Physics
AT QUEENS COLLEGE

Colloquium Notice

Lev Murokh

Queens College

Energy conversion in mitochondria membranes: principles of operations and ideas for nanoelectronics

Living objects at the nanoscale can be viewed as molecular complexes, whose dynamics is often controlled by the transfer of single charges or single-photon absorption events. In many senses, it is similar to the principles of operation of semiconductor nanostructures and elements of molecular electronics. Correspondingly, the methods of condensed matter and statistical physics can be applied.

In this talk, I address proton-pumping complexes and proton-driven nanomotor of the mitochondria membranes. These systems convert the energy obtained from the food to the proton gradient across the membrane, to the mechanical rotation of the nanomotor, and, finally, to the energy of chemical compounds. We propose simple physical models for these complexes which not only allow the quantitative description but can inspire the implementations in nanoelectronics as well.

In the end of the talk, I discuss some details of electron transfer calculations bridging the Marcus theory and equations of motion, two methods widely used in chemistry and physics, respectively. We demonstrate that as a manifestation of the Goldilocks principle, the optimal transfer is governed by a single parameter which is equal to just the inverse square root of two.

Monday
February 3, 2014
Starts at 12:15 PM
Coffee at 12:00 PM
Physics Conference Room, SB B326