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Session B05: Active Matter and Liquid Crystals in Biological and Bio-Inspired Systems II
11:30 AM–2:30 PM, Monday, March 15, 2021
Room: 05

Sponsoring Units: DSOFT DBIO DPOLY GSNP
Chair: Kinjal Dasbiswas, University of California, Merced

Abstract: B05.00008 : Tunable spontaneous circulation of microtubule-based active fluid confined in a compressed water-in-oil droplet using milli-fluidic devices

12:54 PM–1:06 PM Live

← *Abstract* →

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Active matter consumes local fuels to self-propel. When confined in a closed circular boundary, they can self-organize into a circulatory flow. Such coherence originates from the interactions between the active matter and boundaries, and boundary conditions play an important role on self-organization of active fluid. Herein, we probed how fluid boundaries influenced the self-organization of active fluid. The fluid boundaries were created by confining the active fluid in a compressed water-in-oil droplet. Due to surface tension, the droplet shaped into a cylinder-like geometry. Since water and oil were both fluids, their interface was fluid. We systematically probed how droplet shapes and the amount of oil surrounding the droplet influenced the development of circulation. We found that the formation of circulatory flows depended on the thickness of the oil layer surrounding the droplet, implying that the fluid dynamics between the active fluid within the droplet and the oil outside the droplet were coupled. We used a 3D COMSOL-based simulation successfully reproduced such oil-layer dependence. Finally, we developed two milli-fluidic devices to deform the droplet and alter the oil layer thickness manually to trigger and suppress the intra-droplet circulatory flow in real time.