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Rebound and scattering of motile Chlamydomonas al- gae in confined chambers[1] ALBANE THERY, Department of Applied Mathematics and Theoretical Physics, University of Cambridge, UK, CHRISTOPHE ELOY, IRPHE, Aix Marseille Universite, CNRS, France, FLORENCE ELIAS, Laboratoire Matiere et Systemes Complexes (MSC), Universite Paris-Diderot, France, ERIC LAUGA, DAMTP, University of Cambridge — Recent experiments showed that motile algae, as opposed to dead cells, get trapped in draining aquatic foams. Motivated by these observations, we study the swimming behaviour of Chlamydomonas reinhardtii (CR) cells confined in two-dimensional microscopic chambers imitating the cross-sectional shape of a single foam internal channel. We first carry out experiments to track swimming cells and deduce the probability density function of the cells in the chambers, as well as their scattering dynamics along walls. The analysis of the phase space of trapped and escaping trajectories inside a simple three-circles billiard with constant bouncing angle shows that the experimentally observed accumulation of swimmers in the corners has a geometric origin. We then develop a more detailed model based on experimental data to quantitatively reproduce the distribution of swimmers in the chamber. We determine that the trapping of CR is controlled by a combination of the shape of the concave chambers, the finite size of the CR cells, and the angle distribution of the cells bouncing off the walls. We finally observe that the cells are significantly slowed down in the vicinity of walls and show, using numerical simulations, that this effect is of purely hydrodynamic origin.

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