The microtubule/kinesin system: A versatile realization of an active nematic

F. Sagués[1]

[1]Departament de Ciència de Materials I Química Física

Universitat de Barcelona

Abstract

Microtubule-based systems are viewed as minimal in vitro reconstitutions of the cytoskeleton. They are made active by mixing micron-size microtubules 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.

As an Introduction, I will start by briefly reviewing the field of active systems, singularly those with a biophysical interest. In the central part of the talk I will present experimental results corresponding to different scenarios of the microtubule/kinesin active nematic system. First, I will introduce recent observations relative to the onset dynamics and full characterization of a turbulent-like regime, identifying the basic length scales involved in the instability mechanism [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) [4].

References

[1] B. Martinez et al., Nature Physics 15:362, 2019

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[3] P. Guillamat et al., PNAS 114, 5498, 2016

s[4] P. Guillamat et al., Sci. Adv. 4:eeao1470, 2018