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Self-similar dynamics of inertia-driven drop impacts[1] XIANG CHENG, University of Minnesota, LEONARDO GORDILLO, Universidad de Santiago de Chile — We investigate the dynamics of inertia-driven drop impacts on solid surfaces. By synchronizing high-speed imaging with fast force measurements, we simultaneously measure the shape and impact force of impacting drops and demonstrate the existence of self-similar inertial fronts during the initial impact of liquid drops at short times. With the propagation speed six times faster than the impact speed of liquid drops, the inertial front gives rise to a maximal impact force that is important for living organisms and soil and architectural surfaces exposed to the elements. Moreover, we find an exact closed-form self-similar solution for the inertia-driven drop spreading following the initial impact, which quantitatively predicts the shape of spreading drops. Our study reveals hidden self-similarity and illustrates its importance in determining the dynamics of drop impact processes.

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