



March 16–21, 2025, Anaheim, CA and virtual

> Schedule > Focus Session MAR-C59

Focus Session SPLASHY

Biological Active Matter I

3:00 pm – 5:48 pm, Monday March 17 // Session MAR-C59 //

Anaheim Hilton, Pacific B (Ballroom Level)

Chair: Sangwoo Shin, State Univ of NY - Buffalo

Topics:

Biological Physics; Active Matter; Biological Active Matter; Soft Condensed Matter; Statistical and Nonlinear Physics; Fluids; Dynamics; Nematics; Liquids; Networks; Gels

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< Prev

Next >

The battle between internal and external forces in microtubule-kinesin active fluid

3:00 pm – 3:36 pm

Presenter: Kun-Ta Wu (Worcester Polytechnic Institute)

Authors: Joshua Dickie (Worcester Polytechnic Institute), Tianxing Weng (Worcester Polytechnic Institute), Yen-Chen (Anderson) Chen (Worcester Polytechnic Institute), YUTIAN HE (University of Massachusetts Amherst), Saloni Saxena (Department of Physics, Brown University, Providence, RI 02912), Robert Pelcovits (Brown University), Thomas Powers (Brown University)

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.

PRESENTATIONS (12)

Filter presentations



3:00 pm – 3:36 pm

The battle between internal and external forces in microtubule-kinesin active fluid

Kun-Ta Wu (presenter), Joshua H Dickie, Tianxing Weng, Yen-Chen (Anderson) Chen, YUTIAN HE, Saloni Saxena, Robert Pelcovits, Thomas R Powers

3:36 pm – 3:48 pm

Oral: The collective dynamics of urease as triangular oligomers composed of multistate-state dumbbells

James Adams (presenter), Jennifer M Schwarz, Jennifer L Ross

3:48 pm – 4:00 pm

Nematic Locking Principle and its Implications for Microtubule-based Active Nematics

Md Mainul Hasan Sabbir (presenter), Brandon Klein, Daniel A Beller, Spencer A Smith, Kevin A Mitchell

4:00 pm – 4:12 pm

Rotation Dynamics of Flexible Active Filaments with Chiral Self-Propulsion

Chanania Steinbock (presenter), Xinming Shen, Daniel A Beller

4:12 pm – 4:24 pm

Heterogeneous distribution of kinesin–streptavidin complexes revealed by mass photometry

Jing Xu (presenter), Nathaniel Brown, Yeonee Seol, Keir C Neuman



4:24 pm – 4:36 pm

From activity induced anchoring to wetting in liquid-liquid phase separation

Liang Zhao (presenter), Paarth Gulati, Cristina Marchetti, Zvonimir Dogic

4:36 pm – 4:48 pm

Microscale velocity-dependent unbinding generates a macroscale performance-economy tradeoff in actomyosin systems

Jake McGrath (presenter), Brian Kent, Colin Johnson, José R Alvarado

4:48 pm – 5:00 pm

Resolving the Spatiotemporal Power Demand to Sustain Ordered Motor-Microtubule Assemblies

Ana I Duarte (presenter), Gabriel L Salmon, Heun Jin Lee, Bibi Najma, Rachel A Banks, Soichi Hirokawa, Minakshi Ashok, Catherine Ji, Victor Gomez, Matt Thomson, Rob Phillips

5:00 pm – 5:12 pm

Phase separating active fluids form dynamical filamentary networks

Paarth Gulati (presenter), Fernando Caballero, Cristina Marchetti

5:12 pm – 5:24 pm

Non-affine deformations and stress relaxation in contractile active gels

Aniket Marne (presenter), James Clarke, James Lee, José R Alvarado

5:24 pm – 5:36 pm

Active force driven shape change in contractile actomyosin gels

Arnab Roy (presenter)

5:36 pm – 5:48 pm

Measuring active nematic fields in an in vitro actomyosin system

Mohammadamin Tajik (presenter), Peter Hampshire, Lutz Vogeley, Heun Jin Lee, Rob Phillips, Ricard Alert, Stephan W Grill

About

Schedule

Attend the Meeting

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