Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Rapidly Rotated Granular Materials in a Cell with Fixed Walls
ERIC CORWIN, HEINRICH JAEGER, SIDNEY NAGEL, The James Franck Institute and Department of Physics, The University of Chicago — Sand in a spinning bucket takes a shape governed by the interplay of gravity, the sand's own yield stress, and centrifugal acceleration as the sand comes to rest with respect to the bucket.[1] However, if the walls of the bucket are fixed and only the bottom rotates it becomes impossible for the sand to be at rest with respect to all the boundaries of the bucket. Such a setup has been used for fluids at very high rotation rates in which strong shear forces break the axial symmetry of the fluid's surface and give rise to polygonal shapes rotating on the fluid's surface.[2] A similar setup has been employed for granular materials at low rotation rates and negligible grain momentums and leads to the formation of very broad shear bands.[3] We report on an experimental study of granular materials in such a system in which we observe a series of changes in the shape of the material's surface as we move from a regime in which momentum is negligible to one in which it is important. At high shear rates we see the development of a void in the center of the cell. Similarly to the fluid case, we see instabilities developing on the surface of the granular material surrounding this void.

[1]M.E. Vavrek and G.W. Baxter, Phys. Rev. E 50, 3353 (1994)
[2]T.R.N. Jansson, et. al., Phys. Rev. Lett. 96, 174502 (2006)
[3]D. Fenistein and M. van Hecke, Nature 425, 256 (2003)

Eric Corwin
The James Franck Institute and Department of Physics,
The University of Chicago

Date submitted: 07 Aug 2006 Electronic form version 1.4