Classical description of state-selective charge exchange processes in Ar^{3+} + H(1s) and H^{+} + Ar^{2+} collisions

S. Otranto, N. D. Cariatore, N. Bachi and E. Acebal

Instituto de Física del Sur (IFISUR), CONICET-Universidad Nacional del Sur (UNS),
Av. L. N. Alem 1253, B8000CPB - Bahía Blanca, Argentina

In this talk we will describe the classical description of two conceptually different collision systems: Ar^{3+} + H(1s) and H^{+} + Ar^{2+}. The theoretical models employed are based on the classical trajectory Monte Carlo (CTMC) method in the one-active electron approximation [1], and the impact energy range considered will be 1 keV/u-100 keV/u. For Ar^{3+} + H(1s) collisions we have implemented the Z-CTMC method that has been recently observed to lead to an improved description of charge exchange processes between highly charged ions and ground state hydrogen [2-4]. The interaction between the proton and the electron with the partially stripped projectile has been represented by means of the model potential provided by Garvey *et al* based on Hartree-Fock calculations [5], while the binning of quantum *n* levels has been accomplished by implementing the methodology proposed by Schultz *et al* [6]. In the second case, we have made use of the standard microcanonical formulation. Garvey potentials were used to describe the interaction of the active electron and the incoming proton with the target ionic core. In this case, and based on the impact energy range explored, we have restricted our calculations to contributions arising from the M-shell of the target, while l-constrains have been implemented during the initialization procedure for the 3s and 3p electrons.

[1] R. E. Olson, A. Salop, Phys. Rev. A 16, 531 (1977).
[2] N. D. Cariatore, S. Otranto and R. E. Olson, Phys. Rev. A 91, 042709 (2015).
[3] N. D. Cariatore, S. Otranto and R. E. Olson, Phys. Rev. A 93, 066702 (2016).
[4] N. D. Cariatore, N. Bachi, E. Acebal and S. Otranto, Plasma Phys. Contr. Fusion 67, 55003 (2025).
[5] R. H. Garvey, C. H . Jackman and A. E. S. Green, Phys. Rev. A 12, 1144 (1975).
[6] D. R. Schultz, P. C. Stancil and M. J. Raković, J. Phys. B: At. Mol. Opt. Phys. 34, 2739 (2001).