IRAMIS : Institut Rayonnement Matlère de Saclay

Saclay

SPEC/SPHYNX

Matière active : descriptions cinétiques et hydrodynamiques de suspensions denses de micronageurs

Spécialité Physique statistique

Niveau d'étude Bac+5

Formation Master 2

Unité d'accueil SPEC/SPHYNX

Candidature avant le 03/04/2018

Durée 3 mois

Poursuite possible en thèse oui

Contact CHATE Hugues
+33 1 69 08 73 46
hugues.chate@cea.fr

Résumé

Nous avons récemment développé des simulations efficaces pour décrire le comportement collectif de particules simples (micro-nageurs) en suspension. Ces simulations sont susceptibles de générer des développements théoriques permettant une description continue, en termes cinétique ou hydrodynamique. Le sujet de stage, qui peut être poursuivi en doctorat, explorera les premières étapes de cette voie prometteuse. Le projet comprend également des collaborations directes avec des expérimentateurs travaillant sur des colonies bactériennes denses, à Hong Kong et Shanghai.

Sujet détaillé

The past ten years have seen the emergence of Active Matter – composed of particles that convert energy from an ambient source into systematic movement -- as a distinct topic in nonequilibrium statistical physics, motivated mainly by the need to understand and imitate individual and collective motility.
It is fair to say that a satisfactory understanding has been reached for the case of ‘dry’ active matter, i.e. for situations where the fluid surrounding particles can be neglected (e.g. when they crawl on a substrate). For suspensions of swimmers (wet active matter), much remains to be done, in particular in connecting individual-based models to continuous theories. Particularly challenging is the case of dense suspensions.
We have recently developed simple and numerically efficient particle-based models that are amenable to kinetic theory treatments leading to continuous descriptions, either at the kinetic or at the hydrodynamic level. The internship, with a possible extension as a PhD, will explore the first steps on this promising route.
The project will also include direct collaborations with experimentalists working on dense bacterial colonies, in Hong Kong and Shanghai.
Reference:
Chen, Chong and Liu, Song and Shi, Xia-qing and Chaté, Hugues and Wu, Yilin, Weak synchronization and large-scale collective oscillation in dense bacterial suspensions, Nature 542, 210 (2017).

Mots clés

Compétences

Logiciels

Active matter: kinetic and hydrodynamic descriptions of dense suspensions of microswimmers

Summary

We have recently developed simple and numerically efficient particle-based models of suspensions of microswimmers that are amenable to theoretical treatments leading to continuous descriptions, either at the kinetic or at the hydrodynamic level. The internship, with a possible extension as a PhD, will explore the first steps on this promising route. The project also includes direct collaborations with experimentalists working on dense bacterial colonies, in Hong Kong and Shanghai.

Full description

The past ten years have seen the emergence of Active Matter – composed of particles that convert energy from an ambient source into systematic movement -- as a distinct topic in nonequilibrium statistical physics, motivated mainly by the need to understand and imitate individual and collective motility.
It is fair to say that a satisfactory understanding has been reached for the case of ‘dry’ active matter, i.e. for situations where the fluid surrounding particles can be neglected (e.g. when they crawl on a substrate). For suspensions of swimmers (wet active matter), much remains to be done, in particular in connecting individual-based models to continuous theories. Particularly challenging is the case of dense suspensions.
We have recently developed simple and numerically efficient particle-based models that are amenable to kinetic theory treatments leading to continuous descriptions, either at the kinetic or at the hydrodynamic level. The internship, with a possible extension as a PhD, will explore the first steps on this promising route.
The project will also include direct collaborations with experimentalists working on dense bacterial colonies, in Hong Kong and Shanghai.
Reference:
Chen, Chong and Liu, Song and Shi, Xia-qing and Chaté, Hugues and Wu, Yilin, Weak synchronization and large-scale collective oscillation in dense bacterial suspensions, Nature 542, 210 (2017).

Keywords

Skills

Softwares