Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

**On the Strong Localization and Rapid Time Scales of Superheating and Vapor Nucleation in Nanopores** EDLYN LEVINE, GAKU NAGASHIMA, DAVID HOOGERHEIDE, Harvard University, MICHAEL BURNS, The Rowland Institute at Harvard, JENE GOLOVCHENKO, Harvard University — Extreme localized superheating and homogeneous vapor nucleation have recently been demonstrated in thin, solid state nanopores. Electrolytic solution present within the pore is superheated to well above its boiling point by ohmic heating from ionic current driven through the pore. Continued heating of the metastable liquid can eventually lead to explosive nucleation of a vapor bubble in the pore. Here we report on the consistency of theoretical predictions with experimental results concerning the thermal, spatial and temporal scales involved. Calculations demonstrate that extreme spatial localization of the temperature distribution is achieved in the nanopore heating experiments. Our results indicate that the liquid at the center of the pore can be rapidly superheated to several hundred degrees kelvin above the boiling point within tens of microseconds. The temperature within the pore is shown to increase by about 100K from the edge to the center of a 60nm radius pore. This degree of localization strongly indicates that vapor nucleation is homogeneous due to the high temperature dependence of the kinetic nucleation rate.

Edlyn Levine
Harvard University

Date submitted: 15 Nov 2013 Electronic form version 1.4