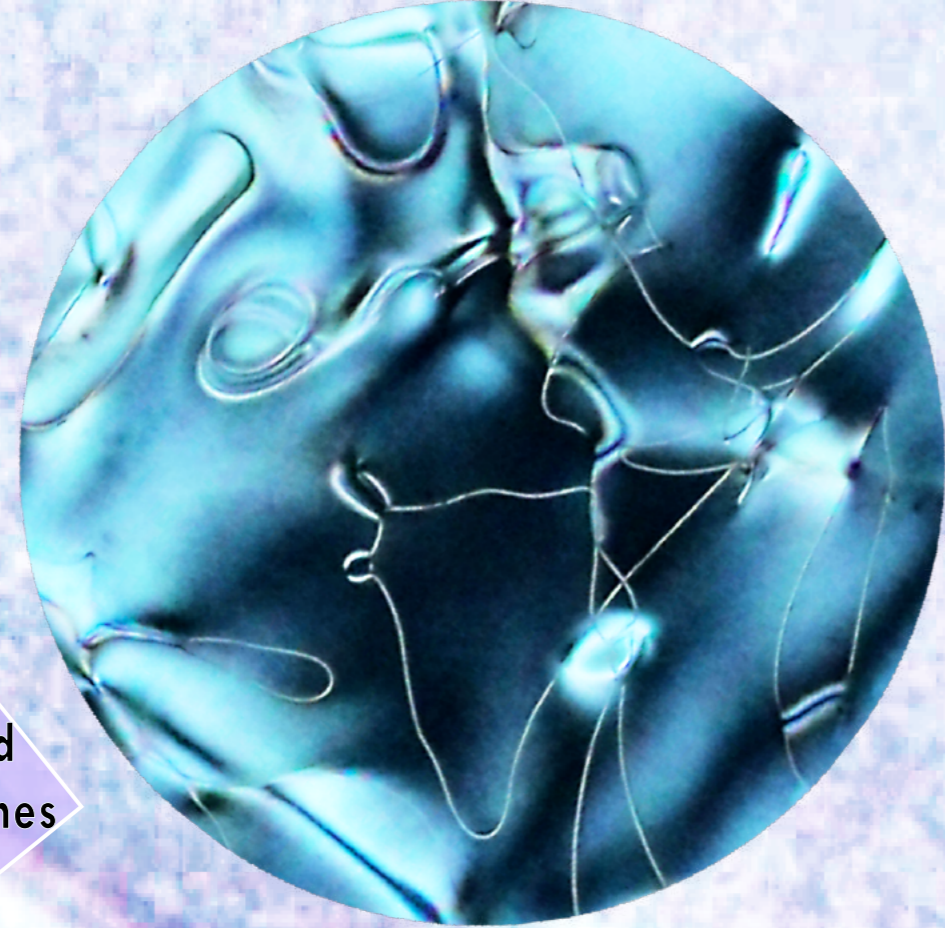


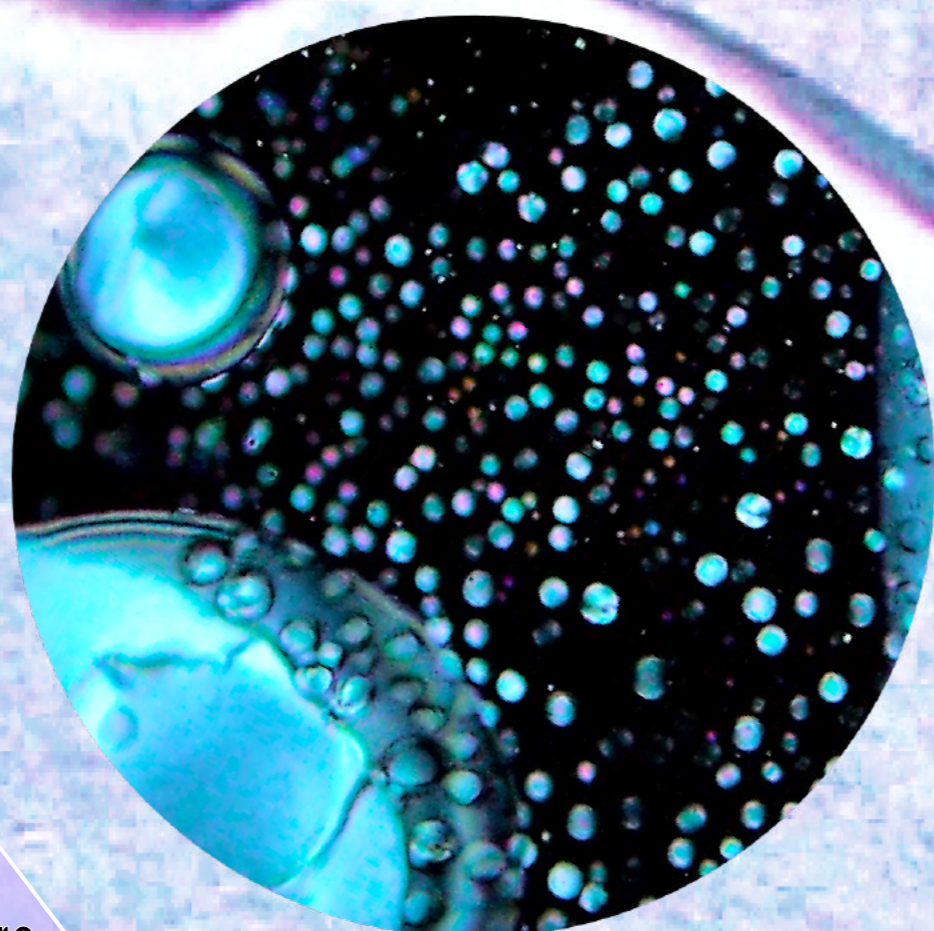
Dancing Droplets on a Defect Line

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Liquid crystalline (LC) phases are made up of molecules, or other small units, that organize into mesoscale assemblies. Their order resembles that of crystalline solids, but since the molecules have some freedom to move position and direction, these assemblies also behave like liquids. Thus, highly birefringent and responsive phases with many defect (or, *disclination*) lines can emerge, as shown on the right. These ever fluctuating lines indicate regions of the LC where the position of the molecules disrupt the local rotational symmetry within the phase.



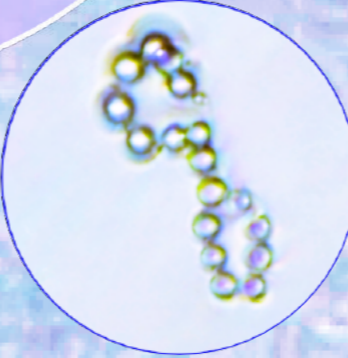
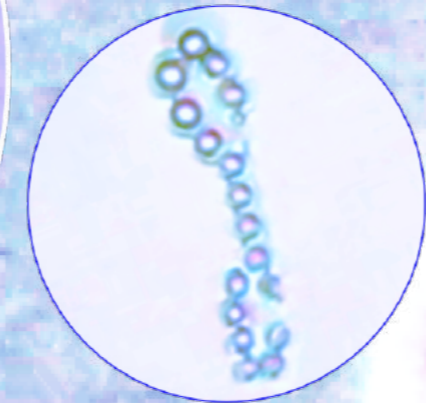
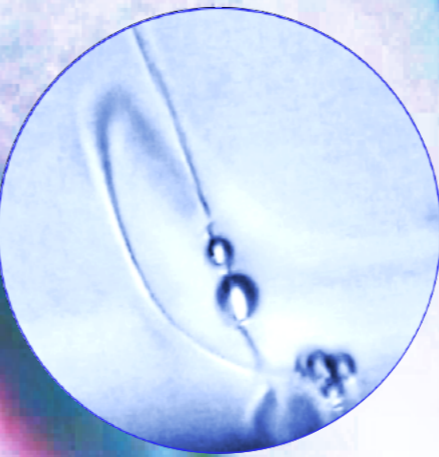
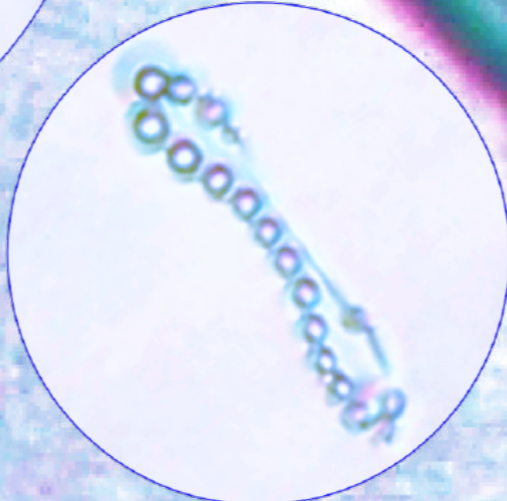
When this LC mixes with aqueous ethanol, surface tension driven Marangoni flow gradients cause droplets to burst from the edges, similar to what occurs when aqueous alcohol and oils mix.¹ The difference now is that each satellite droplet re-assembles its own LC phase when the ethanol evaporates. Whether these droplets have defect lines, or different colors, depends on the elastic energy constraints of the LC phase assembled within.



But, what happens when the ethanol is prohibited from evaporating and the ternary LC-water-ethanol mixture undergoes phase separation at 0°C?

The nucleation and growth of ethanol and water rich micro-droplets, inside LC phase forming regions, intertwine inside of the defect lines from the latter.² This creates the appearance of twirling droplets 'on a string' that persist until they merge with larger similar ethanol-water rich regions or the defect lines annihilate.

Although micro-sphere assembly in LC phases³ has been explored, open questions still remain regarding whether particle or droplet assembly driven by phase separation in mixed LC solvent systems can be exploited.



References: 1. Durey, G. et al. "Marangoni bursting: Evaporation-induced emulsification of a two-component droplet." *Phys. Rev. Fluids* 3, 4–6 (2018). 2. Reyes, C. G. et al. "Isotropic-isotropic phase separation and spinodal decomposition in liquid crystal-solvent mixtures." *Soft Matter* 15, 6044–6054 (2019). 3. Mušević, I. et al. "Two-dimensional nematic colloidal crystals self-assembled by topological defects." *Science*, 313, 954–958 (2006).