Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Sorting Category: 03.1.14 (C)

Plasticity as a Depinning Phase Transition GEORGIOS TSEKENIS, University of Illinois at Urbana-Champaign, PAK YUEN CHAN, None, THOMAS FEHM, Ludwig-Maximilians-Universität Muenchen, JONATHAN T. UHL, None, JONATHAN DANTZIG, NIGEL GOLDENFELD, KARIN DAHMEN, University of Illinois at Urbana-Champaign — Crystalline materials deform in an intermittent way via slip-avalanches, which exhibit a variety of scale-invariant behaviors that have been interpreted as a pinning-depinning transition. We use discrete dislocation dynamics at zero temperature to resolve the temporal profiles of slip-avalanches and extract the finite-size scaling properties of the dislocation system, thus going beyond gross aggregate statistics. We provide a comprehensive set of scaling exponents, which establishes that the dynamics of plasticity, in the absence of hardening, is consistent with the mean field interface depinning universality class, even though there is no quenched disorder. Finally, we show how Phase Field Crystal simulations shed light on the effect of temperature on intermittent dislocation dynamics and its critical scaling behavior.

[X] Prefer Oral Session
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Date submitted: 08 Dec 2011 Electronic form version 1.4