

Physics Colloquium

Michigan Technological University

November 10 (Thursday) 2005, 4:00 to 5:00 pm
Room 139, Fisher Hall

Transport in nanoscale systems: physical issues and application to fast
DNA sequencing

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Abstract

Transport of electrical charge across a nanoscale junction is accompanied by many effects like transfer of energy between electrons and ions and consequent heating of the junction, forces on ions due to current-induced variations of the electronic distribution, current fluctuations etc. I will discuss these effects in nanoscale structures and focus on their description at the atomic level. In particular, I will discuss their relative role in the stability of nanojunctions, the bias dependence of the current and noise on heating and compare these findings with experimental results. Particular attention will be given to open questions regarding these effects, and their impact on nanoscale electronics. I will also discuss an intriguing new application of transport in nanoscale systems, namely a novel approach to DNA sequencing using nanopores which has the potential to considerably increase sequencing speeds.

Biography

Massimiliano Di Ventra obtained his BS degree in Physics /magna cum laude/ from the University of Trieste, Italy, in 1991 and his PhD in Physics from the Ecole Polytechnique Federale of Lausanne, Switzerland in 1997. The same year he moved to Vanderbilt University. From 1998 to 2000 he was Visiting Scientist at IBM T.J. Watson Research Center. From 2000 to 2002 he was Assistant Professor of Physics at Virginia Tech and in 2003 was promoted to Associate Professor. Since January 2004 he is Associate Professor in the Physics Department at the University of California, San Diego. Prof. Di Ventra's research focuses on developing first-principles atomistic approaches to predict the electronic, optical and transport properties of materials. He is on the editorial board of several journals and has received numerous awards and recognition for his work on transport in nanoscale systems, including the NSF-CAREER award. He is also the fellow of Institute of Physics.