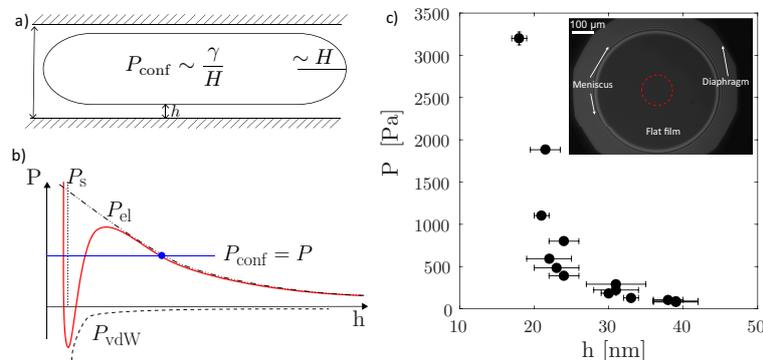


Post-doc position: Transition to droplet wetting

Foams, emulsions, pastes, porous media, biological suspensions or living tissues, are involved in many industrial processes (cosmetics, food, new materials, enhanced oil recovery, diagnostic tools) and are largely studied since several decades. The dynamical properties of these objects (droplets, bubbles, particles, cells) are controlled by the presence of highly confined fluid, under the form of thin liquid films ranging from hundreds of nanometers downwards the critical limit of the film rupture. The considerable developments of nanoscale fluid dynamics, allowing to probe fluid transport down to nanoscales, as well as the fine control of the physico-chemical properties of interfaces, has provided refreshed views on these questions. The ANR ILIAAD, coordinated by MC Jullien, aims at studying these systems, more precisely their stability and dynamics, in a concerted and concomitant manner for all the objects cited above. A preliminary question of this ANR was, *inter alia*, the possibility of predicting the speed of a drop when it is pushed by an imposed velocity of the external phase in a Hele-Shaw cell, as well as the stability of the wetting film at low velocity droplets, *i.e.* triggering the film rupture. Answering these questions requires knowing the shape of the lubricating film located between the drop and the solid wall, as well as the boundary conditions at the interface (the interface velocity). Recently, we have shown that RICM (Reflection Interface Contrast Microscopy) is a powerful tool allowing to build lubrication film topographies with a resolution up to 2 nm [1].

The stability and dynamics of this film is directly linked to the disjoining pressure P , given by the contribution of three interaction in classical DLVO theory: $P = P_s + P_{vdW} + P_{el}$, where P_s is the steric repulsion, P_{vdW} is the van der Waals interaction (attractive in this figure), and P_{el} is the electrostatic interaction (repulsive in this figure).

Figure c shows that we can build disjoining pressure isotherms (pressure – directly given by the Laplace pressure of the squeezed droplet - as a function of film thickness) in a stable situation using RICM [2]. The objective of the post-doc is to study the case for attractive (unstable) disjoining pressure, typically with an attractive electrostatic interaction. As such, when the liquid film becomes too thin, it collapses, leading to droplet wetting.



Different working liquids and surfactants will be characterized using the Laplace-pressure based disjoining pressure isotherm technique in order to screen different type of intermolecular interactions. Static experiments are required in order to get a calibrated situation previously to the addition of an external flow. Droplet dynamics will be thus studied in light of the physico-chemical properties of the systems. We have shown that in the case of stable films it is possible to predict the speed of the drop by measuring the lubrication film thickness [3]. We wish to continue these analyses in the case of unstable films. Typically, a classical configuration consists to trigger film rupture at decreasing velocity in light of recent numerical studies [4]. These studies are of major interest in a large number of applications.

Duration: 18 months

Starting: Preferably no later than may 2021

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