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Weakly Pinned Wigner Solid-FQHE Liquid Phase Transition in the 2-Dimensional Hole System under Ultrahigh Magnetic Fields
CHI ZHANG, Peking University, RUI-RUI DU, Rice University, JUNREN SHI, XINCHENG XIE, Peking University, MICHAEL J. MANFRA, Purdue University, LOREN N. PFEIFFER, KEN W. WEST, Princeton University, JU-HYUN PARK, National High Magnetic Field Lab — In the two dimensional systems, Wigner crystals (WC) solid and fractional quantum Hall effect (FQHE) liquid phase compete under low temperature and high magnetic fields. Here, we exhibit unusual experimental results in the new developed C-doped two-dimensional hole samples. Our derivative conductivity measurements elucidate the existence of reentrant insulating phase (RIP) around the Landau level filling factor v =1/5 in the 2D hole system. Moreover, we report the unexpected feature in the quantum phase transition between the Wigner Solid and FQHE liquid state in the 2D hole system under ultrahigh magnetic fields. Consequently, a systematic phase diagram is obtained based on our analysis. To our surprise, the excited electric field plays an equivalent role as the temperature in our specimen. From the duality of the electric field and temperature, a characteristic length of 450 nm is derived in our Analysis, which is the mean free path of the carriers. Based on the relation between the pinning gap and electric field, we obtained a characteristic domain size of the Wigner crystal.

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