Impact of compound drops: Bouncing or Sticky?

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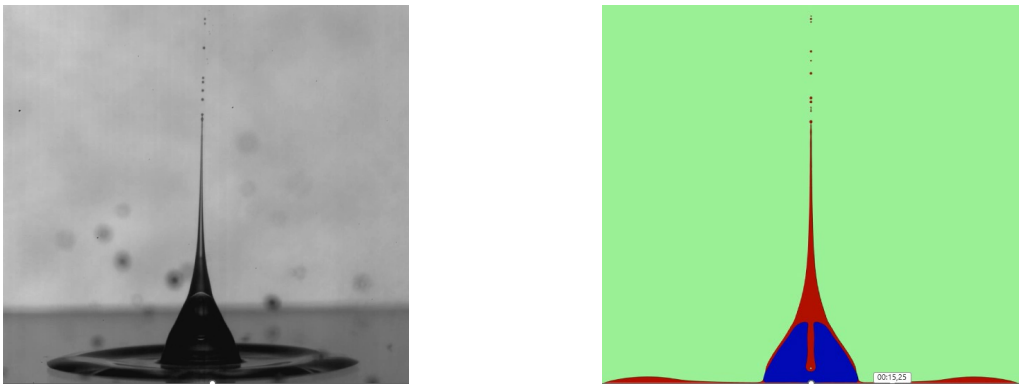
Context: The impact of a drop onto a solid or liquid surface has a wide range of applications including combustion, 3D printing, biological microarrays, pharmaceutics and the food industry. While most of them rely on single fluid drops, the emergence of new additive manufacturing techniques promises to revolutionize these industries by combining multiple fluids into compound drops. One of the critical challenges in these applications is to control the deposition process of the impacting drop and therefore its spreading, potential rebound and splashing.



Rebound of a water-in-oil compound drop onto a solid surface. Left: High-speed imaging experiment. Right: Numerical simulations with the open-source code Basilisk.

Goals: We propose in this project to control the rebound of the water core by varying the viscosity and thickness of the outer oil layer. We will combine high-speed imaging experiments with high resolution numerical simulations to investigate these complex dynamics, and uncover the physical processes involved in the deposition of compound drops.

Profile: Candidates should have a good training in Fluid Mechanics. The project can either be focused on experimental observations and/or numerical simulations depending on the applicant.

Environment: The project will take place at LadHyX in École Polytechnique, in the South of Paris.

References:

[1] Blanken, N., Saleem, M. S., Antonini, C., & Thoraval, M.-J. (2020). Rebound of self-lubricating compound drops. Science Advances, 6(11), eaay3499.
[2] Blanken, N., Saleem, M. S., Thoraval, M.-J., & Antonini, C. (2021). Impact of compound drops: A perspective. Current Opinion in Colloid & Interface Science, 51, 101389.