SPECIAL AMO PHYSICS SEMINAR

"Current-Driven Molecular Machines"

Dr. Tamar Seideman

Northwestern University

ABSTRACT

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.

The talk will begin with a discussion of the qualitative physics underlying current-driven dynamics in molecular-scale devices, where the theory developed to explore these dynamics will be *briefly* outlined and results of ongoing research (as well as our dreams and plans) on surface nanochemistry and molecular machines will be described. We will then 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 molecular dynamics and electric transport in the nanoscale as shown in the Figure below. In conclusion, we will return to nanoelectronics, and illustrate the application of plasmonics to current control in the nanoscale, with a view to ultrafast electric switches.

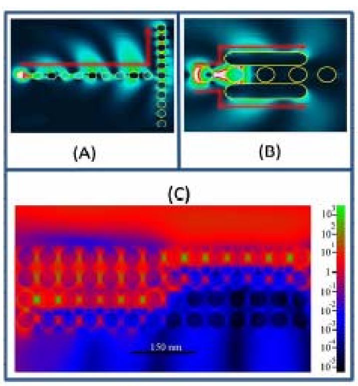

Figure: Several simple elements in what we envision developing into coherently controlled nanoplasmonics are schematically illustrated. (A) The T-junction guides electromagnetic energy traveling down the leg into one or the other of the two symmetry-equivalent arms of the junction. (B) A hybrid construct, which combines elements that provide local enhancement with elements that provide long distance propagation in order to minimize losses. The structural parameters of the construct are optimized using a genetic algorithm. (C) A plasmonic nanocrystal, developed to separate an incident plane wave into two frequency components and funnel each component in a different direction normal to the direction of incidence.

Tuesday, November 24, 2009
10 a.m. Room 578
Mitchell Physics Building

Texas A&M University
Institute for Quantum science and Engineering

(coffee and cookies to be served at 9:45 a.m.)