Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Stress Fluctuations and Nonlinear Dynamical Modes Near Jamming DAVID A. EGOLF, Department of Physics; Georgetown University, EDWARD J. BANIGAN, Dept of Physics and Astronomy; Univ of Pennsylvania —
The jamming transition is often considered a dynamical transition, but how to properly and quantitatively characterize the changes in dynamical behavior is an open question. We perform numerical simulations of a two-dimensional sheared granular layer over a range of packing fractions spanning the transition. Within these simulations, we calculate a partial spectrum of Lyapunov exponents and vectors, which (at least in one sense) is an optimal decomposition of the dynamics of the system. We find that the Lyapunov exponents and vectors corresponding to the most important dynamical modes of the system tend to localize in space and time near important physical events, such as cooperative rearrangements or redistributions of stresses. In addition, we find that the magnitudes of Lyapunov exponents are directly linked to the size of relative stress fluctuations of the system. At high densities, the system changes from chaotic to non-chaotic, and we measure dynamical time and length scales that diverge as the system jams.

David Egolf
Dept of Physics; Georgetown Univ

Date submitted: 01 Dec 2008 Electronic form version 1.4