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Possibility of perfect fluid flow from granular jet impact JAKE ELLOWITZ, NICHOLAS GUTTENBERG, HERVE TURLIER, WENDY W. ZHANG, SIDNEY R. NAGEL, University of Chicago — Axisymmetric collision of a cylindrical water jet with a circular target generates a thin conical sheet, also known as a water bell [1]. Intriguingly, recent experiments on granular jet impact in the regime of dense inertial flow reveal similar behavior: the angles by which the collimated sheets of particles are ejected from the target [2] agree closely with the angles measured in the water-bell experiments. This quantitative correspondence suggests that the collective granular motion during impact can be modeled as an incompressible, continuum fluid. Since viscous effects are weak in water-jet impact and the granular jet is comprised of non-cohesive particles (hence possessing zero surface tension), the simplest scenario is that the continuum motion corresponds to the flow of a perfect fluid. We assess this possibility by comparing exact solutions of 2D Euler-jet impact with 2D discrete-particle simulations of granular impact. We also construct approximate solutions for axisymmetric Euler-jet impact and compare these with granular-impact experiments.
[1] Cheng et al. Phys. Rev. Lett. 99, 2007.
[2] Clanet, C. J. Fluid Mech. 430, 2001.

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