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Active Adsorption of micro-algae at liquid-vapor interfaces using light

Microalgae are living organisms that play a key role in the environment and can also be used for the sequestration of CO2. At the physics department of ENS (LPENS, UMR 8023) we aim at understanding their collective motion as well as their motion close to an interface. We propose a L3 project in collaboration with Cécile Monteux at SIMM lab (ESPCI) aiming to study the adsorption of the micro-algae *Chlamydomonas reinhardtii* at liquid-vapor interfaces. When shining light from below such a suspension, the cells migrate towards the liquid-vapor interface (fleeing the light, negative phototaxis) and after some time start adsorbing at the interface. This can lead to the formation of giant (centimetric) raft of floating cells from capillary interactions, where fractures can be induced (Figure 1-left). We could show that cells adsorb at the interface with their flagella, leaving a giggling body immersed in the liquid below the trapped flagella (Figure 1-right). In this internship we would like to study the structural organization of the cells at the interface, and better understand the mechanism by which the flagella adsorb at the interface (playing for instance with surfactants in the medium).

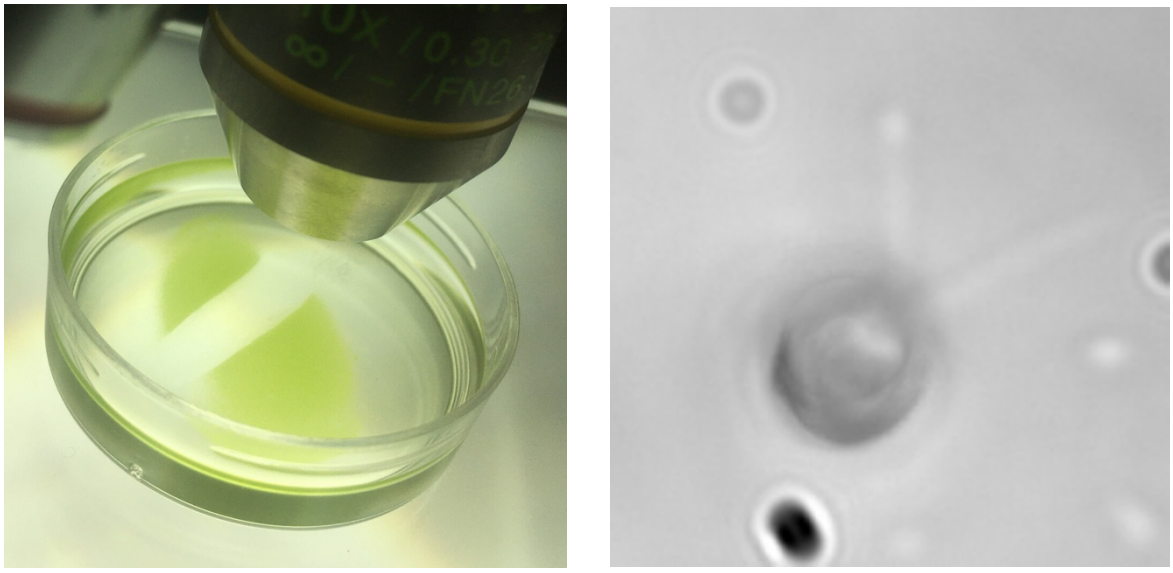

Figure 1. Left: Photograph of a centimetric raft after fracture induced by a small mechanical perturbation of the liquid interface. The raft is composed of millions of adsorbed unicellular micro-algae Chlamydomonas (the Petri dish has a diameter of 3.5cm). Right: Microscopy image of the adsorbed flagella of a single cell (a cell is about 10microns in size). This picture was taken by imposing an exposure time of about 600ms, where the giggling body appears blurry while the immobile (trapped) flagella appear sharp.

Condensed Matter Physics: NO	Soft Matter and Biological Physics: YES
Quantum Physics: NO	Theoretical Physics: NO