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Controlling Defects and Flow in Active Nematic Suspensions[1]

SURAJ SHANKAR, Department of Physics, Syracuse University, PAU GUILLAMAT BASSEDAS, JORDI IGNÉS-MULLOL, FRANCESC SAGUÉS, Department of Physical Chemistry and IN2UB, Universitat de Barcelona, M. CRISTINA MARCHETTI, Department of Physics, Syracuse University — Experiments on active nematics composed of cytoskeletal biopolymers activated by molecular motors have shown that in these systems topological defects drive self-sustained flows and the transition to spatio-temporal chaos. In active nematics, defects become dynamical entities and behave like self-propelled particles. In a freely suspended nematic layer the defect speed is controlled by the activity and the viscosity of the active fluid that is so far unknown. Experiments, however, are carried out on very thin nematic layers at an oil-water interface. Our collaborators in Barcelona have shown that increasing the viscosity of the oil can substantially slow down the defects and increase their number. Considering a model of an active nematic at an oil-water interface, we have calculated the defect speed as a function of oil viscosity and find that theory and experiments agree well when the oil viscosity is changed over four orders of magnitude. Importantly, by combining theory and experiments these results provide a parameter-free estimate for the interfacial viscosity of the active nematic layer, which has never been measured before.

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