High Frequency Magneto Oscillations in low Electron Density GaAs/AlGaAs Quantum Wells

Y.-W. TAN, Phys. Dept., Columbia Univ., H. L. STORMER, Phys. Dept., Appl. Phys. and Math. Dept., Columbia Univ., and Bell Labs, L. N. PFEIFFER, K. W. WEST, Bell Labs — We have observed exceptional magneto oscillations in modulation doped GaAs/AlGaAs quantum well structures with low (10%) Al barriers. These reproducible, rapid oscillations appear in our low density samples \( n \sim 6.5 \times 10^{10}/cm^2 \) after standard illumination and are robust against thermal cycling. They are periodic in inverse magnetic field \( (1/B) \) and the amplitude increases with temperature up to \( \sim 600mK \). With increasing temperature, these oscillations shift from the \( \nu \sim 1/2 \) range towards the \( \nu \sim 1/3 \) range of the underlying, low density 2DES. Some aspects are reminiscent of recent work by G. A. Csáthy et. al. (PRL, 92, 256804(2004)) Under tilt, these oscillations follow the standard \( \cos \theta \) behavior of a 2D system. The period, if naively translates into density, yields \( 1.4 \times 10^{13}/cm^2 \), which significantly outnumbers all countable carriers in the device. A backside gate affects the QHE in the 2DES as well as the rapid oscillations, although the density shifts for the latter are highly incompatible with dimensions and screening considerations.

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