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Granular impact cratering by liquid drops: Understanding raindrop imprints through an analogy to asteroid strikes XIANG CHENG, RUNCHEN ZHAO, QIANYUN ZHANG, HENDRO TJUGITO, University of Minnesota — When a granular material is impacted by a sphere, its surface deforms like a liquid yet it preserves a circular crater like a solid. Although the mechanism of granular impact cratering by solid spheres is well explored, our knowledge on granular impact cratering by liquid drops is still very limited. Here, by combining high-speed photography with high-precision laser profilometry, we investigate liquid-drop impact dynamics on granular surface and monitor the morphology of resulting impact craters. Surprisingly, we find that, despite the enormous energy and length difference, granular impact cratering by liquid drops follows the same energy scaling and reproduces the same crater morphology as that of asteroid impact craters. Inspired by this similarity, we integrate the physical insight from planetary sciences, the liquid marble model from fluid mechanics and the concept of jamming transition from granular physics into a simple theoretical framework that quantitatively describes all the main features of liquid-drop imprints in granular media. Our study sheds light on the mechanisms governing raindrop impacts on granular surfaces and reveals a remarkable analogy between familiar phenomena of raining and catastrophic asteroid strikes.

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