PhD /M2 internship:

Driven motion of swimmers in a complex environment

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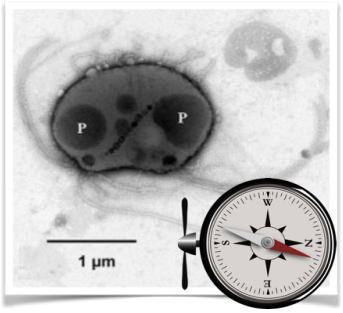
What: Thesis funding is available to work on the controlled movement of swimmers in a complex environment. While the spontaneous movement of bacteria and active particles has been widely studied recently, the movement of swimmers in the presence of additional external guidance is still a nascent topic. We plan in this PhD to exploit external fields to assist, guide, and optimize swimmer transport in a variety of media.



We will study the movement of swimmers whose direction can be externally controlled by a magnetic field. To do so, we will use either magnetotactic bacteria (MTB) which, remarkably, possess a magnet within their body and can thus be steered by a magnetic field, or active colloids with magnetic properties. Those systems can be seen as swimming compasses, whose organization also depends on the hydrodynamic or chemical fields, thus leading to very rich behaviors. We have shown for instance in the group that the conjunction of flow and the magnetic field can create coherent moving MTB swarms.

We aim at capitalizing further on those unique aptitudes of driven swimmers, to create fluids or suspensions that will express singular transport properties. We plan to explore these issues from a physical point of view, using both a theoretical and experimental approach. The candidate will experimentally study the movement of those swimmers under mechanical constraints - which could be either hydrodynamic or geometrical constraints – or chemical constraints and numerically investigate the optimal swimming strategy in a complex environment for driven systems.

Profile Ideally, the candidate would have a strong background in soft matter and/or statistical physics and a taste for both experimental and numerical approaches would be very much appreciated. The research will be conducted in the Liquids and Interfaces team of the ILM (CNRS, University Lyon 1). This thesis project has received funding from ANR BacMag “Harnessing field-assisted transport and rheology of a bacterial magnetofluid”. The student will benefit from interactions with the other partners of this ANR, at ESPCI (Eric Clément’s group) and CEA Cadarache (Damien Faivre’s group)

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