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Anti-levitation of Landau levels in vanishing magnetic fields[1] W. PAN, Sandia National Labs, K.W. BALDWIN, K.W. WEST, L.N. PFEIFFER, D.C. TSUI, Princeton University — Soon after the discovery of the quantum Hall effects in two-dimensional electron systems, the question on the fate of the extended states in a Landau level in vanishing magnetic (B) field arose. Many theoretical models have since been proposed, and experimental results remain inconclusive. In this talk, we report experimental observation of anti-levitation behavior of Landau levels in vanishing B fields (down to as low as B ˜58 mT) in a high quality heterojunction insulated-gated field-effect transistor (HIGFET). We observed that, in the Landau fan diagram of electron density versus magnetic field, the positions of the magneto-resistance minima at Landau level fillings ν =4, 5, 6 move below the "traditional" Landau level line to lower electron densities. This clearly differs from what was observed in the earlier experiments where in the same Landau fan plot the density moved up. Our result strongly supports the anti-levitation behavior predicted recently. Moreover, the even and odd Landau level filling states show quantitatively different behaviors in anti-levitation, suggesting that the exchange interactions, which are important at odd fillings, may play a role.

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