Drop impact on a pool of immiscible liquid

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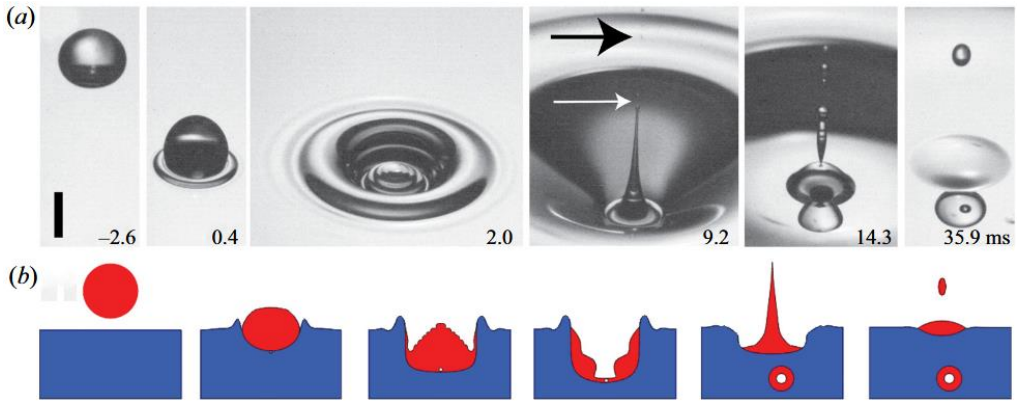
Context: The impact of a liquid drop onto a liquid surface is a commonly observed phenomenon in nature and throughout daily life, and is important for many industrial processes such as spray painting, inkjet printing and spreading of pesticides. It has been demonstrated recently that this process could be used for the mass production of particles with complex shapes and cell encapsulation [1]. The geometry of the resulting particles strongly depends on the impact dynamics and the deformation of the interfaces.



Perfluorohexane drop impacting onto a pool of water. (a) High-speed imaging experimental observation. (b) Sketch of the entrapment dynamics [2].

Goals: In this project, we propose to investigate the formation of complex encapsulations formed by the impact of a liquid drop on a pool of immiscible liquid. We will systematically study the impact of water drops on a pool of an immiscible liquid such as silicone oil. We will combine high-speed imaging experiments with high resolution numerical simulations (using the open-source code Basilisk) to investigate these complex dynamics, and uncover the physical processes involved.

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] An, D., Warning, A., Yancey, K. G., Chang, C.-T., Kern, V. R., Datta, A. K., Steen, P. H., Luo, D., & Ma, M. (2016). Mass production of shaped particles through vortex ring freezing. *Nature Communications*, 7, 12401.
[2] Yang, Z. Q., Tian, Y. S., & Thoroddsen, S. T. (2020). Multitude of dimple shapes can produce singular jets during the collapse of immiscible drop-impact craters. *Journal of Fluid Mechanics*, 904, A19.