Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Clogging in hopper flow and the kinetics of jamming CHARLES THOMAS, DOUGLAS DURIAN, University of Pennsylvania — Understanding the time evolution of a system from an unjammed to a jammed state is a significant and open problem. The clogging of granular materials during hopper discharge is a quintessential example of a system undergoing such a process. When a hopper has a small opening, grains exit until a stable arch forms at the opening and a jamming front propagates up through the system. Conversely, hoppers with large enough openings do not clog. We define the clogging transition as the boundary in parameter space between those systems which can clog and those which will never clog. We have established experimental techniques for locating the clogging transition and describing the grain-scale behavior in hopper flow. We use these methods to study the approach to the clogging transition for a quasi-2D hopper. By tracking particle positions with a high-speed camera, we measure time-averaged velocity fields as well as velocity fluctuations. We have previously shown that systems which can clog exhibit elevated velocity fluctuations. We currently investigate the correlations between velocity fluctuations throughout the hopper as well as the size of dynamical heterogeneties as further promising grain-scale signatures of the approach to the clogging transition and of the kinetics of jamming.

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Date submitted: 08 Nov 2012 Electronic form version 1.4