Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Evidence of two-dimensional quantum Wigner Crystal in a zero magnetic field[1] JIAN HUANG, Wayne State University, LOREN PFEIFFER, KEN WEST, Princeton University — In disorder-dominated cases, Anderson localization occurs as a result of destructive interference effects caused by (short-ranged) random disorders. On the other hand, in interaction-dominated scenarios, striking manifestations of quantum physics emerge in response to strong inter-particle Coulomb energy (E_C). The most prominent interaction-driven effect is the Wigner crystallization (WC) of electrons, an electron solid made up with spatially separated charges settling in a form of a lattice. The classical version of the crystallization, with the Debye temperature $\Theta_D < E_C$, has been demonstrated with two-dimensional (2D) electrons on helium surfaces (EHS). However, the more desired quantum version with the Fermi energy $E_F \ll E_C \ll \Theta_D$, has not been previously observed especially in zero magnetic field. We present a transport study of ultra-high quality dilute two-dimensional hole (2DH) systems in a genuine interaction-driven regime. A high resolution dc VI measurement reveals a pA level threshold transport accompanied by resistivity oscillations, indicating the coexistence of a pinned quantum WC with discrete edge filaments of unpinned carriers.

[1]NSF DMR 1105183

Jian Huang
Wayne State University

Date submitted: 15 Nov 2013

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