SEMINARIUM Z MAGNETYZMU I NADPRZEWODNICTWA

Uprzejmie zawiadamiamy, że we **wtorek**

14 kwietnia 2019 r., o godz.10:00

w sali 203 (bud. 1) odbędzie się seminarium, na którym

Prof. Alexander M. Gabovich

Institute of Physics, National Academy of Sciences of Ukraine, Ukraine

wygłosi referat na temat:

„Electric charges and dipoles in two- and three-layer structures”

Multilayered structures – e.g., heterostructures – with different dielectric properties of constituent media are typical objects not only in such domains as electronics, solid state physics or chemical catalysis, but also in domains dealing with biological matter, such as tissues or cells. The main objects responsible for charge, spin, energy and information transfer are charged particles (electrons and ionized atoms or molecules) and/or polarizable particles (molecules), characterized by permanent or induced electrical dipole moments.

Therefore, it is necessary to know how those entities polarize the adjacent media and interact with them (the so-called image forces) or with one another. The general adequate scheme for point charges and dipoles has been obtained and analyzed for the cases of two- or three-layer structures. Our analytical and numerical results describe basic specific cases, both for charges and dipoles. The obtained general formulas take into account the spatial dispersion of the layers' dielectric permittivities. In particular, it was shown that the preferable orientation of adsorbed extended dipoles might change depending on their equilibrium distance from the interface. It was also shown that the spatial dispersion of the substrate dielectric function strongly affect the functional dependence of interaction between both charges and dipoles on the distance between them as compared with textbook formulas. A new insight was achieved even in the framework of classic electrostatics as a reference point for further researches. It was demonstrated that in both two- and three-layer structures polarization charges induced at interfaces between the layers distort the nominal Coulomb interaction. The deviations from the Coulomb law were analyzed and the dependences of the charge-charge interaction on various system parameters were obtained. For three-layer systems, a simple effective-exponential approximation was suggested, which allowed derivation of finite analytical formula perfectly reproducing numerical results in a wide interval of problem parameters. Our results demonstrate that the frequently assumed two-body electrostatic interaction between charges and dipoles in complex systems should be carefully reexamined and corrected to take into account many-body effects. It is especially important for biological systems where the distances between ions (molecules) are comparable to the layer widths.

Serdecznie zapraszamy

Roman Puźniak / Henryk Szymczak / Andrzej Szewczyk