Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Plasmon induced electric current in a molecular junction PARTHA PAL, NAN JIANG, MATTHEW SONNTAG, NAIHAO CHIANG, EDWARD FOLEY, RICHARD VAN DUYNE, TAMAR SEIDEMAN, Department of Chemistry, Northwestern University — We report light-triggered, plasmon-enhanced charge transport in a tip-molecule-surface molecular junction. Experimentally, enhancement of tunneling current is recorded when a chopped laser beam illuminates the junction. The enhancement is quenched when the sample is devoid of molecules and its amplitude increases steeply when the focus of the beam moves closer to the space between the tip and the mono layered sample. Finite difference time domain calculations indicate that maximum electromagnetic field enhancements due to plasmonic activity, occurs in the space between the tip and the sample which is also the region where the tunneling current perturbation peaks. The perturbation in the transport characteristics at the tip-sample junction is theoretically estimated utilizing a recent formulation for describing the transient electronic distribution due to plasmon decoherences. We find the enhancement in the electronic current to be directly proportional to the plasmon excitations only in the presence of a molecular linker which is in excellent agreement with the experimental results. Further analysis reveals that the nascent distribution allows injection of electrons through additional molecular resonances which were previously inaccessible, thus leading to an increased current.

Partha Pal
Northwestern University

Date submitted: 14 Nov 2014 Electronic form version 1.4