



School of Nano Science

Monthly Colloquium

Life in Active Motion: A Soft Matter perspective

Invited Speaker:

Dr. Ali Naji

Institute for research in fundamental sciences, School of Physics

Abstract:

Life, as we know it, represents a complex, robust and, at the same time, an extremely fine-tuned organization of molecules and molecular processes that make use of stored and/or ambient free energy to drive themselves into a hierarchy of nonequilibrium spatiotemporal forms known as the living matter. While the most basic questions concerning the origin of life and the emergence of its more complex forms (including multicellularity and, eventually, consciousness) still remain unanswered, contemporary advances in molecular and cellular biology have amassed into a substantial body of knowledge on the nature of the living matter, inspiring and attracting wide-ranging interest also from other disciplines, including applied mathematics, computer science, chemistry, and physics. The aim of this talk is to give a perspective on some of the frontiers that have recently developed in the study of living (or active) matter in physics. I will start with a broad introduction and move onto discussing how active and stochastic motion of biomolecular agents at sub-cellular level gives rise to the motion of a whole unicellular organism--in this case, the celebrated *E. coli*, one of the most common types of bacteria, found in our guts. Stochastic processes at the nano- and micro-scale are tightly bound to hydrodynamics of surrounding fluids (mostly water), which appear as extremely viscous media governed by equations that respect time-reversal symmetry over those ranges of scales. Understanding how microorganisms such as *E. coli* can, nevertheless, 'swim' in directed motion in such environments has opened up rapidly expanding forefronts in soft matter, statistical physics and bio-fluid mechanics research over the last few years. I will discuss some of the general aspects of the nonequilibrium behavior of both biological and synthetic microswimmers, self-propelling through viscous fluids, provide examples from recent areas of interest in the field and, in the end, give a short overview of our active matter research at IPM.

Wednesday, 17 Azar 95 (7 December, 2016), 4-5 pm

Farmaniyeh building, Conference Hall