

## SUPERIONS IN THE NARROW NANOPORES WITH MULTIPLE OCCUPANCY

*V.N. Kharkyanen, S.O. Yesylevskyy, N.M. Berezetskaya*

Department of Physics of Biological Systems,  
Institute of Physics, Nat. Acad. of Sci. of Ukraine  
(*Prosp. Nauky, 46, Kyiv 03039, Ukraine*)

### S u m m a r y

The general theory of the single-file multiparticle diffusion in narrow pores can be greatly simplified in the case of the inverted bell-like shape of a single-particle energy profile, which is often observed in biological ion channels. There is a narrow and deep groove in the energy landscape of multiple interacting ions in such profiles, which corresponds to the pre-defined optimal conduction pathway in the configurational space. If such a groove exists, the motion of multiple ions can be reduced to the motion of a single quasiparticle, called the superion, which moves in a one-dimensional effective potential. The concept of superions reduces the computational complexity of the problem and provides the very clear physical interpretation of conduction phenomena in narrow pores.