Interaction of helium and nitrogen atoms with singly charged lithium ion

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We present a non-perturbative classical treatment of the charge transfer and ionization processes in collisions between singly charged lithium ions with helium and nitrogen atoms. Our work is a gap-filling work, as there is either very limited total cross section data are available or no available differential cross section data for this system. To model our collision systems, we used the 3-body classical trajectory Monte Carlo (CTMC) technique. The interactions among the particles are taken into account with the Garvey model potential [1]. The target was split into a single active electron and the target core consisting of the nucleus and remaining non-active electrons. The projectile was the third particle. This model potential takes into account the effective charge of the target, incorporating the screening effect of non-active electrons. In our simulations the classical equations of motion were solved numerically using the adaptive Runge-Kutta method, the step size depends on the initial parameters of all particles.
We found that, for both systems, our CTMC results for the capture process show good agreement with the previous results in the high projectile impact velocity range. Moreover, at the same time, we found that at lower impact energy range, while our total capture cross sections for helium target follows the trend of the experimental data, for the case of nitrogen target, they overestimating it a bit [2]. In addition, we also present and discuss the total ionization cross-sections of these two systems.

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References

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