

Atomic charge-changing processes in plasmas

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Charge-changing processes (electron capture, loss and ionization) occurring in interaction of probing particle beam with a plasma are considered over a wide collision energy range. A special attention is paid to the roles of particles of metastable states both in plasmas and in a particle beam. Available computer codes which can provide reasonable cross-section values at low and high energies are briefly described, suggesting how to deduce the data at intermediate energies where calculations encounter serious difficulties. It is pointed out that density effects [1] in dense plasmas are important, tending to increase ionization cross sections, on one hand, and to decrease capture cross sections, on the other hand, due to high collisional frequencies leading to step-by-step ionization of excited atomic states. Contribution of multiple-electron processes [2] of heavy probe-beam ions by plasma particles to total cross sections is discussed. Formulae for the rate coefficients for different atomic processes are given when a probe beam with an arbitrary velocity penetrates plasmas with an arbitrary temperature.

[1] V.P. Shevelko, H. Tawara, O.V. Ivanov, T. Miyoshi, K. Noda, Y. Sato, A.V. Subbotin and I.Yu. Tolstikhina, *J. Phys. B* **38** (2005) 2675

[2] V.P. Shevelko, M.S. Litsarev and H. Tawara, *J. Phys. B* **41** (2008) 115294