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Modeling meteorite crater by impacting melted tin on sand

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By impacting a granular bed by steel balls and liquid drops, previous researchers focused mainly on the morphology of impact craters. [1-2] To
mimic the heated exterior of a meteorite, we adopt the melted tin. A high-speed camera allows us to follow step by step the fiery interaction between melted
tin and sand, as manifested in PIV and CNN, and monitor their deformation. Kinetic energy, temperature and diameter of the projectile are used to build
phase diagrams for the morphology of both players. We are able to reproduce simple and complex craters based on the morphology. By employing the
feature detection with deep learning, we can further verify that the mechanism for generating a central peak in our pearl crater is indeed similar to that in
complex craters. How the width and depth of crater are correlated and separately vary with kinetic energy are shown to change with the granular size. For
our finest sand, the pearl and cookie craters share the same relationship for a simple crater, while the snowflake crater behaves more like a complex one.
Geological compilations of crater data are clearly mixed with different meteorite energy and temperature. Thus, our work is not confined to reproducing
real observations, but has the potential of debunking artifacts.

1 F. Pacheco-Va´zquez et al., Impact Craters in Granular Media: Grains against Grains, PRL 107, 218001 (2011).
[2] Runchen Zhao et al., Granular impact cratering by liquid drops: Understanding raindrop imprints through an
analogy to asteroid strikes, PNAS 112, 342 (2014).

Poster link

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