Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Power Spectra of Force Fluctuations in Granular Materials Under Shear ERIC CORWIN, HEINRICH JAEGER, SIDNEY NAGEL, The James Franck Institute and Department of Physics,The University of Chicago — We measure the time-varying forces at the bottom surface of a granular system sheared at the top. The shear is applied by rotating a roughened piston while maintaining a constant, uniaxial compressive force. We report on the force autocorrelation and the corresponding power spectrum S of the variation of force on individual grains at the bottom surface. These forces are obtained from video tracking of imprints in a pressure-sensitive birefringent layer across the bottom surface. Averaging over concentric annuli we find power-law behavior $S \sim 1/f^{\alpha}$ over several orders of magnitude in each annulus. The power law exponents α appear to be correlated with the in-plane shear strain rate. In our system friction with the stationary side walls introduces a radial gradient in the shear rate, which is maximum at the outer edge and zero at the center. The corresponding power law exponents suggest strict $1/f$ noise ($\alpha = 1$) at the outer, shearing edge and an increasing index as one approaches the center and the shear rate vanishes.

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

Date submitted: 30 Nov 2005 Electronic form version 1.4