Confinement effects in surfactant-driven Marangoni flows

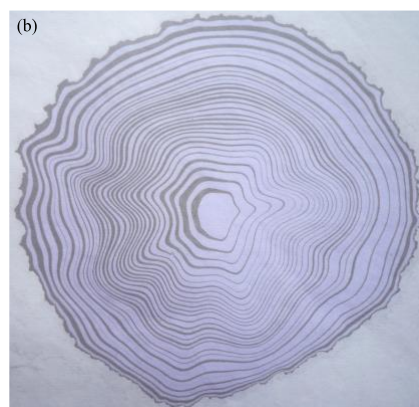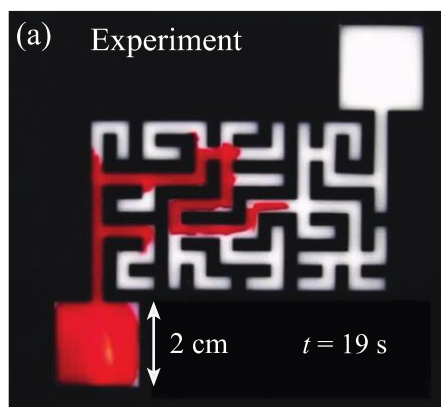**Porteur** : Julien LANDEL
Laboratoire : LMFA
Composante : Mécanique

Nature du financement demandé : Stage de M1 ou M2
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Description
Recently, we have observed that surfactants deposited on liquid films can cause complex flows in confined areas. Surfactants are molecules typically found in soaps, but also in other substances. They can alter the surface tension between two phases, such as a liquid phase (water) and a gas phase (air). When the concentration of surfactants at an air-water interface is non-uniform, this creates a Marangoni tension, which leads to the spreading of the surfactants to even out their concentration. In most liquids, there is a trace of endogenous surfactants at very low concentrations, due to natural contamination. These endogenous surfactants can interact with exogenous surfactants locally deposited on the interface and alter the Marangoni-driven spreading. This can lead, for example, to flows capable of solving a maze (see photo to the left and our [award winning video](#), [Temprano-Coleto et al. Phys. Rev. Fluids, 2018](#)), or it can be at the origin of the Japanese art of Suminagashi (right picture, also [Mcnair et al. J. Fluid Mech. 2024](#)). The aim of this project is to obtain experimental data to, ultimately (and beyond this project, which is part of a broader research framework), validate models describing the interactions between endogenous and exogenous surfactants in confined geometries.

Initially, experimental tests will be conducted to reproduce the art of Suminagashi in order to determine the key parameters. In the second phase, measurements of the spreading dynamics and the equilibrium reached over long times will be made, to compare the experimental data with existing models. The experimental study will use imaging techniques with dyes and tracers. The intern will also learn image analysis for the processing and interpretation of the results.