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Algal bioconvection in confined dispersed media

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Active particles are inherently out-of-equilibrium systems, able to uptake energy from their environment and convert it to motion.
For example, Chlamydomonas Reinhardtii (CR) is a micro-swimmer whose orientation can be dictated by a light gradient in its environment (phototaxis). It is known that a collective motion triggered due to the phototaxis of a population of CR generates a nonlinear phenomenon: bioconvective structures that affect the fluid medium [1].

The purpose of this experimental study is to control the motion of algae swarms and resulted bioconvective vortices in order to achieve a guided transportation of microscopic objects submerged in the algal suspension. High concentrations of algae and microparticles were confined in a small square Hele-Shaw cell surrounded by a series of LED, allowing us to apply different well-controlled gradients of light stimulus in a quasi-2D horizontal domain.
It was shown that the microparticles can be transported to a target zone by controlling the displacement of algal bioconvective structures.

[1] J. Dervaux, M. Capellazzi Resta, and P. Brunet, Nature Phys 13, 306–312 (2017).

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