30th Summer School and International Symposium on the Physics of Ionized gases, August 24-28, 2020, Šabac, Serbia

POTENTIAL ENERGY CALCULATIONS OF A CHARGED PARTICLE OUTSIDE A REAL METAL SURFACE

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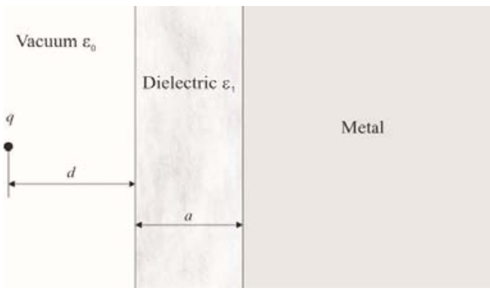
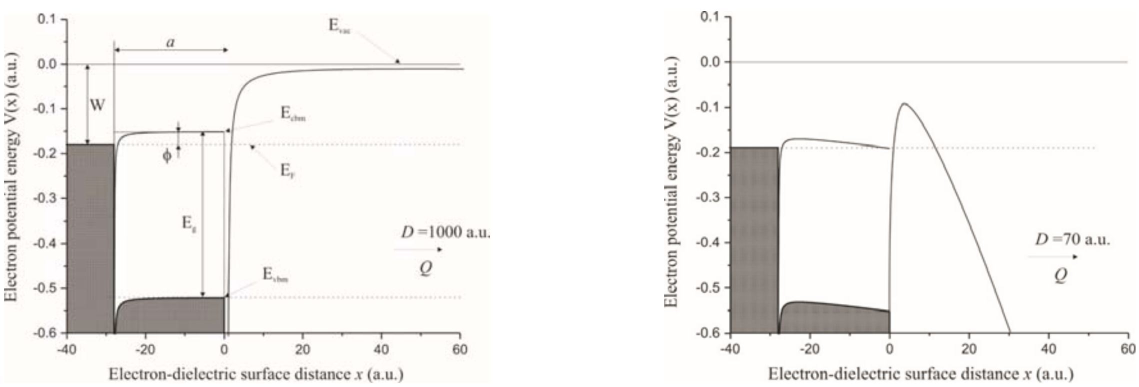
In this work we consider a more complex system with the point charge located between the real metal covered with thin dielectric film and multiply charged ion. In many cases, precise knowledge of the potential energy of a charge particle outside a real planar surface is very important for deep understanding many transfer processes. For metal-vacuum interface, the charge transfer play a significant role especially for photo and thermionic emission and also in a different ion beam processes. Furthermore in electron diffraction and positron diffraction spectroscopy as well as in scanning tunneling microscopy, charge transfer between a metal and the vacuum is also involved.



A point charged particle q at a distance d from the metal surface covered with a thin oxidized film. The thickness a reaches several nanometers.

Considering the population of the Rydberg states ($n_A >> 1$) of highly charged ions ($Z >> 1$) interacting with solid surfaces, two aspects of the process can be analyzed. The first one is devoted to the intermediate stages of the population dynamics. These stages are characterized by the neutralization rates and the neutralization distances R_c. The final population probabilities represent another important aspect of the process. In order to find appropriate neutralization distances, or any other values which characterized the population process, we have to estimate the potential energy function, i.e., to estimate the electron potential energy at any point between real metal surfaces and approaching or outgoing ion subsystem.



The electron potential energy inside metal Co, inside dielectric Al_2O_3 and between the dielectric surface and ion charge $Q = 44$ for a) $D = 1000$ a.u. and b) $D = 70$ a.u.

Acknowledgement. This work is supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia.

- Aumayr, F., Facsko, S., El-Said, A. S., Trautmann, C., Schleberger, M. : 2011, *J. Phys: Condens. Matter*, **23**, 393001.
- Galijaš, S. M. D., Poparić, G. B. : 2019, *Phys. Scr.*, **94**, 025401.
- Jennings, P. J., Jones, R. O. : 1988, *Adv. Phys.*, **37**, 341.
- Lake, R. E., Pomeroy, H., Grube, H., Sosolik, C. E. : 2011, *Phys. Rev. Lett.*, **107**, 063202.
- Nedeljković, N. N., M. D., Galijaš. S. M. D., Mirković, M. A. : 2014, *J. Quant. Spectrosc. Radiat. Transfer*, **134**, 46.