THE CHINESE UNIVERSITY OF HONG KONG

Department of Physics

SEMINAR

Mechanical Stress Fluctuations in *Myxococcus xanthus* Monolayers Revealed by Traction Force Microscopy

by

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Time: 10:00 - 11:00 a.m
Join ZOOM Meeting: https://bit.ly/3ukLze7

ALL INTERESTED ARE WELCOME
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Abstract

The soil-dwelling bacterium *Myxococcus xanthus* exhibits sophisticated multicellular cooperative behaviors while moving on solid surfaces. In a nutrient-poor environment, a population of *M. xanthus* transitions from a two-dimensional monolayer of cells to three-dimensional droplet-like aggregates which later develop into fruiting bodies that are key to their survival. From the perspective of physicists, we see familiar phenomena in such a system: macroscopically, the aggregation process shares many similarities with liquid-liquid phase separation [1]; microscopically, the rod-like cells form an active nematic material [2]. In addition to biological regulation, do the cells exploit physics to achieve their goals? If so, how? To fully understand these problems, force measurements on both the colony and cellular length scales are crucial. However, the experimental techniques to do so for bacteria are highly limited. In this talk, I will present our work on directly measuring the mechanical stress generated by a thin layer of *M. xanthus* cells using high-resolution traction force microscopy. Our focus is on the initial motion of cells into the third dimension, which occurs at special points in the monolayer where there is a topological defect in the cellular alignment field. In the experiments, we simultaneously mapped out the alignment and velocity fields of the cells, as well as the relevant spatial distribution of the mechanical forces they apply on a soft hydrogel substrate. This allows us to capture the average stress generated by the defects, and thus test existing theories of active nematics. Moreover, our measurements reveal previously unidentified strong stress fluctuations within the cell monolayer that drive the initial stage of fruiting body development.

[1] G. Liu, *et al.* Phys. Rev. Lett. 122(24), 248102 (2019).
[2] K. Copenhagen, *et al*. Nat. Phys. 17, 211–215 (2021).

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