Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Wave-function Localization and Impurity-induced First Order Phase Transition in Correlated Liquids Near the Thermal Freezing Point SHAHRIAR SHADKHOO, ROBIJN BRUINSMA, University of California, Los Angeles — A quantum mechanical impurity coupled to an ohmic charged liquid near the crystallization phase transition, can stabilize a local cluster in the liquid. A nonlinear free energy functional is borrowed from Landau-Brazovskii (LB) model; the theory of weak crystallization, where in Gaussian approximation and near the thermal freezing point, the correlation of fluctuations with a characteristic wave vector q_0 diverges, hence a crystal with unit cells of the size q_0^{-1} forms. Adding nonlinearities to the free energy, however, opens up a gap in density field (order parameter) across the transition, implying a first order phase transition. We apply the instanton technique to study the first order local phase transition of the charged field from liquid to crystalline phase, induced by the impurity. We demonstrate that the particle, can stabilize the metastable minimum of the free energy slightly above the actual transition point, and facilitate the local transition.

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Date submitted: 14 Nov 2013 Electronic form version 1.4