Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Local to global avalanches in sheared granular materials DENG-MING WENG, Lanzhou University, DONG WANG, Duke University, THIBAULT BERTRAND, Yale University, JONATHAN BARES, Duke Universty, BOB BERHINGER, Duke University — Commonly, granular materials yield or flow if sufficiently large shear stress is applied, leading to avalanche-like behavior. Rearrangement phenomenon can produce dramatic events like snow avalanches, landslides or earthquakes. For experimentally sheared media, we seek to understand the dynamics of the grain rearrangements from the local to the global scale. In this work, force networks and displacement fields are measured on two-dimensional sheared material for cyclically sheared photoelastic circular particles. Avalanches, their size, location and duration are extracted at the global scale from the rapid variation of the macroscopic energy stored in the system whereas at the local scale they are measured from the energy drop, displacement and rotation of each particle. Statistics of those different quantities are computed and correlated to test their intrinsic entanglement and analyze their universal dynamics. These results are quantitatively different from what has been observed for different analytic coarse-grained approaches and permit a clear measurement of the effect of the packing fraction and inter-particle friction coefficient on the statistical behavior.

Jonathan Bares
Duke University

Date submitted: 31 Jul 2015 Electronic form version 1.4