MASTER 2 INTERNSHIP PROPOSAL

The dynamics of anisotropic floaters in surface waves

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While the propagation of a wave on the surface of a liquid is a classical problem in fluid mechanics, the presence of an intermediate body on the surface can considerably complicate the problem, and sometimes lead to surprising behaviors. Such an intermediate body can be cohesive floating objects (foam rafts, granular medium etc.) or a contamination of the liquid surface by a microscopic layer (surfactant, oil etc.)

In addition to an increase of the wave dissipation, such an intermediate phase can have a strong effect on the dynamics of the waves. Recent experiments [1,2] have shown, for example, that under certain conditions, the foam on the surface of a beer glass in circular translation can rotate in the opposite direction to that imposed on the glass.

The objective of this internship is to explore the dynamics of anisotropic floaters on the surface of a liquid subjected to a wave train. The nonlinear interaction between the wave and the floater leads to a torque which can modify its orientation, and consequently influence its drift velocity: it is then possible to "control" the floaters by modifying the wave properties. When several floaters are present, their capillary interaction (“Cheerios effect”) can lead to non-trivial collective dynamics.

This internship will include an experimental part and a numerical part. The student will develop a setup to track the position and angle of the floaters, and to measure the dynamics of the waves using Particle Image Velocimetry and Free-Surface Synthetic Schlieren [3]. Numerical simulations will be developed to model the wave-floater interaction and compare it with the experimental results.

This internship can be continued with a PhD thesis (application to Ecole Doctorale SMEMAG)

[1] Counter-rotation in an orbitally shaken glass of beer, F. Moisy, J. Bouvard, W. Herreman, EPL 122, 34002 (2018)
[2] Mean mass transport in an orbitally shaken cylindrical container, J. Bouvard, W. Herreman and F. Moisy, Phys. Rev. Fluids 2, 084801 (2017)
[3] A Synthetic Schlieren method for the measurement of the topography of a liquid interface, F. Moisy, M. Rabaud, K. Salsac, Exp. in Fluids 46 (6), 1021-1036 (2009).