Transport of GaAs two-dimensional holes in strong Coulomb interaction regime JIAN HUANG, D.C. TSUI, Princeton University, L.N. PFEIFFER, K.W. WEST, Bell Labs, Lucent Technologies — We report experimental findings on the 2D holes in a GaAs/AlGaAs heterojunction insulated-gate field-effect transistor in the strong interaction regime ($E_{ee} \gg E_F kT$) with the carrier densities ($p$) varying from $7 \times 10^9 \text{ cm}^{-2}$ to $7 \times 10^8 \text{ cm}^{-2}$. Though the temperature dependence of the resistivity ($\rho$) resembles that observed in typical 2D Metal-to-Insulator Transition (MIT), there are two things strikingly different. First, for each density, a kink/dip appears in the $T$-dependence of the conductivity ($\sigma$) around a characteristic temperature which we call $T_c$. In the $T_c$-$p$ relation, there is a sudden change at a characteristic density which is the same as the critical density $p_c$ where the apparent MIT is observed. The linear $T_c$-$p$ at high densities suggests that $T_c$s for $p > p_c$ correspond to the Fermi temperature $T_F$s. However, $T_c$ shows little $p$-dependence at $p < p_c$ ($p_c = 4 \times 10^9 \text{ cm}^{-2}$). Second, $T_c$ divides the $\sigma$-$T$ into a linear part for $T > T_c$ and a power-law part for $T < T_c$. The $\sigma$ is finite at the base temperature of 35mK even for the lowest density $7 \times 10^8 \text{ cm}^{-2}$. These results rule out the possibility of hopping transport, or the insulator of a pinned Wigner crystal.

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