

Department of Physics & Astronomy

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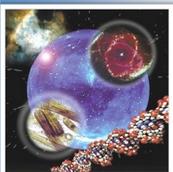
Friday, April 12, 2013

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

BB 3.04.18

**Ultrafast Nanoplasmonics: Toward Controlled Chemistry
as the Space-Time Limit**

Inelastic electron tunneling via molecular-scale junctions can induce a variety of fascinating dynamical processes in the molecular moiety. These include vibration, rotation, inter-mode energy flow and reaction. Potential applications of current-driven dynamics in heterojunctions range from new forms of molecular machines and new modes of conduction, to new directions in surface nanochemistry and nanolithography. In the first part of the talk, I will discuss the qualitative physics underlying current-driven dynamics in molecular-scale devices, briefly skim through the theory we developed to explore these dynamics, describe the results of ongoing research on surface nanochemistry and molecular machines, and sketch several of our dreams and plans in these areas. The application of light to control molecular motions and electronic transport in junctions is intriguing, since photonic (by contrast to electronic) sources offer (sub)femtosecond time resolution and tunable phase and polarization properties. One of several challenges, however, is the requirement of coherent light sources that are tightly localized in space. It is here that plasmonics offer an opportunity. In the second part of the talk, we will combine plasmonics physics with concepts and tools borrowed from coherent control of molecular dynamics with two goals in mind. One is to introduce new function into nanoplasmonics, including ultrafast elements and broken symmetry elements. The second is to develop coherent nanoscale sources and apply them to coherent control of both mechanical motions and electric transport in the nanoscale. To conclude the talk, we will discuss ongoing research on ultrafast molecular nanoplasmonics in both weak and strong molecule-plasmon coupling limits.

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