Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Measuring an Equation of State in an Air-Fluidized Monolayer on Approach to Jamming LYNN J. DANIELS, University of Pennsylvania, NING XU, Chinese University of Hong Kong, DOUGLAS J. DURIAN, University of Pennsylvania — We examine the pressure in a quasi-two-dimensional monolayer of bidisperse steel beads, fluidized by an upflow of air, and its dependence on packing fraction and temperature on approach to the jamming transition. By tilting the system at an angle θ, we introduce a component of gravity into the plane of our system and measure a depth-dependent pressure, $P = m_>(z)g\sin(\theta)/L$ where $m_>(z)/L$ is the total mass per unit length above a depth z, over three orders of magnitude. By tracking the beads in time, we calculate packing fraction ϕ, effective temperature kT, mean square displacement, and relaxation time, all as functions of depth. This is done for different tilt angles as well as initial filling fractions. The data for $P\sigma^2/kT$ vs ϕ, where σ is the small bead radius, constitute an equation of state. The results show excellent collapse and agree well with the results of a simulation of two-dimensional bidisperse disks interacting via hardcore repulsion.

Lynn Daniels
University of Pennsylvania

Date submitted: 19 Nov 2009 Electronic form version 1.4