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Shock wave-induced drop fragmentation upon raindrop impact on biological surfaces SEUNGHO KIM, BRIAN WU, JASON J. DOMBROSKIE, SUNGHWAN JUNG, Cornell University — Rainfall on biological superhydrophobic surface (e.g. bird feathers, insect wings, plant leaves, etc) is ubiquitous in nature. Previous studies in the laboratory have focused on low-speed impacting drops (less than 1 m/s) only, which is far from the speed of real raindrops (more than 5 m/s). In this present work, we explore raindrop impact at high speeds, which exhibits unexpected drop dynamics: numerous shock-like waves are generated on a spreading drop in the presence of microscopic textures on biological surfaces. Then, the spreading drop with shock-like waves is fragmented soon after it approaches a maximal spreading extent, thereby reducing the residence/contact time more than twofold. Since it is known that the heat and momentum transfer of an impacting drop onto the substrate can be reduced by decreasing the contact time of impacting drop, our findings may help to understand how endothermic animals lower hypothermia risks, and how insects stabilize their flight position during rainfalls. Here, we visualize such salient high-speed drop dynamics using a high-speed camera, and validate the distinctive features through experiments and theoretical models.

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