Abstract Submitted
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Gas-Mediated Impact Dynamics in Fine-Grained Granular Materials[1] JOHN ROYER, ERIC I. CORWIN, BRYAN CONYERS, MARK L. RIVERS, PETER J. ENG, HEINRICH M. JAEGER, James Franck Institute, University of Chicago — Non-cohesive granular media exhibit complex responses to sudden impact that often differ from those of ordinary solids and liquids. We investigate how this response is mediated by the presence of interstitial gas between the grains. Using high-speed x-ray radiography we simultaneously track the motion of a steel sphere through the interior of a bed of fine-grained granular material and measure local changes in the bed packing density below the sphere. In an initially loosely packed bed, interstitial gas allows for nearly incompressible, fluid-like flow of the bed and aids the penetration of the sphere. In an initially densely packed bed the interstitial gas plays the opposite role, strengthening the bed and inhibiting the penetration of the sphere. These two seemingly incongruous effects are both due to the low permeability of the fine grained-bed, which traps the interstitial gas in the bed. This trapped gas resists changes in the bed packing density, inhibiting compaction in the loose bed and inhibiting dilation in the dense bed.

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