Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

What is the granular response to a high-speed impact?[1] ABE CLARK, LOU KONDIC, R.P. BEHRINGER, Duke University — Although many studies of impact on a granular material exist, the connections between the local granular response, the microscopic processes which dissipate kinetic energy, and the intruder dynamics are unclear, largely due to experimental difficulties in obtaining very fast data at the grain scale. We use high-speed imaging (40 kHz) of an intruder striking a quasi-2D system of photoelastic disks, yielding both the intruder dynamics and the force response of individual grains. The frame rates are fast enough to resolve rich acoustic activity on the particle scale. For long time scales, the intruder dynamics are consistent with previously used empirical force laws. However, for short time scales, we observe very large fluctuations in the deceleration, which we connect to the intermittent acoustic activity beneath the intruder as it moves. We show that these intense, intermittent acoustic pulses, which travel much faster than the intruder along networks of grains, are the primary microscopic mechanism of energy loss. These pulses carry energy away into the medium, and they decay roughly exponentially with distance. We examine the statistics of these fluctuations in order to better understand their origin and behavior.

[1]Supported by the US DTRA under grant HDTRA1-10-0021.

Abe Clark
Duke University

Date submitted: 03 Aug 2012 Electronic form version 1.4