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Impact cratering on granular beds: from the impact of raindrops to the strike of hailstones[1] LEONARDO GORDILLO, JUNPING WANG, FRED JAPARDI, WARREN TEDDY, XIANG CHENG, Univ of Minnesota - Twin Cities — The craters generated by the impact of a spherical object onto a granular bed strongly depend on the material properties of impactors. As an example, impact cratering by liquid drops and by solid spheres exhibit qualitatively different power-law scalings for the size of resulting impact craters. While the basic energy conservation and dimensional analysis provide simple guiding rules, the detailed dynamics governing the relation between these power-law scalings are still far from clear. To analyze the transition between liquid-drop and solid-sphere impact cratering, we investigate impact cratering by liquid drops in a wide range of impact energies, viscosities, surface tensions and drop sizes. Using high-speed photography and laser profilometry to survey more than 8000 laboratory-controlled impact cratering events, we fully delineate the solid-to-liquid transition and unveil a rich set of regimes with different scaling laws and crater morphologies. Our research provides a unified framework for understanding the scaling relations in granular impact crateringa phenomenon ubiquitous in nature ranging from daily-life raindrop and hailstone impacts on sandy surfaces to catastrophic asteroids strikes on planetary bodies.

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