

Nanostructures and strongly correlated materials

– Douglas Natelson, Rice University



One of the great miracles of condensed matter physics is how often we can get away with ignoring the electron-electron repulsion. Noninteracting band structure does a good job of predicting the electronic properties of many common materials, including silicon, aluminum, and diamond. In contrast, materials with strong electron-electron and electron-lattice interactions often exhibit rich, complex competition between phases possessing properties such as magnetism, superconductivity, and other forms of order. Our group has been applying nanostructure techniques to study such materials. I will discuss recent results concerning one such system, vanadium dioxide, a transition metal oxide that ordinarily undergoes a dramatic phase transition at 65 C between a low temperature insulating state and a high temperature metallic state. I will discuss how atomic hydrogen can suppress this transition, stabilizing an unusual metallicity down to low temperatures, where we have examined electronic transport properties and quantum corrections to conduction in a previously inaccessible regime. Time permitting, I will also show a recent, fun, related result demonstrating the rare inadequacy of a freshman physics model of inductors.

**SEMINAR
WEDNESDAY
APRIL 29
600 LINDY
BOGGS
TULANE
3:00 PM**

Prof. Natelson came to Rice University in 2000 following a postdoctoral fellowship at Bell Labs. His research focuses on applying nanoscale techniques and tools to address open questions in condensed matter physics, specifically through measurements of the electronic, optical, and magnetic properties of very small systems. The interdisciplinary character of this research has led to courtesy appointments in Electrical and Computer Engineering as well as Materials Science & Nanoengineering. Prof. Natelson is a fellow of the APS and AAAS, blogs about science at nanoscale.blogspot.com, and is the author of a forthcoming textbook (Nanostructures and Nanotechnology) available this summer from Cambridge University Press. <http://natelson.web.rice.edu/>

All seminars are available via HD videoconferencing at the following venues:
LA Tech - 211 Nethken Hall, LSU - 1008B DMC, SUBR - 211 J.B. Moore Hall,
Tulane - 600 Lindy Boggs, UNO - 234 Liberal Arts Building, Xavier - 226 Qatar Pavilion.