The effect of counterions on polaronic transport through DNA

M. Sidowski[1] and K. Walczak[1,2]

[1]*Institute of Physics, Adam Mickiewicz University, Umultowska 85, 61-614 Poznań, Poland*
[2]*School of Electrical and Computer Engineering, University of Virginia*
351 McCormick Road, Charlottesville, VA 22904, USA

It is still not clear, which mechanism is responsible for electrical conduction through DNA. Since nucleobases involved into the transport process are thermally activated to vibrations and vibrational coupling parameter is sufficiently strong, charge carriers could be locally coupled to phonons leading to polaron formation. Besides, the conducting behavior of DNA strongly depends on the ambient solution in which the experiment is conducted. Here we discuss some theoretical results related to the influence of counterions on polaronic transport through DNA molecules. Poly(dG)-poly(dC) DNA is considered as a linear chain of quantum dots described within tight-binding approach with electron-phonon interactions modeled through the use of Holstein treatment [1]. Randomness associated with the fluctuation nature of the counterions is taken into account through the variations of site energies of each quantum dot and hopping integrals between two neighboring dots (given by the Wolfsberg-Helmholtz expression). The current flowing through the DNA-based junction is computed using inelastic version of Landauer formula averaged over many disorder configurations.

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Name of the presenting author (poster session II): Mariusz Sidowski
e-mail address: masi@amu.edu.pl
http://www.staff.amu.edu.pl/~masi