Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Filling up of a cylindrical hole in a viscous film MATILDA BACKHOLM, Department of Physics & Astronomy and the Brockhouse Institute for Materials Research, McMaster University, Hamilton, ON, Canada, MICHAEL BENZAQUEN, THOMAS SALEZ, ELIE RAPHAEL, Laboratoire de Physico-Chimie Theorique, UMR CNRS Gulliver 7083, ESPCI, Paris, France, KARI DALNOKIVERESS, Department of Physics & Astronomy and the Brockhouse Institute for Materials Research, McMaster University, Hamilton, ON, Canada — A small cylindrical hole is a naturally occurring surface perturbation in viscous films. The flow dynamics of the hole is relevant for industrial applications, but more generally also important for the understanding of relaxation processes in thin films. Here, the capillary levelling of cylindrical holes in viscous polystyrene films was studied using atomic force microscopy and analytical scaling arguments. The relaxation of holes of various sizes was shown to consist of two different time regimes: an early regime where opposing sides of the hole do not interact, and a late regime where the hole is filling up. All theoretically derived scaling laws as well as the long-term solution of the intermediate asymptotic regime were shown to be in excellent agreement with experiments. In short, the system presented here provides an ideal sample geometry with which to probe flow on the nano-scale.

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Date submitted: 14 Nov 2013 Electronic form version 1.4