Patterns in Liquid Crystals: from Driven to Active Realizations

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I will briefly revise my research experience in the field of liquid crystals. This history started more than thirty years ago prompted by a suggestion from Prof. M. San Miguel, and was initially motivated by the interest in looking for external noise effects on the onset of the Freedericksz transition. Much more recently, my interest in the field turned from classical and pure theoretical formulations to experimental active realizations. Active liquid crystals are a new class of soft materials that have recently raised a huge interest. In particular, reconstituted suspensions of cytoskeletal filaments and associated motor proteins have proven ideal for quantitative studies of the origin of subcellular organization. Here we refer to the system initially engineered by the group of Z. Dogic (Brandeis University), consisting of bundled microtubules powered by ATP-fueled kinesin motors. We concentrate on two-dimensional preparations showing nematic textures and streaming flows, from largely-organized to seemingly chaotic. The most striking scenario presented corresponds to interfacing the active nematic with a liquid crystal in its smectic phase. In this latter situation a totally unprecedented strategy of control of the active flows has been recently demonstrated. Other scenarios corresponding to encapsulated active nematics, both in contact with isotropic and anisotropic oils will be briefly presented.