Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Exploring the scaling laws of crystal plasticity with a Phase Field Crystal model GEORGIOS TSEKENIS, University of Illinois at Urbana-Champaign, THOMAS FEHM, Ludwig-Maximilians-Universität Muenchen, PAK YUEN CHAN, None, JONATHAN UHL, JONATHAN DANTZIG, Retired, NIGEL GOLDENFELD, KARIN DAHMEN, University of Illinois at Urbana-Champaign —
A wealth of experiments and simulations the last years has cemented the fact that crystalline materials deform in an intermittent way with slip-avalanches that are power-law distributed. Recently we showed that zero temperature discrete dislocation dynamics simulations predict mean field scaling exponents for both static and dynamic critical exponents. To model a wider range of experimental observations and predict the dependence on experimental parameters that are not captured by discrete dislocation dynamics we work with a Phase Field Crystal (PFC) model in two dimensions. The PFC model has the advantage that it does not require any ad hoc assumptions about the dislocation interaction or their creation and annihilation. It also models the dislocation dynamics at finite temperature. We extract the avalanche distributions and show that they scale according to the Mean Field Depinning universality class even though there is no quenched disorder.

Georgios Tsekenis
University of Illinois at Urbana-Champaign

Date submitted: 10 Dec 2012 Electronic form version 1.4