LadHyX Seminar – December 16, 11:00, Amphi Lagarrigue and Zoom

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Light-induced phase separation and pattern formation by phototactic micro-algae

Excess of light can be hazardous and lethal for photosynthetic organisms. When intensity is too high, the motile micro-algae Chlamydomonas reinhardtii therefore reorient itself to swim away from the incident light (negative phototaxis). We recently discovered that a collection of such migrating cells can be unstable, whereby small spatial fluctuations in cell density can trigger the local densification of the system and the formation of dynamic branching patterns, whose features depend on the global cell density, the intensity and wavelength of light and the concentration of extra-cellular calcium. Mutants with deficient eyespots (organelle for light detection) still perform negative phototaxis but do not exhibit branching patterns. This new kind of instability originates from the strong coupling between cell density and light fields through both negative phototaxis and light absorption/scattering by the individual cells. Here I will present our results on the quantitative characterization of the patterns and the minimal model we developed in order to qualitatively capture the basic physics of the problem. We believe our findings will help to better understand the phototactic reorientation mechanism of the algae and will provide a simple protocol to quantitatively assess phototactic abilities of micro-algae populations.