Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

2D Granular Impact Dynamics with Photoelasic Particles[1] ABE CLARK, Duke University, LOU KONDIC, New Jersey Institute of Technology, R.P. BEHRINGER, Duke University — What is the response of a granular material to a high speed impact from a foreign object? To answer this question, we use a large 2D granular system which is impacted from above by an intruder. Using photoelastic discs and a high-speed camera (frame rates at 7,000-775,00 fps at varied resolution, typically 40,000 fps at 584x256 pixels), we are able to observe the dynamics in this process in a way which has not been done previously. Data consists of the trajectory of the intruder, as well as either particle positions or interparticle force information. High frame rates allow observation of complex acoustic waves during the impact process. We examine the effects of varying the initial velocity, density, shape, and size of the intruder, with the goal of extracting the grain-scale mechanisms responsible for the dissipation of the intruder's kinetic energy. In comparing our data to macroscopic frictional models used in past work, we observe good agreement with the low-frequency behavior in our experiments, but we also observe large high-frequency fluctuations in the acceleration which are inherently granular, and not captured by these models. The large fluctuations are well correlated to the emission of localized intermittent stress pulses, seen in the photoelastic response.

[1]This work is supported by DTRA, grant HDTRA1-10-0021

Abe Clark
Duke University

Date submitted: 06 Dec 2011 Electronic form version 1.4