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Evidence for a New Intermediate Phase in a Strongly Correlated 2D System near Wigner Crystallization[1] XUAN GAO, RICHARD QIU, NICHOLAS GOBLE, Case Western Reserve University, ALEX SERAFIN, LIANG YIN, JIAN-SHENG XIA, NEIL SULLIVAN, National High Magnetic Field Laboratory and University of Florida, LOREN PFEIFFER, KEN WEST, Princeton University — How the two dimensional (2D) quantum Wigner crystal (WC) transforms into the metallic liquid phase remains an outstanding problem in physics. In theories considering the 2D WC to liquid transition in the clean limit, it was suggested that a number of intermediate phases might exist. We have studied the transformation between the metallic fluid phase and the low magnetic field reentrant insulating phase (RIP) which was interpreted as due to the WC [Qiu et al, PRL 108, 106404 (2012)], in a strongly correlated 2D hole system in GaAs quantum well with large interaction parameter r_s ($\sim$20-30) and high mobility. Instead of a sharp transition, we found that increasing density (or lowering r_s) drives the RIP into a state where the incipient RIP coexists with Fermi liquid. This apparent mixture phase intermediate between Fermi liquid and WC also exhibits a non-trivial temperature dependent resistivity behavior which can be qualitatively understood by the reversed melting of WC in the mixture, in analogy to the Pomeranchuk effect in the solid-liquid mixture of Helium-3. Reference: R. Qiu et al, arXiv:1509.07463.

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Xuan Gao
Case Western Reserve University

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