3D surface scattering of a puller microalgae

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While many studies describe the motion of microswimmers far from boundaries [1], interactions with walls are less understood especially in the case of puller-type swimmers. Since these interactions are known to play an important role in confined media, it is necessary to have a 3D understanding of the behaviour of microswimmers at the surface.

Pusher-type swimmers such as bacteria have been shown to accumulate at surfaces while hydrodynamic interactions lead to their parallel reorientation to the walls and to a clockwise circular motion [2]. Previous studies ([3], [4]) have characterised the rebound of pullers in 2D : they have shown a preferential escaping angle regardless of the entering angle. However, in these experiments, the microswimmers were confined between walls in the third dimension, perpendicular to the observation plane.

In our case, two 3D tracking set-ups allow complete studies of all angles involved in the scattering of micro-swimmers on walls. The first one relies on a Lagrangian formalism [5] to track in real time single cell swimming in a vertically confined environment. The second one is a single camera stereoscopy technique using two mirrors [6] allowing a vertical Eulerian tracking in a square based capillary offering two dimensions of confinement. Thanks to the multiplicity of the studies we can compare the results and provide an analysis on the specularity of the rebounds observed in these types of media. In a larger extent, trajectories of micro-algae under Poiseuille flow have been performed granting us to look at the modification of laws ruling surface interactions under shear.

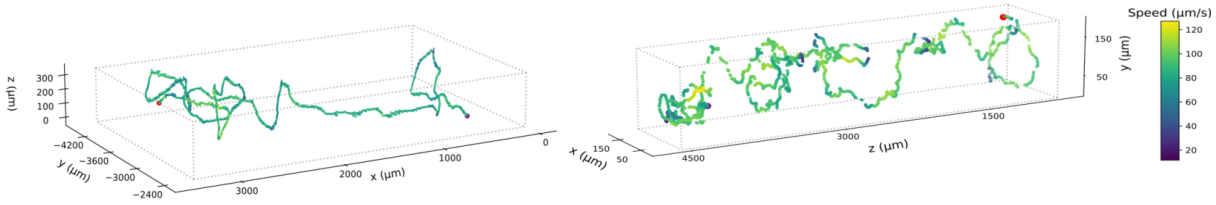

Figure 1. 3D trajectories of microalgae with a Lagrangian tracking (left) and the stereoscopy technic (right)

Références

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