Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

New melting transition in Quantum Hall systems[1] GEORGE SIMION, TSUGING LIN, JOHN D. WATSON, MICHAEL J. MANFRA, GABOR CSATHY, LEONID ROKHINSON, YULI LYANDA-GELLER, Department of Physics, Purdue University, West Lafayette, IN 47907 USA — We discover a new melting transition caused by topological excitations of two dimensional electrons in the quantum Hall regime. Experimentally, strain dependence of resistivity changes sign upon crossing filling-factor-specified boundaries of reentrant integer quantum Hall effect (RIQHE) states. This observation violates the symmetry of electron bubble crystal, whose melting was thought to be responsible for insulator to metal transition in the range of RIQHE filling factors. We demonstrate theoretically that electron bubbles become elongated in the vicinity of charge defects and form textures of finite size. Textures lower the energy of excitations. In the two-electron bubble crystal these textures form hedgehogs (vortices) around defects having (lacking) one extra electron. At low density these textures form an insulating Abrikosov lattice. At densities sufficient to cause the textures to overlap, their interactions are described by the XY-model and the defect lattice melts. This explains the sharp metal-insulator transition observed in finite temperature conductivity measurements. In this regime, melting is a function of several variables and forms a continuous phase boundary in the field-temperature ($B-T$) plane.

[1]Research was partially supported by the U.S. Department of Energy, Office of Basic Energy Sciences, Division of Materials Sciences and Engineering under Awards DE-SC0010544 (Y.L-G), DE-SC0008630 (L.P.R.), DE-SC0006671 (G.S. and M.M.).

Yuli Lyanda-Geller
Department of Physics, Purdue University, West Lafayette, IN 47907 USA

Date submitted: 15 Nov 2013 Electronic form version 1.4