北京大学量子材料科学中心

物理学院·复杂与生命系统物理

Seminar

DNS of Micro-Swimmer in Complex Fluids

Ryoichi Yamamoto

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Time: 2:00 pm, Sept.23, 2026 (Wednesday)

时间：2026年9月23日（周三）下午 2:00

Venue: Room B101, Lui Che Woo Building Peking University

地点：北京大学吕志和楼 B101

Abstract

Microswimmers often exploit chirality to convert rotational motion into translational movement, displaying distinct behaviors in complex fluids compared to Newtonian fluids. However, the mechanisms governing these differences remain unclear. In this study, we clarify the underlying physics driving the unique behaviors of microswimmers in Newtonian and non-Newtonian fluids using the SP method. We reveal that the enhanced speed of chiral swimmers arises from the Weissenberg effect, which is induced by normal stress differences generated by chiral flows. Furthermore, we identify swimmer-specific normal stress differences in viscoelastic fluids and show that swimming speed varies depending on whether the swimmer functions as a pusher or a puller. Additionally, we explore the hydrodynamic interactions between pairs of chiral squirmers. When aligned parallel or perpendicular to their swimming axis, they exhibit tendencies to either separate or approach. These findings enhance our understanding of their collective dynamics and the rheological properties of viscoelastic fluids containing microswimmers, offering insights for diverse applications.

About the speaker

Ryoichi Yamamoto is Professor of Chemical Engineering at Kyoto University. He received his Ph.D. in Engineering from Kyoto University in 1996 and has held his current professorship since 2008. His research focuses on computational soft matter, complex fluids, and active matter, particularly transport phenomena, colloidal hydrodynamics, and multiscale simulation. He is a member of the IUPAP Commission on Soft Matter (C7) and chaired both the International Program Committee and the Local Organizing Committee of ISMC 2023. His honors include the Research Award of the Molecular Simulation Society of Japan and the Research Encouragement Award of the Hosokawa Powder Technology Foundation. He has also served as a PRESTO Research Fellow and a CREST Project Leader at the Japan Science and Technology Agency.