Experimental physics research with Cacey Bester

Experiments with grains: a far-from-equilibrium system
What are granular materials?

- Stones on a mountain
- Coal
- Flowing corn
- Sand dune
- Sand in hourglass
- Logs
- M&M candies
Describing systems of grains

Sand departs from standard thermal physics:
1. Grains are large ➔ thermal fluctuations negligible \((k_B T << mgd)\)
2. Grains contact, lose energy
3. Grains can be rigid like a solid or flow like a fluid

Ripples in sand dune in CA
Visualizing granular response

Use birefringent material to show response of grains to applied stress.

Diagram:
- Compression and decompression
- Shear
- Light source
- Polarizers
- Granular packing
- Camera
Visualizing granular response

Forces
Polarized light + photoelastic grains

Arrangement
White light
Data Analysis: determining rearrangements in a marginal granular system

Electronics and coding: automating data acquisition and image analysis

Project I

Signatures of creep

Project II

Grains under confinement

Experiment construction: displacements and stresses of grains among “pins”

With Prof. Amy Graves

Project III

Deformations of sheared granular material

Research at the University of Pennsylvania
Interested? Questions? cbester1@swarthmore.edu

- Experimental physics of granular systems
- Experimental design and construction
- Imaging methods of granular physics
- Interdisciplinary research

Research opportunities
Summer 2020 – 10 weeks
Positions also available Spring 2020