Title: Universal slip statistics and dynamics -- from compressed nanopillars to earthquakes?

Abstract:
The deformation of many solid and granular materials is not continuous, but discrete, with intermittent slips similar to earthquakes. Here we suggest that the statistical distributions of the slips, such as the slip-size distributions, reflect tuned criticality, with approximately the same regular (power-law) functions, and the same tunable exponential cutoffs, for systems spanning 13 decades in length, from tens of nanometers to hundreds of kilometers; for compressed nano-crystals, amorphous materials, sheared granular materials, lab-sized rocks, and earthquakes. The similarities are explained by a simple analytic model, which suggests that results are transferable across scales. The study provides new predictions for future experiments and simulations. The studies draw on methods from the theory of phase transitions, the renormalization group, and numerical simulations. Connections to other systems with avalanches, such as magnets, high entropy alloys, and neuron firing avalanches in the brain are also discussed.

Karin Dahmen
Department of Physics, University of Illinois at Urbana Champaign, 1110 West Green Street, Urbana IL 61801, phone 217-244-8873, fax 217-333-9819,