Master 2: ***International Centre for Fundamental Physics***

INTERNSHIP PROPOSAL

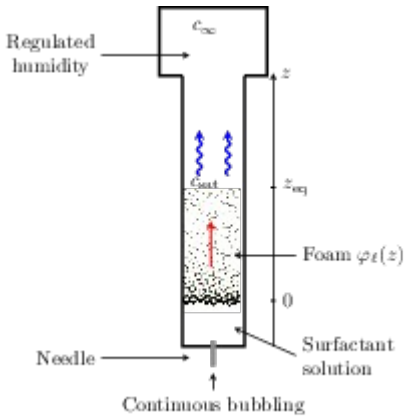
Laboratory name: Laboratoire de Physique des Solides
CNRS identification code: UMR 8502
Internship director'surname: BOULOGNE François and RIO Emmanuelle
e-mail: firstname.surname@universite-paris-saclay.fr Phone number: 01 69 15 53 64
Web page: https://equipes2.lps.u-psud.fr/mmoi/
Internship location: LPS, Université Paris-Saclay, 1 Rue Nicolas Appert, 91405 Orsay

Thesis possibility after internship: YES
Funding: NO If YES, which type of funding:

Evaporation of a liquid foam

Made of liquid and gas, liquid foams are complex fluids whose structural, rheophysical and physicochemical properties derive from the diversity of length scales involved, from surfactant molecules to bubble assemblies. They are present in our daily lives, particularly in detergents and cosmetics. Stability control is crucial in these applications, but the mechanisms driving stability are not yet fully understood. Among the factors influencing lifetime, evaporation is an essential phenomenon. Firstly, it induces thinning of the films, increasing their fragility. Secondly, the enthalpy of vaporization cools the film by several degrees Celsius [1,2]. This temperature drop probably has implications for stability that have yet to be determined. Furthermore, the physical-chemistry influences stability under the evaporation regime [3], whereas it has no effect in the absence of evaporation, demonstrating the existence of complex mechanisms associated with evaporation.

We propose to explore these questions by first determining the relationship between the destruction of soap films on the surface of a foam and the rate of evaporation. To this end, we will work on a controlled experiment in which a stationary state is obtained by continuously generating foam that reaches an equilibrium height.
The approach will involve a combination of image analysis, electrical conductivity measurements of the foam's liquid fraction, and temperature measurements.



The aim of this internship, which may be continued as a PhD thesis, is to address the following questions:
- How does evaporation modify the liquid fraction in foam?
- What criterion can be used to describe the rupture of films forming the surface of a foam?
- Does physical chemistry play a role in this criterion?

[1] Boulogne, Restagno, Rio. Phys. Rev. Lett., 2022. arxiv:2212.07104, doi:10.1103/PhysRevLett.129.268001.
[2] Boulogne, Rio, Restagno. Langmuir, 2023. arxiv:2309.10362, doi:10.1021/acs.langmuir.3c01463.
[3] Pasquet, Boulogne, Saint-Anna, Restagno, Rio. Soft Matter, 2022. arxiv:2202.03231, doi:10.1039/D2SM00157H.

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