DEPARTMENT OF PHYSICS UNIVERSITY OF MARYLAND **CNAM** Condensed Matter Colloquium

2pm, **April 17th**, Room 1201

Metal- Insulator Transition in Solid State Nanopores and Biological Ion Channels

Professor Boris Shklovskii

University of Minnesota

This work deals with ion transport in a water filled nano-pore in a silicon film or in a protein ion channel in a lipid membrane of our cells. Due to the large ratio of dielectric constants of water filling the channel (81) and that of SiO (4) or the surrounding lipid (2), an ion placed inside the channel has its electric lines squeezed in the channel and two oppositely charged ions are confined as two quarks in a meson. This should lead to a large electrostatic self-energy barrier and to an exponentially large Ohmic resistance of the channel. Nevertheless we function well what means that biological channels are well transparent for ions. In order to address this paradox, I study reduction of the electrostatic barrier by a finite concentration of salt in water and/or by immobile charges on the internal channel walls. We show that both types of charges lead to the insulator-metal transitions (elimination of the self-energy barrier) with their increasing concentrations. These transitions resemble the Mott insulator-metal transitions in a dense exciton gas or in a doped semiconductor. They are even closer to studied in heavy nuclei collisions quark de-confinement.

Host: Victor Galitski