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Active nematics: from turbulence to control

Nematic order, where elongated, but head-tail symmetric entities align in a common direction, is observed ubiquitously in active and living matter. Examples range from suspensions of filamentary proteins extracted from living cells to bacterial colonies, biological tissue and even entire organisms. In all these realizations the elongated units use energy from the environment to generate motion and forces, maintaining the system out of equilibrium. Active nematic liquids exhibit self-sustained chaotic flows, with proliferation of motile topological defects. I will discuss how these chaotic flows may be controlled by patterning activity, as realized in experiments on light responsive active fluids. Such control is an essential prerequisite for extracting useful energy from active fluids or for building biomimetic systems with a responsiveness and adaptiveness that begins to approach what is commonplace in biology.