Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Geometry Dependence of the Clogging Transition in a Tilted Hopper CHARLES THOMAS, DOUGLAS DURIAN, University of Pennsylvania — We report the effect of system geometry on the clogging of granular material flowing out of a flat-bottomed hopper. We vary the hopper tilt angle, aperture shape, and granular media shape, investigating smooth spheres (glass beads), compact angular grains (beach sand), and rod-like grains (rice). We measure the average number of grains discharged before a clog halts the flow. This value grows with hole size as a power law, diverging above a critical hole size. We determine the critical value by performing a least-squares fit to the data. Beyond that critical hole size, the flow does not clog for any given tilt angle. This critical hole size grows with increasing tilt, diverging at $\pi - \theta_r$, where θ_r is the angle of repose. The value of the critical hole size as a function of tilt angle describes a well-defined transition on a clogging phase diagram. For circular apertures, the shape of this transition is similar for all grain types. However, this is not the case for the narrow slit apertures, where the rate of growth of the critical hole size with tilt angle depends on the material. The growth rate is the fastest for angular grains, then smooth spheres, with rod-like grains showing the slowest growth. This suggests a profound link between the aperture geometry and the particle shape.

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Date submitted: 17 Nov 2010 Electronic form version 1.4