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Pressure and Shear Stress Distribution of Drop Impacts TING-PI SUN, XIANG CHENG, University of MInnesota — Drop impacts are ubiquitous and relevant to many important natural and industrial processes. Although the kinematics of drop impact have been extensively studied experimentally due to the fast advance of high-speed photography techniques, the dynamic aspects of drop impacts remains largely unexplored. We investigate the pressure and shear stress distributions of drop impacts via a newly-developed technique, high-speed stress microscopy. By combining laser-sheet illumination, high-speed photography, and traction force microscopy, we track the fast movements of fluorescent particles embedded in elastic gels under the impact of liquid drops. The measurements enable us to obtain strain fields of the elastic gels induced by the impact. The temporal evolution of impact pressures and shear stresses of liquid drops can then be extracted based on the strain-stress relation of continuum mechanics. Our study on the pressure distribution confirms the key prediction of the self-similar theory and simulations, where the maximum impact pressure occurs near the contact line, rather than the center of impacting drops. The temporal evolution of the drag force can be deduced by integration of the shear stress. The information is crucial for mitigating impact-induced damages on solid substrates.

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