MPIDS Colloquium

MAX-PLANCK-GESELLSCHAFT

Onset and control of flows in microtubule-based active nematics

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Microtubule-based systems are viewed as minimal in vitro reconstitutions of the cytoskeleton. They are made active by mixing them with kinesin proteins fueled with ATP. When this material is two-dimensionally interfaced with oil, it conforms nematic textures pervaded by topological defects and active flows on large length scales.
I will present experimental results corresponding to different scenarios of this active nematic preparation. First, I will introduce recent results relative to the onset dynamics and fully characterization of a turbulent-like regime, identifying the basic length scales and involved instability mechanisms [1, 2]. Later, a strategy of control of these active flows will be commented, based on patterning the viscous coupling of the active nematic at the oily interface [3]. Finally, I will refer to situations of active nematics droplets, dispersed in isotropic and anisotropic oils (liquid crystals) as well [4]. In the latter case, exotic dynamical regimes arising from the coupling of active and passive topological defects will be discussed.

[1] B. Martinez et al., Nature Physics (accepted for publication)
[2] P. Guillamat et al. Nat. Comm. 8:564, 2017
[3] P. Guillamat et al., PNAS 114, 5498, 2016
[4] P. Guillamate et al., Sci. Adv. 4:eeao1470, 2018

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