Chair: Physics of Fluids group

Air layer drainage under an impacting hydrogel droplet

Description

When a liquid droplet impacts on a solid substrate, the air layer between the droplet and the substrate is squeezed radially outward. For Newtonian liquids, this drainage phenomenon is well characterized through state-of-the-art experimental measurements and numerical computations (as shown in Fig. 1). However, there is still a lack of fundamental insight on the air drainage behavior when the liquid is non-Newtonian, e.g. a hydrogel. Hydrogels are an interesting class of non-Newtonian liquids that can serve as a model system for a variety of complex real-world scenarios, such as the inks in inkjet printing. In this work, we will numerically investigate how the air layer drains when a hydrogel droplets impacts on a solid substrate. The work is part of an academic-industrial collaboration, and provides the opportunity to study interesting, complex physics that can be directly applied to solve real-world problems. We will also work closely with experimentalist from University of Wageningen to characterize this process.

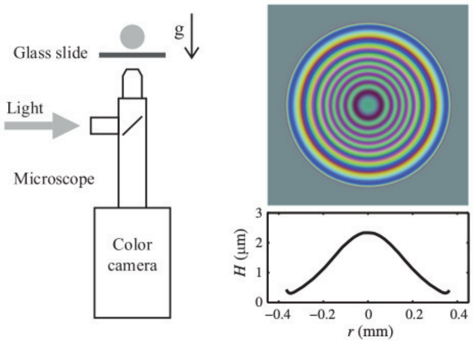

Figure 1: Air layer thickness under an impacting Newtonian droplet (adapted from [1]).

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 the air layer drainage under an impacting hydrogel droplet.

1. You will learn about non-Newtonian liquids, viscoplasticity, and lubrication flows.
2. You will work with experimentalists and our industrial collaborators at Canon Production Printing.
3. You will learn about the Computational Fluid Dynamics (CFD) fundamentals, and use the free software program Basilisk C (http://basilisk.dalembert.upmc.fr).
4. You will learn how to do basic and advanced scientific data analysis.

For any questions, please feel free to contact Vatsal; details below:

Supervision	E-mail	Tel.	Office
Vatsal Sanjay	contact@vatsalsanjay.com	053 489 1973	Meander 246B
Assis. Prof. Dr. Uddalok (Udo) Sen	uddalok.sen@wur.nl	External member	University of Wageningen
Prof. Dr. Detlef Lohse	d.lohse@utwente.nl	053 489 8076	Meander 261

References

[1] W. Bouwhuis, R. C. A. van der Veen, T. Tran, D. L. Keij, K. G. Winkels, I. R. Peters, D. van der Meer, C. Sun, J. H. Snoeijer, and D. Lohse. Maximal air bubble entrainment at liquid-drop impact. *Phys. Rev. Lett.*, 109:264501, 2012.