

Sliding of oil-engulfed droplets

Description

The sight of rain droplets sticking to window panes is fairly ubiquitous. Upon closer inspection, one can see that sometimes the droplets stick, whereas on other occasions they slide. While sticky droplets may be fine on a window pane, they can be quite a nuisance on the windshield of a car or on the lenses of prescription glasses. One way to get rid of this droplets is to make the surface slippery by coating it with a thin layer of a transparent oil. This facilitates gravity-driven sliding of the water droplet. In such a situation, depending on the interfacial tensions, the oil may completely engulf the water droplet (as shown in Fig. 1). However, how this engulfment affects the sliding behavior of the water droplet is not yet fully understood. In this work, we will experimentally and/or numerically study the sliding behavior of water droplets engulfed by an oil layer.



Figure 1: Water droplet engulfed by an oil layer (adapted from [1]).

What you will do and what you will learn?

In the Physics of Fluids group, we are looking for enthusiastic students to join our newly established project on sliding of oil-engulfed droplets.

1. You will learn about wetting phenomena in 4-phase systems, precursor films, and viscous dissipation.
2. You will work with experimentalists and/or numericists.
3. You will get hands-on experience on experiments involving state-of-the-art high-speed imaging.
4. You will learn about the Computational Fluid Dynamics (CFD) fundamentals, and use the free software program Basilisk C (<http://basilisk.dalembert.upmc.fr>).
5. You will learn how to do basic and advanced scientific data analysis.

For any questions, please feel free to contact Udo (experiments) or Vatsal (numerics); details below:

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References

- [1] Y. Li, C. Diddens, T. Segers, H. Wijshoff, M. Versluis, and D. Lohse. Evaporating droplets on oil-wetted surfaces: suppression of the coffee-stain effect. *Proc. Natl. Acad. Sci. USA*, 117(29):16756–16763, 2020.