Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Non-equilibrium Steady-State of Granular Fluids[1] MARK SHATTUCK, PEDRO REIS[2], ROHIT INGALE, Benjamin Levich Insitute, City College of New York — We experimentally investigate the non-equilibrium steady-state (NESS) structure of a uniformly heated quasi-2D granular fluid as a function of the filling fraction. For the first time we experimentally show that the structure (as measured by radial distribution function, bond order parameter, and shape factor) of a NESS behaves identically to that of it's equilibrium counterpart. In our driven dissipative system there is a constant energy flow through the system making it far from equilibrium, yet it behaves as though it were in equilibrium with a maximization principle like entropy. It appears that homogeneity and stationarity are more important than energy conservation for producing a thermodynamic state. The existence of a thermodynamics for NESS has profound consequences for granular systems and more broadly for any systems, which are out of equilibrium due to energy flux, and may lead to a fundamental justification for a theory of gradients in a near-NESS analogous to Navier-Stokes equations for near-equilibrium systems.

[1]This work is funded by The National Science Foundation, Math, Physical Sciences Department of Materials Research, Faculty Early Career Development (CAREER) Program (DMR-0134837), PMR partial funding: Portuguese Ministry of Science and Technology, POCTI.
[2]Currently: PMMH, ESPCI, Paris

Mark Shattuck
City College of New York

Date submitted: 31 Jul 2006 Electronic form version 1.4