PHYSICAL MATHEMATICS SEMINAR

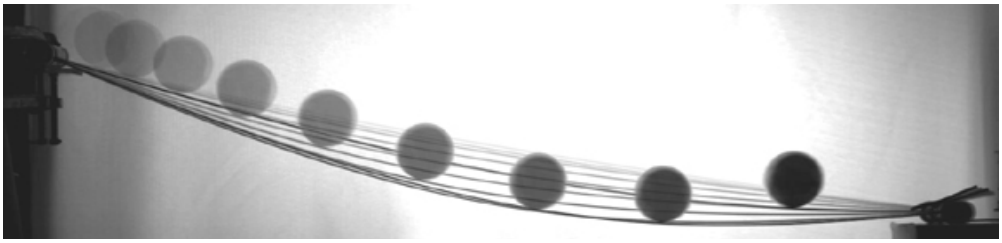
On Falling Spheres: Impact with a Water Surface, and Descent Along a Flexible Beam

JEFFREY ARISTOFF
Massachusetts Institute of Technology

ABSTRACT:

This talk has two parts. In the first part, we consider the vertical impact of hydrophobic spheres on a water surface. Particular attention is given to characterizing the shape of the resulting air cavity in the limit where cavity collapse is driven principally by surface tension rather than gravity. A theoretical description is developed to describe the evolution of the cavity shape and yields simple expressions for the pinch-off time and location. Theoretical predictions compare favorably with our experimental observations, and also yield new insight into the regimes considered by previous investigators.

In the second part, we consider the motion of a sphere on an inclined flexible beam. A theoretical model is developed to describe the dynamics, and in the limit where the beam reacts instantaneously to the loading, we obtain exact solutions for the load trajectory and descent time. Theoretical predictions compare favorably with our experimental observations in this quasi-static regime. The time taken for descent along an elastic beam, the elastochrone, is compared to the classical brachistochrone, the shortest time between two points in a gravitational field.



TUESDAY, DECEMBER 2, 2008
2:30 PM
Building 2, Room 105

Refreshments at 3:30 PM in Building 2, Room 349
(Applied Math Common Room)

Massachusetts Institute of Technology

Department of Mathematics
Cambridge, MA 02139