ETH zürich

Institute of Fluid Dynamics
Institute of Energy and Process Engineering

Colloquium Thermo- and Fluid Dynamics

Living Droplets Get to Work

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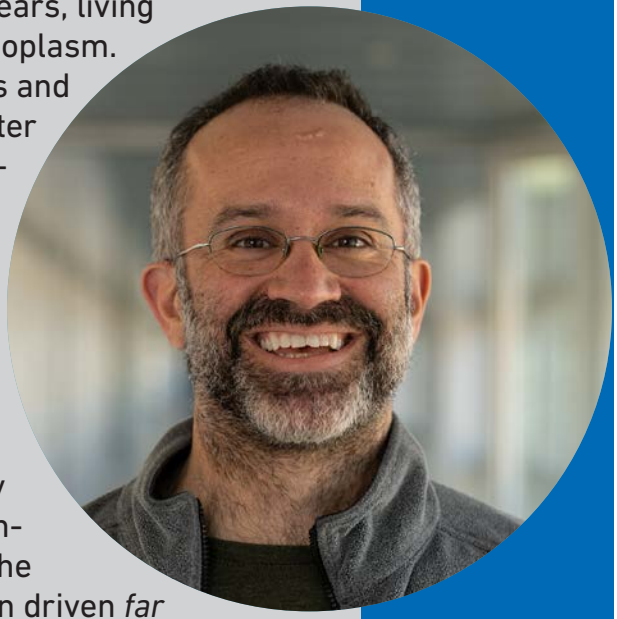
Droplets of simple liquids, like oil and water, are essential engineering fluids. Classically, we use droplets to deliver material, transport heat, and control chemical reactions. Thanks to microfluidic technology, a wealth of new applications has emerged in recent years.
Evolution, however, beat us to it. For more than a billion years, living cells have been producing microscopic droplets in the cytoplasm. These droplets have very different chemical compositions and mechanical properties than the simple liquids we encounter daily. They are thought to play an essential role in organizing chemical reactions in the cytoplasm.
Using some simplified *in vitro systems*, I will highlight the essential physical properties of such fluids. After describing key aspects of their bulk and interfacial thermodynamics, I will demonstrate three mechanisms that enable these droplets to do useful mechanical work.
Quasistatically, droplets' interfacial tension can deform other compliant objects. *Near equilibrium*, the free energy of condensation can be harnessed to remodel the surrounding matrix. If that matrix is elastic, this feeds back into the droplet's phase behavior in some unexpected ways. When driven *far from equilibrium* by localized chemical reactions, droplets display stunning fluid motion, characterized by persistent cell-like motility and directed motion along chemical gradients.



Date: Wednesday, 28 September 2022
Time: 16:15 - 17:15h
Place: ETH Zurich, ML F 36
Host: Prof. Filippo Coletti, IFD

Further information: https://ifd.ethz.ch/events/ktf.html

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