Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Cyclotron Dephasing Times in the Quantum Hall Regime X. WANG, D. J. HILTON, L. REN, D. M. MITTLEMAN, J. KONO, Department of Electrical and Computer Engineering, Rice University, J. L. RENO, Sandia National Laboratories, M. M. FOGLER, Department of Physics, University of California at San Diego — We have used time-domain THz spectroscopy to study a high-mobility GaAs two-dimensional electron gas in quantizing magnetic fields. We observe very long-lived (up to ∼30 ps) coherent cyclotron oscillations, which can be viewed as the free induction decay of a coherent superposition between the lowest-unfilled Landau level and the highest-filled Landau level induced by the incident coherent THz pulse. From the frequency and decay time of these oscillations, we can directly determine the cyclotron mass and dephasing time. The magnetic field dependence of the dephasing time shows an oscillatory behavior, which can be due to the filling factor dependent dielectric screening of long-range potentials. The temperature dependence of the dephasing time at a fixed magnetic field shows three pronounced regions where different scattering potentials dominate. The two high temperature regions have standard interpretations while the lowest temperature range has not been observed before, to our knowledge. A sharp increase in dephasing time is observed below $\sim$ 5 K, which could be due to strong screening enhanced by the spin splitting of Landau levels. We provide detailed theoretical calculations to explain these observations.

Xiangfeng Wang
Department of Electrical and Computer Engineering, Rice University

Date submitted: 02 Dec 2006 Electronic form version 1.4