Electric Microfield Distributions (EMD) and their tails in Alkali Plasmas with account of the ion structure

S. P. Sadykova[1], W. Ebeling[1] , I. M. Sokolov[1]

[1] *Institut fuer Physik, Humboldt Universitaet zu Berlin, Newtonstr. 15, 12489 Berlin, Germany*

The electric microfield influences many elementary processes in plasma (ionization etc.) as well as governs a number of its optic properties. Alkali plasmas are widely applied in many technical projects. For instance, Li will be used to produce ^{3}H in magnetically confined nuclear fusion reactor (ITER project) using ^{2}H and ^{3}H as the fuel. We calculate the EMDs for alkali plasmas at the location of an ion using Ortner's method [1] and the Hellmann-Gurskii-Krasko pseudopotential model taking into account the ion structure [2]. It is worth to notice, that our models take into account both quantum-mechanical, ions' structure and screening field effects. In order to include these screening effects, the screened Hellmann-Gurskii-Krasko potential is derived on a base of a method described in [3]. Additionally, we derive the new type of the screened Hellmann-Gurskii-Krasko potential, where for electron-electron interaction we use the corrected Kelbg potential [4] instead of the here employed Deutsch potential [5] and compare them. The influence of the coupling parameter on the EMD along with the ion's structure is investigated. For comparison the corresponding EMDs for H^+ plasmas were given too. In this case no ion shell exists and we may see clearly the influence of the shell structure. High density as well as non-ideality causes a shifting of the maximum of probability to lower fields and significantly modifies EMDs. The theoretical results are compared with molecular dynamics simulations and are found in a good agreement. All the EMDs of alkali plasmas studied in the present work show long tails (high field regions) revealing a large probability of high microfields. An important observation is that the high-field tails for alkali plasmas decay much faster than the fields acting on protons in hydrogen plasmas. This means that strong fields are less probable and all high-field effects are weakened by the ion shell structure.

[1] J. Ortner, I. Valuev, W. Ebeling, Contrib. Plasma Phys. \textbf{40}, 555-568 (2000); **[2]** Z. A. Gurski, G. L. Krasko , Proceedings of USSR Academy of Sciences (in russ), V. 197, Nr4., P. 810-813 (1971); Krasko G. L., Gurskii Z. A. , JETP letters 1969. V. 9, iss. 10. P. 363-366; **[3]** Yu. V. Arkhipov, F.B. Baimbetov, A.E. Davletov, Eur.Phys. J. D 8, 299-304 (2000); **[4]** W. Ebeling, G.E. Norman, A. A. Valuev, I. Valuev, Contr. Plasma Phys. 39, 61 (1999); **[5]** S. P. Sadykova, W. Ebeling, I. Valuev, I. Sokolov, Contr. Plasma Phys. **49**, 76 – 89 (2009) ; **49**, 388-402.