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Dynamics of drag force for projectile impact in granular media[1]
LAUREN BEHRINGER, CACEY STEVENS BESTER, ROBERT BEHRINGER, Department of physics, Duke University — We study the way in which momentum is dissipated as a free-falling projectile impacts a dense granular target. An empirical force law has been widely accepted to describe this process, defining the stopping force as the sum of depth-dependent static force and velocity-dependent inertial drag. However, a complete understanding of the stopping force, incorporating grain-scale interactions during impact, remains unresolved. Using direct force measurements by way of a photoelastic imaging technique, we explore the complex fluctuating behavior of the forces acting on the projectile decelerating through a granular medium. Our results are used to study the static drag as the projectile comes to rest, as well as its connection to the effect of the container boundary of the granular target. We additionally vary the shape of the impeding object to infer intruder-grain interactions from force measurements.

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