Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Near field infrared spectroscopy of the ferromagnetic semiconductor $Ga_{1-x}Mn_xAs$ at the nanoscale. G.O. ANDREEV, University of California at San Diego, M. BREHM, F. KEILMANN, Max-Planck-Institut fur Biochemie, Martinsried, Germany, M.M. QAZILBASH, T. DRISCOLL, University of California at San Diego, K.S. BURCH, Los Alamos National Laboratory, J. STEPHENS, D.D. AWSCHALOM, University of California at Santa Barbara, D.N. BASOV, University of California at San Diego — We report on the nanoscale infrared response of a prototypical ferromagnetic semiconductor $Ga_{1-x}Mn_xAs$ at Mn doping fractions in the range of x=1.8-7.75 %. These studies have been carried out using an apertureless scattering Scanning Near field Infrared Microscope (s-SNIM) with a pseudoheterodyne detection scheme operating at the wavelength near 10 μm.. For samples with doping fractions below 7% we observe a contrast-free near field infrared signal, suggesting a homogenous electronic state on the length scale down to 10-20 nm determined by the spatial resolution of s-SNIM.. At doping fractions of 7.66% and 7.74% we find significant contrast in the form of surface clusters ranging in diameter from 15 to 30nm in both topographical and near field images. These clusters occupy approximately 15% of the total image area. We will discuss possible origins of the observed contrast within the framework of the effective polarizability dipolar model of the tip-sample interaction.

G.O. Andreev
University of California at San Diego

Date submitted: 06 Dec 2006 Electronic form version 1.4