Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Critical Scaling of Avalanche Dynamics in Sheared Amorphous Solids with Inertia[1] K. MICHAEL SALERNO, Johns Hopkins University, CRAIG MALONEY, Carnegie Mellon University, MARK O. ROBBINS, Johns Hopkins University — We present results from molecular-dynamics simulations of model disordered solids under quasi-static, steady-state shear in two and three dimensions. Plastic deformation occurs through intermittent "avalanches" of local rearrangements. As in other slowly-driven systems from magnets to geologic faults, avalanches exhibit critical scaling behavior. Results for the avalanche statistics, duration and power spectrum are analyzed with finite-size scaling. The exponents describing the power law distribution of avalanches and the relation between their size and duration are independent of dimension, suggesting that mean field behavior extends to two dimensions. In contrast, the scaling exponents depend on the degree of inertia or damping, with distinct universality classes in the underdamped and overdamped limits [1]. The same universality classes are observed with Galilean-invariant and non-Galilean-invariant thermostats, but the crossover between these limits will be contrasted. The implications for different experimental systems will be discussed. [1] PRL 109, 105703 (2012).

[1]Supported by DMR-1006805 and OCI-0963185.

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Date submitted: 09 Nov 2012

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