Impact Force and Pressure Distribution of Drop Impacts

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Drop impacts are ubiquitous and relevant to many important natural processes and technical applications including ink-jet printing and spraying coating. Although the kinetics of drop impacts have been extensively studied via high-speed photography, the dynamics of drop impacts is still far from fully understood. Particularly, the temporal variation of impact forces during impact has not been systematically investigated in experiments. Here, by synchronizing high-speed imaging with fast force sensing, we investigate the detailed temporal evolution of drop-impact forces over a wide range of Reynolds numbers. Our experiments on the rise of impact forces at early times demonstrate the existence of self-similar structures during the initial impact of liquid drops. Moreover, we also explore the pressure distribution of drop impacts. By tracking the movements of fluorescent particles embedded in elastic gels, we measure the temporal evolution of the pressure distribution induced by drop impacts on the gels. Our study reveals the temporal evolution of impact forces and provides a powerful method to map the pressure distribution underneath impacting drops.