THE UNIVERSITY OF HONG KONG

DEPARTMENT OF MECHANICAL ENGINEERING

# SEMINAR

Online

**Title:** **Emerging states of isotropic self-phoretic disks: from crystalline solid to active turbulence**

**Speaker:** **Dr. Lailai Zhu**
**Assistant Professor**
**Department of Mechanical Engineering**
**National University of Singapore**
**Singapore**

**Date:** **25 November, 2022 (Friday)**

**Time:** **10:00 a.m. (Hong Kong Time)**

**Join Zoom Meeting:**
**https://hku.zoom.us/j/97212525551?pwd=bHJuRmpUMklDR2ppZ1drUHhYQ3R4Zz09**

**Meeting ID:** **972 1252 5551**

**Password:** **345263**

**Abstract:**
**Active droplets and Janus colloids are popular phoretic swimmers extensively developed to generate emergent collective behaviors reminiscent of biological systems. This development will benefit from a proper understanding of their emergence. Recent modeling has helped us understand how Janus colloids self-organize collectively, whereas it remains largely elusive for active droplets due to the substantially increased difficulty modelling them. Here, we conduct simulations resolving full hydrochemical interactions to examine a model system---a**

**suspension of self-phoretic disks, spanning a parameter space of Péclet number and area fraction. Varying them, the suspension self-organizes into diverse states: triangular lattice crystal, liquid phase, gas-like clusters, and active turbulence. A narrow range of hexatic phase between the liquid and solid phases has been identified, with its emergence well captured by our far-field scaling theory. Our simulations have reproduced a few independently reported experimental observations, including the crossing and reflecting trajectories of two active droplets, and the stationary crystalline structure formed by or turbulent motion of camphor boats (as the macroscopic analogy of active droplets). These findings might illuminate building biomimetic architectures with static patterns, or dynamically adaptive organizations and functionalities.**

**Biography:**
**Lailai Zhu obtained his Ph.D. degree from KTH, Royal Institute of Technology (Sweden) in 2014. He then worked as a postdoc at EPFL (Switzerland) till 2016. After that, he joined the group of Prof. Howard A. Stone at Princeton University as a postdoc. Since 2020, Jan, he joined ME at NUS as a tenure-track assistant professor. He mainly uses theory and simulations to address viscous flow problems involving bio-physics, bio-inspired design and microfluidics.**

**ALL INTERESTED ARE WELCOME**

**For further information, please contact Dr. A.C.H. Tsang at 3917 1505.**

**Research area: Thermofluids**