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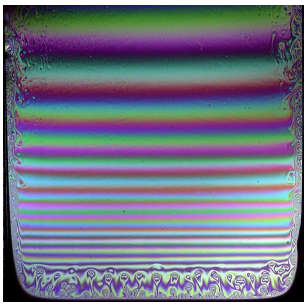
Bachelor or Master internship position

Experimental investigation of wave propagation in soap films

Internship location:
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Salary: ~ 650 €/months



Project description

An analogy can be drawn between the oceans or the atmosphere and vertical soap films [1]. Oceans and the atmosphere are density-stratified fluids, meaning that their density varies with altitude z. In a vertical soap film, gravity causes the micrometric liquid film to be thicker at the bottom than at the top, leading to a thickness also varying with z. This stratification explains the appearance of interference color fringes, with each color corresponding to an iso-thickness line, as shown in the figure. The system is stable: lighter fluid rises (thinner elements move upward) due to buoyancy (Archimedes' force). In principle, this property leads to characteristic behaviors when the system is perturbed: the propagation of density waves in stratified liquids, known as internal waves [2], and by analogy, the propagation of thickness waves in soap films [1]. While these waves are easily observed in experiments with stratified liquids, friction with the surrounding air dominates the low inertia of soap films, making the waves strongly damped and difficult to observe.

The main goal of this project is to detect and characterize internal waves in a vertical soap film by working under rarefied air conditions. To achieve this, the candidate will employ a new experimental system that allows control of the surrounding air density and viscosity, and will use it to observe and characterize the waves in this environment.

Profile

We are looking for bachelor or master students with a broad outlook and a strong interest in **soft matter physics,** and **experimental projects**. The candidate will work within the *Complex fluids* team and acquire several experimental skills (thin-film interferometry, image processing, data treatment) as well as general knowledge in fluid mechanics.

[1] Y. Couder, J.M. Chomaz, M. Rabaud, "On the hydrodynamics of soap films", https://doi.org/10.1016/0167-2789(89)90144-9, Physica D: Nonlinear Phenomena **37**, 384–405 (1989).
[2] C. Brouzet, "Internal wave attractors: from geometrical focusing to non-linear energy cascade and mixing.", Ph.D. thesis, Université de Lyon (ENS de Lyon) (2016). https://theses.hal.science/tel-01361201v1