Using experimental physics to explore sediment transport

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Summer 2019 research advertisement
Certain materials defy categories as solid or fluid.
granular materials
large collection of solid grains; Dissipative, athermal, exist in phases

Pharmaceuticals
Coffee beans
Logs
Coal
M&M candies

Phase transitions? Constitutive models?

Andreotti, Forterre, and Pouliquen Granular Media (2012)
Earth’s surface is composed of granular materials

- Boulders
- Soil
- Landslide with long runout
- Mudslide near Minneapolis, MN
- Soil creep
- Plumes at Mississippi delta

Slow Creep (~10^-8 m/s) ↔ Debris flows and avalanches (10 m/s)

Goal: describe geophysical flows w/ granular physics
Sediment: an experimental physicist’s perspective

**Project Idea I**

*Universal signatures of creep*

Experiment: simplification of a river channel

**Data Analysis:**
Analyze grain-scale displacement to assess topological rearrangements and dynamical heterogeneities

**Project Idea II**

*Signal transmissibility of Marginal granular systems*

**Experiment design and construction:** 2D apparatus to measure grain displacements and internal stresses while remotely controlling individual constituents
Questions? Contact: bester@sas.upenn.edu

Experimental physics of fluid and granular systems with motivations in geomorphology

Experimental design and construction

Imaging methods of soft matter physics

Computational analysis

Interdisciplinary research