Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

The Lightning Rod Model: a Genesis for Quantitative Near-Field Spectroscopy ALEXANDER MCLEOD, University of California San Diego, GREGORY ANDREEV, Bruker Nano Surfaces Division, GERARDO DOMINGUEZ, California State University San Marcos, MARK THIEMENS, MICHAEL FOGLER, D.N. BASOV, University of California San Diego — Near-field infrared spectroscopy has the proven ability to resolve optical contrasts in materials at deeply sub-wavelength scales across a broad range of infrared frequencies. In principle, the technique enables sub-diffractional optical identification of chemical compositions within nanostructured and naturally heterogeneous samples. However current models of probe-sample optical interaction, while qualitatively descriptive, cannot quantitatively explain infrared near-field spectra, especially for strongly resonant sample materials. We present a new first-principles model of near-field interaction, and demonstrate its superb agreement with infrared near-field spectra measured for thin films of silicon dioxide and the strongly phonon-resonant material silicon carbide. Using this model we reveal the role of probe geometry and surface mode dispersion in shaping the measured near-field spectrum, establishing its quantitative relationship with the dielectric properties of the sample. This treatment offers a route to the quantitative determination of optical constants at the nano-scale.

Alexander McLeod
University of California San Diego

Date submitted: 14 Dec 2012 Electronic form version 1.4