Laboratory name: Laboratoire de Physique de l'ENS (LPENS)
CNRS identification code: UMR8023
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Internship location: LPENS, 24 rue Lhomond, 75005 Paris
Thesis possibility after internship: YES Funding: YES

Single cell phototaxis in the model micro-alga *Chlamydomonas reinhardtii*

We propose a M2 research internship at the physics department of ENS (LPENS, UMR 8023) aiming to better characterize the mechanism by which the unicellular micro-alga *Chlamydomonas reinhardtii* performs phototaxis, which is the ability to navigate in light fields, a still poorly understood process. In particular we will aim to understand how the dynamic light signal arriving on the eyespot (the light detector of the cell, Fig. 1A) is interpreted by the cell to reorient in the correct direction thanks to the differential beating of its two flagella. This study will be based on microscopy techniques to visualize at the same time the eyespot of the cell and the body (Fig. 1B), and observe the trajectories of the cells in well-controlled light fields (static and dynamic). We will then correlate the body motion and reorientation to the inferred light signal on the eyespot and build a theoretical model to account for the experimental observations. An originality in this study will be the use of multiple light sources (Fig. 1C), as opposed to all physical studies on phototaxis so far that made use of a single light source. Mounting the full setup will be part of the internship.

In this research project, the intern will use optics, video-microscopy, image analysis, basic microalgal culturing techniques, microfluidic techniques and statistical analysis of the experimental data as well as apply theoretical concepts from Statistical Physics. The internship can lead to a funded PhD. During the PhD the student will have the opportunity to also work on collective behaviours induced by phototaxis in populations of these micro-algae.

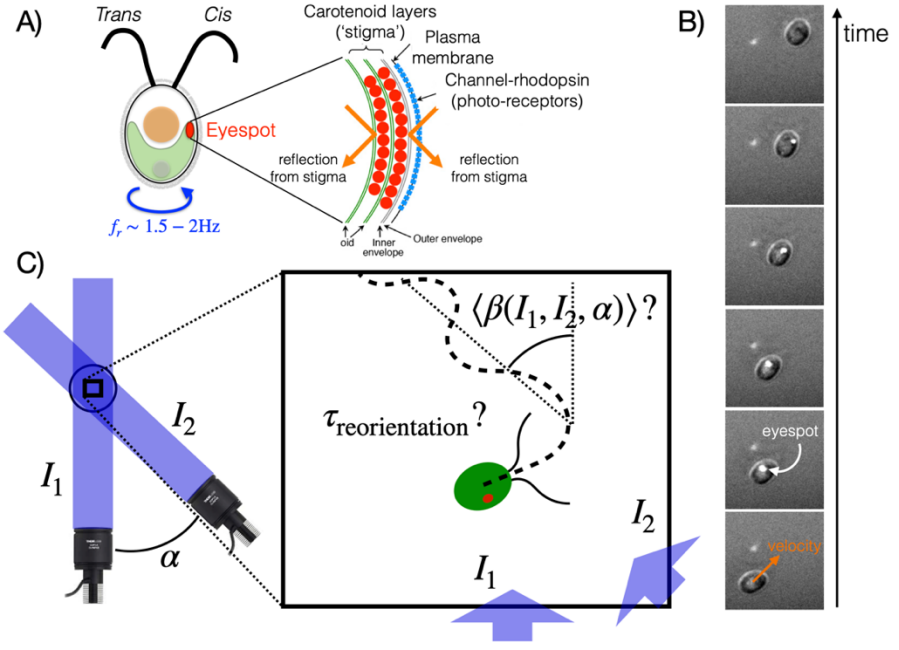

Fig.1. A) Schematics of a *Chlamydomonas reinhardtii* cell, which swims using its two front-mounted flagella and sense light with its eyespot. B) Image sequence showing the eyespot that spins as the cell swims forward, obtained in reflection microscopy. C) Schematics of the setup that will be used to quantify phototactic reorientation when cells are submitted to two identical light sources. We will aim to understand how the dynamic light signal arriving on the eyespot is used by the cells to reorient.

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