

Master Internship proposal

Effective surface tension in miscible fluid flows

- **Earliest starting date:** Any time
- **Laboratory:** Laboratoire de Physique des Solides (LPS), Orsay, France
- **Supervision:** Théo Lenavetier
- **Website:** MMOI team <https://equipes.lps.u-psud.fr/mmoi/>
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Project and context

When two miscible liquids meet, transient composition gradients across their boundary generate an effective interfacial tension. This gives rise to **complex interfacial flow dynamics governed by tightly coupled mass and momentum transport**: a fundamental problem with broad implications in microfluidics, active mixing, and soft matter physics.

In this project, the student will investigate these interfacial flows through a combination of precision experiments and physical modelling. You will design and prototype custom millifluidic channels (using **3D printing and microfabrication**, no prior knowledge about it required) and perform **micro-PIV measurements on a state-of-the-art inverted fluorescence microscope** to map local velocity fields at the interface. Depending on the candidates background, the experimental work can be complemented by analytical scaling laws and calculations or numerical simulations.

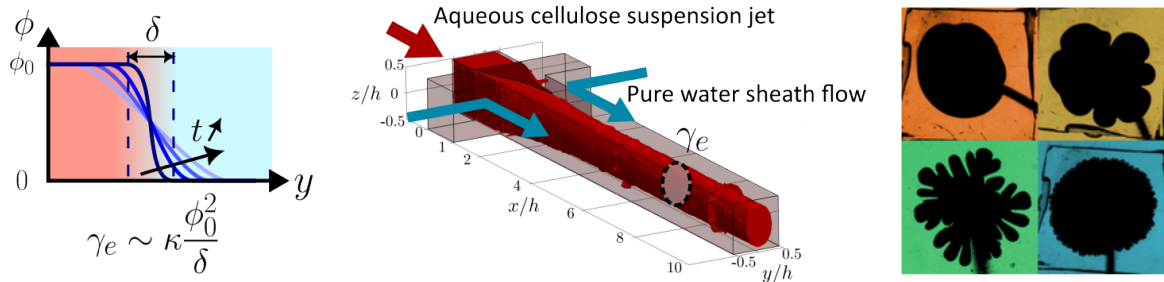


Figure 1: **Effective surface tension in miscible flows.** (Left) Composition gradient across a diffuse interface. Effective surface γ_e tension governs various interfacial phenomena: (Center) Jet shaping in colloidal core-sheath flows (Gowda et al., JFM 2019); (Right) Viscous fingering selection in Saffman-Taylor instabilities (Truzzolillo et al., PRX 2016).

Profile

We are looking for a 1st or 2nd year masters student seeking to complete a thesis or an internship in the fields of hydrodynamics, soft matter physics, or material engineering. A strong interest in experimental fluid dynamics is essential, as well as proficiency in programming (Matlab or Python).

Working Environment

The student will be working at the Laboratoire de Physique des Solides (LPS), in the Matière Molle aux Interfaces (MMOI) team. The Lab is located on the new campus of Université Paris-Saclay, 30 min away from Paris inner town by public transports.