# ME Faculty Colloquium

## Swimming in Nematic Liquid Crystals

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### ABSTRACT

In this talk, I will present our research on swimming of microswimmers in nematic liquid crystals. Microswimmers are self-driven micrometre-sized self-propelled particles (organisms, colloids or droplets) which are capable of converting stored or ambient energy into a systematic motion in a suspending fluid medium. Recently, we study the low-Reynolds-number hydrodynamics of a model microswimmer, a squirmer, in nematic liquid crystals. We focus on the importance of anisotropy and elasticity of the suspending fluid in geometrical confinement on the dynamics of an individual microswimmer. A squirmer in a homeotropically aligned nematic liquid crystal cell shows remarkable differences as compared to squirmer dynamics in Newtonian fluids. The squirmer trajectories depend strongly on the self-propulsion mechanism, self-propulsion strength, and degree of confinement. We have obtained three distinct types of behaviour: steady swimming along the channel centreline for pullers, steady hovering near a wall for strong pushers, and oscillating motion for weak pushers. The steady hovering state of strong pushers near a wall has been found in recent experiments.

### ABOUT THE SPEAKER

Dr. Shubhadeep Mandal is working as an Assistant Professor in the Department of Mechanical Engineering at IISc Bangalore. Prior to joining IISc, Shubhadeep was an Assistant Professor in the Department of Mechanical Engineering at IIT Guwahati. Shubhadeep was a postdoctoral fellow for two years at the Max Planch Institute for Dynamics and Self-Organization in Göttingen. Shubhadeep did his BE in Mechanical Engineering from Jadavpur University and obtained his MTech and PhD degrees from IIT Kharagpur. Shubhadeep is interested in the area of complex and biological fluids with a focus on understanding the low-Reynolds number hydrodynamics of passive and active particles in complex fluidic environments.

**September 30, 2022, 4:00 pm, A R Auditorium, ME@IISc**