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New England Section Fall 2024 Meeting

Friday–Saturday, October 18–19, 2024; Northeastern University, Boston, Massachusetts

Session I01: Invited Session Soft Matter and Biophysics III

1:00 PM–2:20 PM, Saturday, October 19, 2024

Northeastern University Room: Ell Hall - Blackman Auditorium

Chair: Dapeng Bi, Northeastern University

Abstract: I01.00001 : The battle between internal and external forces in microtubule-kinesin active fluid*

1:00 PM–1:40 PM

[Abstract →](#)

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Microtubule-kinesin active fluids consume ATP to generate internal active stresses, driving spontaneous and complex flows. While numerous studies have explored the fluid's autonomous behavior, its response to external mechanical forces remains less understood. This study explores how moving boundaries affect the flow dynamics of this active fluid when confined in a thin cuboidal cavity. Our experiments demonstrate a transition from chaotic, disordered vortices to a single, coherent system-wide vortex as boundary speed increases, resembling the behavior of passive fluids like water. Furthermore, our confocal microscopy revealed that boundary motion altered the microtubule network structure near the moving boundary. In the absence of motion, the network exhibited a disordered, isotropic configuration. However, as the boundary moved, microtubule bundles aligned with the shear flow, resulting in a thicker, tilted nematic layer extending over a greater distance from the moving boundary. These findings highlight the competing influences of external shear stress and internal active stress on both flow kinematics and microtubule network structure. This work provides insight into the mechanical properties of active fluids, with potential applications in areas such as adaptive biomaterials that respond to mechanical stimuli in biological environments.

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