

セミナーのお知らせ

開催日時：2026年6月8日（月）13時から14時20分

開催場所：理学部 E002 講義室

Collective motion and external control in active droplets

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Abstract

The collective motions of self-propelled particles, such as flocks of birds or schools of fish, are studied in physics within the domain of active matter. Using microfluidics, living and synthetic microparticles have become an ideal playground to study these systems.

In this talk, we present two experiments using bacterial suspensions to produce active droplets, with the objective of understanding how microscale bacterial activity can drive macroscopic droplet motion. In other words, how useful work can be extracted from confined suspensions. First, we show that confining *E. coli* in a water-in-oil emulsion produces bacterially propelled droplets performing a persistent random walk. Second, we show that magnetotactic bacteria confined in a similar emulsion self-assemble, under a constant magnetic field, into a rotary motor that generates a vortex motion reversible upon field inversion. Finally, we introduce a synthetic active droplet system based on liquid crystals capable of reproducing living features such as chemotaxis and light sensing. By incorporating photosensitive chiral dopants, we demonstrate that UV and visible light trigger dopant isomerization, altering the cholesteric droplet pattern and switching the swimming regime, opening new avenues for precise active matter manipulation.

Biography

Dr. Ramos was born in Viña del Mar, Chile, in 1989. He received an M.Sc. in Physics from the Catholic University of Valparaiso, Chile, in 2015, and his Ph.D. in Physics from the University of Chile in 2020, where his doctoral research focused on the dynamics of confined microswimmers inside droplets. Subsequently, he became a Postdoctoral Fellow at the Fluid Mechanics Institute of Toulouse (IMFT), France, where his research investigated the behavior of bacterial biofilms in porous media and their resistance to fluid flow. He then held a second postdoctoral position jointly supervised by the Laboratoire de Génie Chimique (LGC) and IMFT, during which his work centered on the influence of hydrodynamic flows on bacterial communication, specifically Quorum Sensing. In 2024, Dr. Ramos joined the Softmat Laboratory at the University of Toulouse, where his research focuses on the design and control of artificial microswimmers based on light-sensitive liquid crystal droplets, with the aim of elucidating the mechanisms of photoactive chiral dopants, light-responsive matter, and microscale transport strategies.

本セミナーは、令和8年度二国間交流事業(SAKURAプログラム)「効果的な物質輸送を志向した自己駆動体の持続性と集団性の創発」の一環で行われます。また、統合生命科学研究所セミナーとして、プログラム共同セミナーの対象です。

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