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PHYSICS COLLOQUIUM

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Tuesday, November 2, 2004; Kusch Auditorium, FN 2.102
Networking 3:30-4:00 PM; Presentation 4:00-5:00 PM

Nanostructured Carbon and the Nanotechnology Revolution

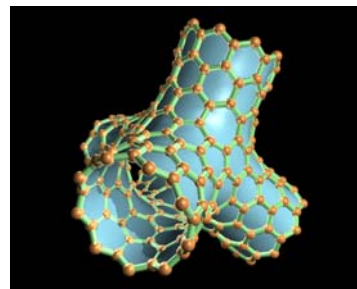
Professor David Tománek

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The continuous reduction of device sizes, which is rapidly approaching the atomic level, calls for new approaches to design and test future building blocks of Nanotechnology. Computers will become the most powerful tool to interpret what happens on the nanometer scale, where as I will illustrate, structures of carbon may become stronger than steel, yet turn into quantum conductors or even efficient heat conductors [Phys. Rev. Lett. 84, 4613 (2000)]. In nanostructures that form during a hierarchical self-assembly process, even defects may play a different, often helpful role. An efficient self-healing process may convert less stable atomic assemblies into other, more perfect structures, thus answering an important concern in molecular electronics [Chem. Phys. Lett. 392, 209 (2004)]. Defects may even be used in nano-scale engineering to form complex systems such as carbon nanotube junctions [Phys. Rev. Lett. 92, 075504 (2004)], nanotube peapods [Phys. Rev. Lett. 88, 185502 (2002)], or all-carbon magnets [Phys. Rev. Lett. 91, 237204 (2003)]. In this presentation, I will show how some of these challenging problems can be most efficiently addressed in simulations on recently available massively parallel supercomputers.



Schematic model of nanoVELCRO



sp² bonded all-carbon magnet

About the speaker: David Tomanek is Professor of Physics at Michigan State University (MSU). After his Ph.D. at the Free University Berlin, he joined the AT&T Bell Laboratories and then continued as a Research Fellow at the Physics Department of the University of California in Berkeley. At MSU he established a strong research program in Computational Nanotechnology. Focusing on fullerenes, nanotubes, ferrofluids, metallic and magnetic clusters, he developed and applied a wide range of numerical techniques to study the structural, electronic, and optical properties of these systems. He devotes most of his time to fundamental research in Nanotubes and related nanostructures at MSU and at the Computational Nanotechnology Project in Tokyo. He chairs the Board of Directors of the nanotube manufacturing company Rosseter Holdings Ltd. in Cyprus. Tomanek established The Nanotube Site on the web. As Interdisciplinary Professor at the Tokyo Institute of Technology and Distinguished Professor of Physics at the Seoul National University in Korea, he recently held a series of lectures on Nanotechnology, which attracted wide attention.