QPhysics AT QUEENS COLLEGE

Colloquium Notice

Douglas Durian

University of Pennsylvania

Granular impact cratering

Experiments on the low-speed impact of solid objects into granular media have been used both to mimic geophysical events and to probe the unusual nature of the granular state of matter. Observations have been interpreted in terms of conflicting stopping forces: product of powers of projectile depth and speed; linear in speed; constant, proportional to the initial impact speed; and proportional to depth. This is reminiscent of high-speed ballistics impact in the 19th and 20th centuries, when a plethora of empirical rules were proposed. To make progress, we developed a means to measure projectile dynamics with 100 nm and 20 μ s precision. For a 1-inch diameter steel sphere dropped from a wide range of heights into non-cohesive glass beads, we reproduce prior observations either as reasonable approximations or as limiting behaviors. Furthermore, we demonstrate that the interaction between projectile and medium can be decomposed into the sum of velocity-dependent inertial drag plus depth-dependent friction. Thus we achieve a unified description of low-speed impact phenomena and show that the complex response of granular materials to impact, while fundamentally different from that of liquids and solids, can be simply understood. This work was done in collaboration with Dr. Hiroaki Katsuragi.

Monday
October 27, 2008
Starts at 12:15 PM
Coffee at 12:00 PM
Physics Conference Room, SB B326