Abstract Submitted
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Granular Crater Formation[1] ABE CLARK, ROBERT BEHRINGER, Duke University, JOHN BRANDENBURG, ORBITEC — This project characterizes crater formation in a granular material by a jet of gas impinging on a granular material, such as a retro-rocket landing on the moon. We have constructed a 2D model of a planetary surface, which consists of a thin, clear box partially filled with granular materials (sand, lunar and Mars simulants...). A metal pipe connected to a tank of nitrogen gas via a solenoid valve is inserted into the top of the box to model the rocket. The results are recorded using high-speed video. We process these images and videos in order to test existing models and develop new ones for describing crater formation. A similar set-up has been used by Metzger et al.[2] We find that the long-time shape of the crater is consistent with a predicted catenary shape (Brandenburg). The depth and width of the crater both evolve logarithmically in time, suggesting an analogy to a description in terms of an activated process: $dD/dt = A\exp(-aD)$ (D is the crater depth, a and A constants). This model provides a useful context to understand the role of the jet speed, as characterized by the pressure used to drive the flow. The box width also plays an important role in setting the width of the crater.

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[2]P. T. Metzger et al. Journal of Aerospace Engineering (2009)

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