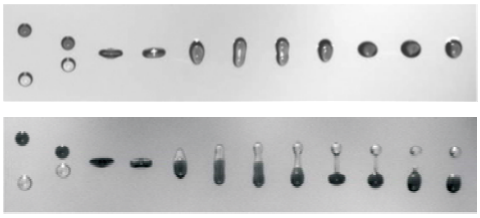
Institut für Strömungslehre und Wärmeübertragung

Diplomarbeit / Master Thesis

Binary drop collisions: wettability and miscibility

Drop impacts are very important to many industrial processes and technical fields. Such impacts may involve two or more drops (sprays), a drop and a liquid bath/liquid film/solid (printing, coating), a drop and a jet (injection). One single liquid or two different ones may be involved. These impacts may cause the deposition, coalescence or encapsulation of the drop; its bouncing; or the fragmentation of the liquid entities giving rise to more drops. To ensure the expected outcome is obtained (for example deposition versus splashing) it is crucial to understand the physics of such impacts.

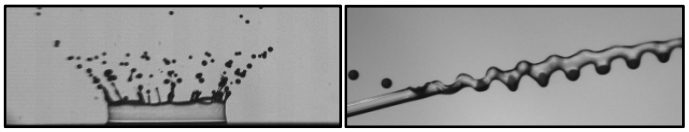
The proposed project focuses on the collisions of two drops made of two different liquids and which could be used to manufacture monodisperse capsules [1]. Thus, the objective of this study is double (i) extend the knowledge obtained using immiscible liquids with total wetting [1-2] to other liquids (miscible or not, totally or partially wetting) and (ii) confront the results obtained with drops to those collected for different geometries (drop-liquid film in collaboration with Stuttgart university [3]; drop-jet in an on-going project of the Institute [4]).



Immiscible binary drop collisions (drop diameter 200 µm), drops move from left to right, from [2]

[1] JFM 2012, Planchette et al.

[2] JFM 2017, Planchette et al.



Left: drop splashing on a thin liquid film (immiscible)

Right: drops colliding on a continuous immiscible liquid jet

[3] DROPIT 2018, Bernard et al, collaboration with Stuttgart

[4] PRF 2018, Planchette et al.

Tasks

- Produce binary drop collisions with different liquid pairs (existing set-up in house)
- Characterize the liquids (density, surface and interfacial tension, viscosity)
- Analyze collision photographs to obtain the relative velocity, drop diameters and eccentricity
- Classify the outcomes in different regimes, build regime maps and propose a physical analysis of the transition between different regimes
- Write the corresponding scientific documentation.

We offer

- A scientific supervision of high quality
- An international and dynamic work atmosphere
- Access to all the required facilities of the Institute

The master project will be accomplished at the Institute of Fluid Mechanics and Heat Transfer (Institut für Strömungslehre und Wärmeübertragung). The project can start any time. If interested, please contact Dr. Carole Planchette, Tel. 0316 873-7357, Email carole.planchette@tugraz.at