Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Melting of the electron Wigner Crystal: Theory of the metal-insulator transition in two dimensions (2DMIT) JOHN JANIK, SERGEY PANKOV, VLADIMIR DOBROSAVLJEVIC, NHFML/FSU National High Magnetic Field Laboratory and Department of Physics, Florida State University, Tallahassee, FL 32310 — Past theoretical work in explaining the 2D metal-to-insulator transition at $T = 0$ has focused on perturbative approaches around the Fermi Liquid state, and has met with limited success [1]. Starting from the opposite limit we propose a charge transfer model with vacancy-interstitial pair formation as the mechanism for the phase transition. A new picture of the phase diagram has emerged [2], which our theory explains. At low carrier density we find an insulating phase with short-range order, at high density a metallic phase with no order, and a persistent intermediate density metallic phase with short range order. Our theory also explains the experimentally observed strong effective mass enhancements, as the metal-insulator transition is approached from the metallic side.
1. Abrahams, E., Kravchenko, S. V., and Sarachik, M. P., Rev. Mod. Phys. 73, 251-266 (2001). 2. Falakshahi, H. & Waintal, X., Phys. Rev. Lett. 94, 046801 (2005).

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Date submitted: 06 Dec 2005 Electronic form version 1.4