Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

**Extending the Scaling Laws of Plasticity** GEORGIOS TSEKENIS, KARIN DAHMEN, Physics Department, University of Illinois at Urbana-Champaign — Crystalline materials are known to deform in an intermittent way with avalanches. Power laws govern the statistics of the avalanche sizes, energies and times between avalanches. In this work we are studying the universal aspects of plasticity and dislocation dynamics. We employ a discrete dislocation dynamics simulation, which allows us to reproduce the distributions of avalanche sizes and energies of previous works. In addition, our model accounts for time explicitly. Thus we are able to extract distributions of dislocation slip avalanche durations and interevent times, which compare quite well with the experimental findings. We are also able to extract the power spectra of the dislocation activity that exhibit power law behavior as well. Furthermore, finite stress rate forces avalanches to occur concurrently in time and/or space and appears to lead to similar effects as previously studied for spin systems driven by an increasing magnetic field. The study of larger system sizes and slower stress rates and comparison to new experiments will give us deeper insight into the problem of plasticity as a nonequilibrium critical phenomenon.

Abstract APS

Date submitted: 07 Dec 2009 Electronic form version 1.4