



International Conference on Micro Nano Fluidics (ICOM 2025)



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Tentative topic of the invited talk

Topological Microfluidics

Abstract of the invited talk

Liquid crystals (LCs) are mesogenic phases of matter which combine liquid fluidity with crystalline solid properties. Precise knowledge of the molecular orientations – close to the boundaries and within the material bulk – is necessary for understanding their flow behaviour, especially in microfluidic settings. While the boundary conditions are set, passively, by surface-induced molecular orientations, the bulk orientation in flow is determined, actively, by the anisotropic coupling between the flow and the molecular orientation. The active coupling between flow and director fields is particularly manifest in living fluids comprising biological swimmers or emergent living fluids like growing bacterial colonies and tissue ensembles. Taken together, biological activity and relevant confinements like geometry and curvature offer a range of topological constraints, which regulate geometry, order and topology of such systems, ultimately underpinning phenotypic traits and biological functions. The concept of Topological Microfluidics can be extended to different classes of anisotropic fluids, allowing us to explore and to employ such fluids as complex functional materials for microfluidics, thereby significantly broadening the reach of conventional microfluidics in a range of contexts.