University of Texas at San Antonio

Department of Physics & Astronomy

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Advanced Technologies Manager — SEMATECH

Friday, February 10, 2012

Time: 3:00 p.m.-4:00 p.m.

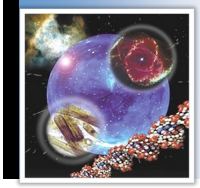
BB 3.04.18

Molecular Switches and Rectifiers: The Electronic Properties of Molecular Junctions

Molecular switches are devices that are able to switch between two or more conductance states. Although many highly conjugated molecules have been reported to show conductance switching, there continues to be a strong need within the community to pinpoint the origin of this electronic property. Similarly, an argument can be made for the origin of molecular rectifiers. These devices have the ability to control current in one direction. This behavior is attributed to either the asymmetry in the electrodes or in the molecule. However, it may be possible to observe rectification in a device with symmetry in both the molecule and electrode.

Experimental results are discussed and future experiments are proposed that will provide key insights into a two-state conductance observed in porphyrin molecules and connecting the existence of the conductance to redox states and vibration modes that exist in the molecules. Results will be discussed that demonstrate how one can simultaneously measure the conductance of a single molecule and control the surface potential near the redox states of the molecules to manipulate conductance in a junction. In addition, data will be presented that show for the first time rectification observed in porphyrin molecules self-assembled as molecular layers on gold facets using conductive atomic force microscopy. Studies will be presented to explore another explanation for the existence of rectifying behavior in molecular junctions by investigating the effects of molecular multilayers and the molecule-electrode coupling on rectification observed in porphyrin molecules.

Biosketch: Kim Michelle Lewis graduated from the University of Michigan - Ann Arbor and completed a Ph.D. in Applied Physics in 2004 and an M.S. in Electrical Engineering in 2003. Upon entering graduate school she received a $120,000 Packard Fellowship to complete her studies in 6 years. After completing her graduate studies she earned a Ford Postdoctoral Fellowship to work at Louisiana State University in Baton Rouge to study molecular electronics. In 2006 Dr. Lewis joined the Rensselaer physics faculty. Since accepting her position she has received an NSF Award, Woodrow Wilson Career Fellowship, a NNIN Fellowship, a Rensselaer RAMP-Up Career Campaign Award, and a SET Innovation Paper Award for her work on molecular electronics.



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