Spécialité de M2 : Concepts Fondamentaux de la Physique
Ecole Doctorale de Physique de la Région Parisienne (ED107)

PROPOSITION DE SUJET DE STAGE DE M2

Nom Laboratoire : Applied Math Lab, Department of Mechanical and Aerospace Engineering
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Lieu du stage: University of California, San Diego

Stage uniquement : OUI Thèse uniquement: NON
Stage pouvant déboucher sur une thèse : OUI
Financement proposé : NON si oui, type de financement :

Synchronization of flagella during cell locomotion

Résumé

Fluid mechanics plays a crucial role in many cellular processes. One example is the external fluid mechanics of motile cells such as bacteria (figure a, below), spermatozoa (figure b), and essentially half of the microorganisms on earth. The most commonly-studied organisms exploit the bending or rotation of a small number of flagella (short whip-like organelles, length scale from a few to tens of microns) to create fluid-based propulsion. As a difference, ciliated microorganisms (figure c) swim by exploiting the coordinated surface beating of many cilia (which are short flagella) distributed along their surface.

Experimentally it is observed that flagella between nearby swimming cells synchronize, which might (or might not) be due to hydrodynamic interactions. In this stage de M2, we propose to develop theoretical models for the fluid-based synchronization of flagella in fluids. We will address both eukaryotic cells (spermatozoa) where the flagella are actively deforming with planar flexible wavelike dynamics, and prokaryotic cells (bacteria) where the helical flagella are passively rotating in response to the driving by rotary motors. One of the interesting questions we will address is the role of stochastic forcing in the synchronization dynamics.

The ideal background for the stage de M2 is a student interested in biophysics, statistical physics, continuum mechanics, and fluid mechanics, with a taste for theoretical and physical modeling. Any question should be directed to elauga@ucsd.edu.

Indiquez le ou les parcours (ex DEA) qui vous semblent les plus adaptés au sujet :
Physique de la matière condensée : OUI Physique des Liquides OUI
Physique Quantique: OUI Physique Théorique OUI