

UNIVERSITY OF HAWAI'I AT MĀNOĀ MECHANICAL ENGINEERING

Thursday, May 1, 2025 3:00pm-6:00pm Holmes Hall 300 PhD defense

Chemotactic behavior for a self-phoretic Janus particle near a patch source of fuel

Viviana Mancuso PhD. Candidate University of Hawaii at Manoa

Abstract

Many biological microswimmers are capable of chemotaxis, i.e., they can sense an ambient chemical gradient and adjust their motility mechanism to move towards or away from the source of the gradient. Synthetic active colloids endowed with chemotactic behavior hold considerable promise for targeted drug delivery and the realization of programmable and reconfigurable materials. Here, we study the chemotactic behavior of a Janus particle, which converts "fuel" molecules, released at an axisymmetric chemical patch located on a planar wall, into "product" molecules at its catalytic cap and moves by self-phoresis induced by the product. The chemotactic behavior is characterized as a function of the interplay between the rates of release (at the patch) and the consumption (at the particle) of fuel, as well as of details of the phoretic response of the particle (i.e., its phoretic mobility). Among others, we find that, under certain conditions, the particle is attracted to a stable "hovering state" in which it aligns its axis normal to the wall and rests (positions itself) at an activity-dependent distance above the center of the patch.

About the Speaker



Viviana Mancuso earned her Bachelor's in Chemical Engineering in 2017 and her Master's in Industrial Bioengineering (Magna Cum Laude) in 2020 from the University of Naples Federico II. She is currently completing her Ph.D. in Mechanical Engineering at the University of Hawai'i, where her research focuses on the chemotactic behavior of self-phoretic Janus particles, with applications in nanomedicine and targeted drug delivery. She has conducted research at the Max Planck Institute in Stuttgart, Germany, and the Laboratoire Interdisciplinaire de Physique in Grenoble, France, and is currently collaborating with SKCM² at Hiroshima University. Viviana has presented at international conferences such as IEEE Nanomed and ACS Colloids. As she nears graduation, she aims to transition into the medical affairs industry.