



THE CHINESE UNIVERSITY OF HONG KONG
Department of Physics
SEMINAR

DNS of Micro-Swimmer in Complex Fluids

by

Professor Ryoichi YAMAMOTO (山本量一教授)
Department of Chemical Engineering
Kyoto University, Japan

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ALL INTERESTED ARE WELCOME

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 smoothed-profile 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.