THE CHINESE UNIVERSITY OF HONG KONG

Department of Physics

SEMINAR

Unveiling the Secrets of Drop Impact

by

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Time: 2:00 - 3:00 p.m.
Place: Rm G25, Science Centre North Block, CUHK

ALL INTERESTED ARE WELCOME
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Abstract

From raindrops battering a windshield to coffee droplets splashing onto a table, everyday drop impact often belies the extreme mechanics underlying this ubiquitous fluid process. Drop impact plays a key role in a wide range of natural and agricultural processes, from soil erosion to drip irrigation, and is central to many industrial applications, including coating, printing, and advanced additive manufacturing. While most prior studies have focused on Newtonian fluids, the impact dynamics of non-Newtonian drops—widely used in industry—remain incompletely understood. By combining simulations, experiments, and scaling analysis, we establish a general framework for predicting the maximum spreading of impacting non-Newtonian drops, encompassing both shear-thinning and shear-thickening behaviors. These results advance the fundamental understanding of drop impact and provide practical guidelines for optimizing impact-driven processes through tailored fluid properties.

Beyond kinematics, my laboratory has developed a new method, high-speed stress microscopy, that directly measures the pressure and shear stress distributions beneath impacting drops, a key dynamic quantity governing drop-impact-induced erosion. Leveraging this approach, our experiments reveal the rapid propagation of self-similar, off-center pressure maxima beneath impacting drops, which produces shock-like responses on the impacted surface that substantially enhance impact damage. This work enables quantitative measurements of impact stresses and sheds new light on the origin of pervasive drop-impact erosion.

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