Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Measurement of electrical field enhancement in plasmonic nanogaps via optical rectification DANIEL WARD, DOUGLAS NATELSON, Rice University — Planar nanogap structures have been demonstrated to exhibit plasmonically enhanced electrical fields. Electric field enhancements in these structures are sufficiently large to observe single molecule surface enhanced Raman scattering (SERS) (Nano Lett. 8, 919 (2008)). Nanogaps can be integrated into electrical circuits allowing simultaneous optical and electrical characterization of the gap. Nanogaps exhibit an electrical nonlinearity in their tunneling conduction. This nonlinearity results in a rectified current proportional to the square of an applied oscillating voltage. We have found that when illuminated such gaps exhibit a photocurrent proportional to this electrical nonlinearity, suggesting that this rectification process is at work at optical frequencies in these structures. By detecting the optically rectified current in nanogaps and comparing with simultaneously acquired electrical measurements, we infer the plasmonically enhanced local electrical field in the nanogap. Inferred electric field strengths are on the order of 100 times the incident field. This enhancement of the electric field is consistent with the enhancement necessary to observe single molecule SERS.

Daniel Ward
Rice University

Date submitted: 19 Nov 2009 Electronic form version 1.4