Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Jamming, Clogging, and Fragility in Frictionless Disk Systems with Quenched Disorder CHARLES REICHHARDT, Los Alamos National Laboratory, EVAN GROOPMAN, ZOHAR NUSSINOV, Washington University, CYNTHIA OLSON REICHHARDT, Los Alamos National Laboratory — We consider a two-dimensional simulation model of binary frictionless disks which have a well defined jamming density of $\phi_j \approx 0.84$ in the absence of quenched disorder. When quenched disorder is added in the form of impenetrable immobile disks, the jamming density is reduced. As the density of the quenched disorder sites increases, we observe a crossover from a jamming transition to a clogging transition. The clogged state is defined as a highly heterogeneous granular packing that resists shear along one direction and that is composed of a combination of high density patches at the clean jamming density and very low density patches or voids. These clogged states are fragile in the sense that they are only clogged in the direction of an externally applied drive. After a clogged state has formed, if a new drive is applied in a different direction the disks can flow freely for a period of time before reorganizing into a new clogged state. In contrast, jammed systems are jammed in all directions simultaneously.

Charles Reichhardt
Los Alamos National Laboratory

Date submitted: 19 Nov 2010 Electronic form version 1.4