Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Terahertz Near-Field Nanoscopy of Mobile Carriers in Single Semiconductor Nanodevices ANDREAS J. HUBER, Max-Planck-Institut fur Biochemie, Munich, Germany and CIC nanoGUNE, San Sebastian, Spain, FRITZ KEILMANN, Max-Planck-Institut fur Biochemie, Munich, Germany, J. WITTBORN, Infineon Technologies AG, Munich, Germany, JAVIER AIZPURUA, CSIC-UPV/EHU and DIPC, San Sebastian, Spain, RAINER HILLENBRAND, Max-Planck-Institut fur Biochemie, Munich, Germany and CIC nanoGUNE, San Sebastian, Spain — We introduce ultraresolving Terahertz (THz) near-field microscopy based on THz scattering at atomic force microscope tips. Nanoscale resolution is achieved by THz field confinement at the very tip apex to within 30 nm, which is in good agreement with full electro-dynamic calculations. Imaging semiconductor transistors, we provide first evidence of 40 nm ($\lambda/3000$) spatial resolution at 2.54 THz (wavelength ≈ 118 μm) and demonstrate the simultaneous THz recognition of materials and mobile carriers in a single nanodevice. We find that the mobile carrier contrast can be directly related to near-field excitation of THz-plasmons in the doped semiconductor regions. This opens the door to quantitative studies of local carrier concentration and mobility at the nanometer scale. The THz near-field response is extraordinary sensitive, providing contrast from less than 100 mobile electrons in the probed volume. Future improvements could allow for THz characterization of even single electrons or biomolecules.

Javier Aizpurua
CSIC-UPV/EHU and DIPC, San Sebastian, Spain

Date submitted: 11 Nov 2008 Electronic form version 1.4