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Observation of a Spin-polarization Driven Insulating Phase between the Quantum Hall States in a Dilute Metallic 2D Hole System[1]

RICHARD L. QIU, XUAN P.A. GAO[2], Case Western Reserve University, LOREN PFEIFFER, KEN WEST, Princeton University, PRINCETON UNIVERSITY COLLABORATION — The origin of Metal-Insulator Transition (MIT) in strongly correlated 2D electron systems has long been of great interest. Here we present the transport properties of 10nm wide GaAs quantum wells with hole densities around the critical point of the 2D MIT (critical density $p_c \approx 0.92 \times 10^{10}\text{cm}^{-2}$). For hole density above p_c but less than $1.2\times 10^{10}\text{cm}^{-2}$, an insulating phase is observed between the ν=1 and ν=2 quantum Hall states which both show metallic temperature dependence ($\text{d}R_{xx}/\text{d}T > 0$). Through studying the evolution of this insulating phase versus 2D hole density, we show that it is connected to the zero field insulating phase. The interplay between the spin-polarization induced 2D MIT physics and the formation of quantum Hall states is suggested to explain the insulating phase we report. We will also present detailed data on the Hall resistivity ρ_{xy} of our dilute 2D hole system near p_c.

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