ZERNIKE INSTITUTE COLLOQUIUM

Thursday, January 16th, 2014

16:00h, Lecture Hall: 5111.0080 **Coffee and cakes from 15:30h**

Hierarchical Self Assembly in Liquid Crystals: From Renewable Energy to the Origin of Life

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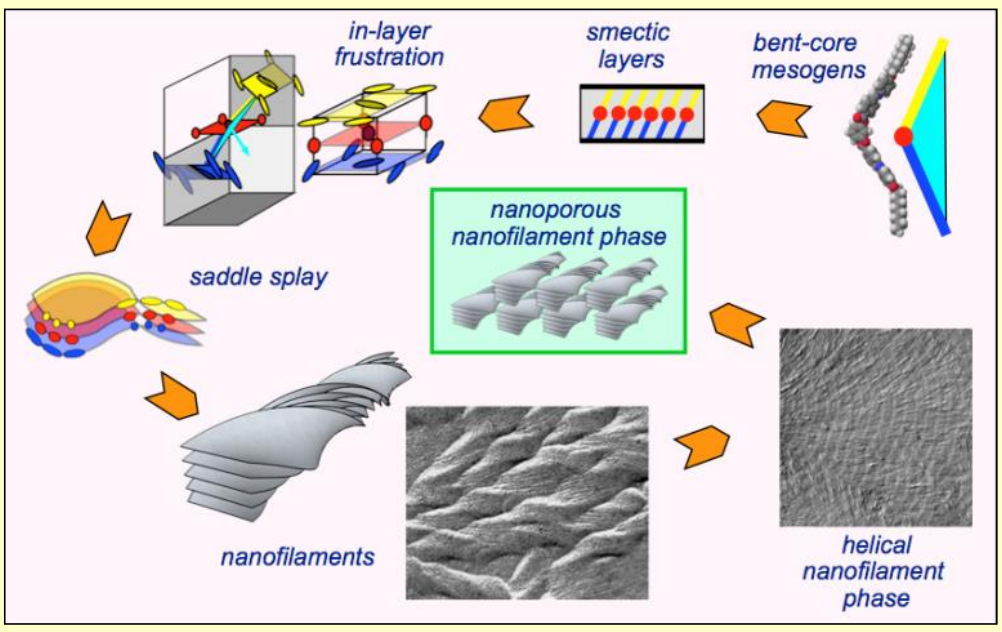
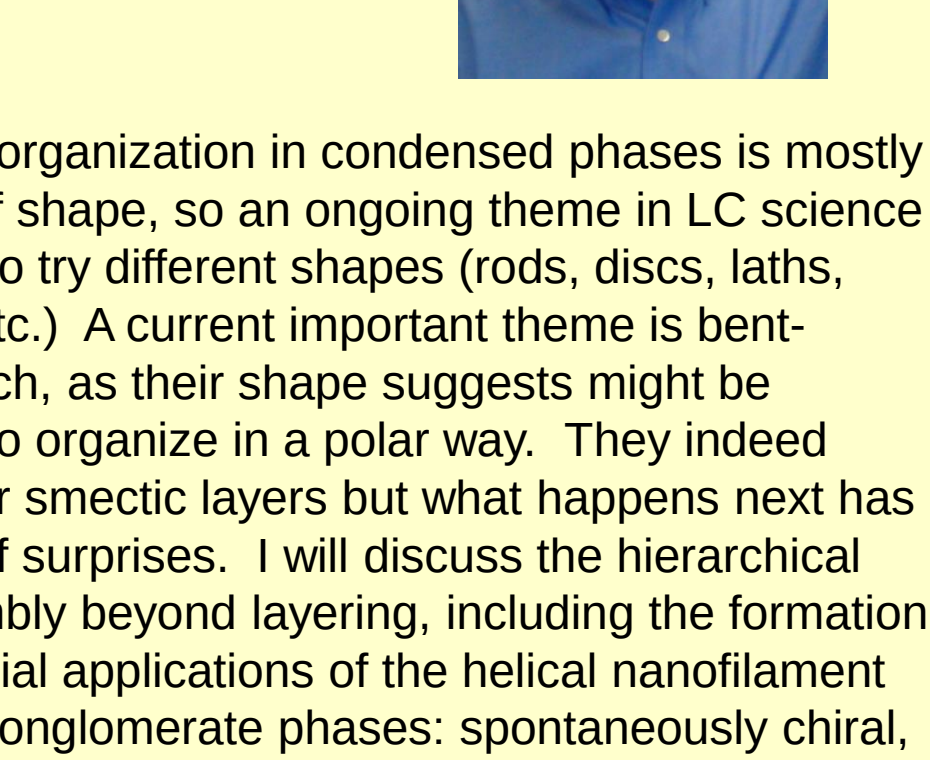


Molecular organization in condensed phases is mostly a matter of shape, so an ongoing theme in LC science has been to try different shapes (rods, discs, laths, wedges, etc.) A current important theme is bent-cores, which, as their shape suggests might be expected to organize in a polar way. They indeed make polar smectic layers but what happens next has been full of surprises. I will discuss the hierarchical self-assembly beyond layering, including the formation and potential applications of the helical nanofilament and dark conglomerate phases: spontaneously chiral, topologically disordered, and stabilized by intralayer structural mismatches.

A second example of hierarchical self-assembly is the formation of LC phases from nano-length DNA and RNA: pairs of short linear oligomers consisting of water soluble chains stitched together as a pair by the complementary hydrogen bonding of aromatic hydrocarbon side groups (base pairs) and then further aggregating to enable LC ordering. The "RNA world", transitioning between the prebiotic and metabolic eras, required such polymers complex enough to be selectively replicated and to exhibit catalytic activity, something like at least 35 base pairs in length. One of the prevailing mysteries is how, with only energy input and dynamic environmental conditions, such complex molecules could appear out of chemical noise, the complex mixture of aromatic hydrocarbons, sugars, phosphates, and other inorganics believed to be available in aqueous environments of the prebiotic earth. Clearly, their organizing principle had nothing to do with biology. I will discuss progress in pursuit of the proposal that the linear polymer shape of RNA and DNA has been templated by liquid crystal phase formation during early life.



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