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Long-Lived Coherent Cyclotron Oscillations in a 2D Electron Gas X. WANG, R. SRIVASTAVA, A. BARKAN, D. M. MITTLEMAN, J. KONO, Department of Electrical and Computer Engineering, Rice University, J. L. RENO, Sandia National Laboratories, DEPARTMENT OF ELECTRICAL AND COM-PUTER ENGINEERING, RICE UNIVERSITY TEAM, SANDIA NATIONAL LABORATORIES COLLABORATION — We have used the technique of timedomain THz spectroscopy to study coherent charge dynamics in a high-mobility two-dimensional electron gas (2DEG) in quantizing magnetic fields. By analyzing the magnetic field dependence of the transmitted THz waveform, we successfully extracted the real and imaginary parts of the dynamic conductivity at various magnetic fields and temperatures for a GaAs/AlGaAs 2DEG with a 1.5 K mobility of 3.7 $\times 10^6 \text{ cm}^2/\text{Vs}$. We observed pronounced coherent cyclotron oscillations persisting more than 50 picoseconds and 20 periods. From the frequency and decay time of these oscillations, we can directly determine the cyclotron mass and phase coherence time. The basic phenomenon observed can be understood 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. Finally, we discuss the possibility of using this technique to overcome the saturation effect, which is known to prevent the determination of true cyclotron resonance linewidths in highmobility $(> 10^5 \text{ cm}^2/\text{Vs})$ 2DEG measured with conventional far-infrared techniques using CW and incoherent sources.

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