



PHYSICS AND ASTRONOMY COLLOQUIUM

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“Unifying Theory for Tuned-Critical Quake Statistics: From 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 cut-offs, for systems spanning 13 decades in length, from tens of nanometers to hundreds of kilometers; for compressed nanocrystals, amorphous materials, sheared granular materials, and earthquakes. The similarities are explained by a simple analytic model, which suggests that results are transferable across scales. This study provides a unified understanding of fundamental properties of shear-induced deformation in systems ranging from nanocrystals to earthquakes. It also provides many 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 and neuron firing avalanches in the brain are also discussed.

Wednesday, September 17, 2014

3:30 p.m.

Bob Wright Centre

Room A104