

INTERNSHIP PROPOSAL

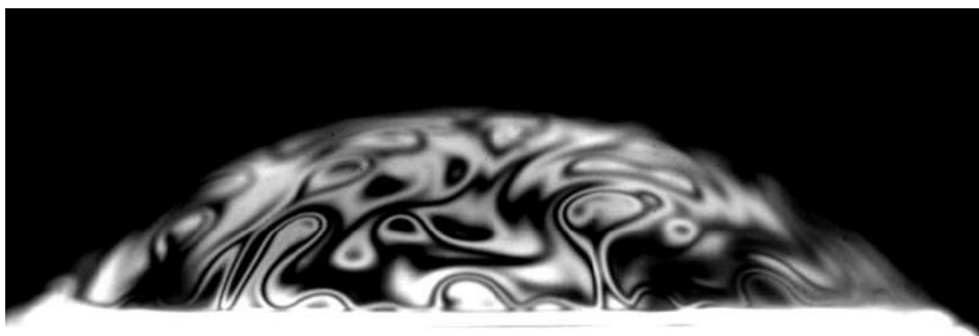
(One page maximum)

Laboratory name: Surface du Verre et Interfaces
CNRS identification code: UMR 125
Internship director's surname: Laurence TALINI and Martin COUX
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Internship location: Saint-Gobain Recherche Paris, 41 quai Lucien Lefranc, 93300 Aubervilliers
Thesis possibility after internship: YES
Funding: YES If YES, which type of funding: ANR

Drainage of bubbles in liquid mixtures

The coalescence of two bubbles or of a bubble with a free surface is a complex process that has only been described quantitatively in the case of pure liquids. In the presence of surfactants, the coupling between the flow induced by drainage in thin films and variations in surfactant concentration remains unclear due to the complexity of the effects involved. As a result, it is not possible to predict the lifetime of a bubble in these liquids. However, we have recently shown that the coupling between velocity and concentration fields can be described quantitatively in mixtures of miscible liquids that exhibit surface rheology even in the absence of surfactants [1]. In these mixtures, surface elasticity is controlled by composition and can be varied simply and over several orders of magnitude [2]. These systems open up a new avenue for understanding coalescence phenomena. The aim of the internship is to study the drainage of bubbles formed on the surface of liquid mixtures. The Bond number, which quantifies the relative effects of gravity and capillarity, will be varied. Optical techniques will be used to measure the thickness of the liquid film forming the bubble over time, in particular to characterise the behaviour of marginal regenerations, which are areas of low thickness that form spontaneously and are observed on surface bubbles (photo). The contribution of marginal regenerations to bubble drainage will also be quantified.

The internship is offered as part of the ANR Coliflow project, a collaboration between the SVI, PMMH and SIMM (ESPCI) laboratories and the IPR (Rennes 1). The subject may be pursued in a PhD thesis with ANR funding.



View of the marginal regenerations on a bubble (radius 5mm). From [3].

References

- [1] *Modelling pinching dynamics in thin films of binary mixtures*. A. Choudhury et al. J. Fluid Mech. **1007** A39 (2025).
[2] *Understanding Frothing of Liquid Mixtures: A Surfactantlike Effect at the Origin of Enhanced Liquid Film Lifetimes*. H.P. Tran, et al. Phys. Rev. Lett. **125**, 178002 (2020). [3] *Bursting bubble aerosols*. Lhuissier, H. and E. Villermaux, J. Fluid Mech. **696**, 5 (2012).

Please, indicate which speciality(ies) seem(s) to be more adapted to the subject:

Condensed Matter Physics: NO Soft Matter and Biological Physics: YES
Quantum Physics: NO Theoretical Physics: NO