy Ps formation.

This work was supported by the National Natural Science Foundation of China (Grant Nos. 11404223, 11447158 and 11504128), and the Doctoral Program Foundation of Shenyang Normal University.

References

[1] R. K. Janev *et al.* 2016 *Matter and Radiation at Extremes* **1** 237

[2] P. Rej *et al.* 2016 *J. Phys. B: At. Mol. Opt. Phys.* **49** 125203

[3] J. Ma *et al.* 2012 *Phys. Plasmas* **19** 063303

[1]E-mail: rickywangyc@aliyun.com
[2]E-mail: majia@sau.edu.cn