Faculty application talks by Dr.Kushal Bagchi

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Talk 2: **Harnessing liquid crystallinity to prepare macroscopically organized solids: An alternative to traditional crystallography.**

The growth of single crystals is the traditional route to control molecular structure over macroscopic distances (~ 1cm). However, single crystals cannot be grown for all molecules. Moreover, crystals usually exhibit poor mechanical properties and limited compositional flexibility. Organizing and solidifying liquid crystals provides an alternative to traditional crystallography. We discuss here the use of nanofabrication to direct the self-assembly of blue-phase and discotic liquid crystals. Blue-phases are cubic liquid crystalline phases observed in systems with a high degree of chirality. We demonstrate how aligned blue-phases, prepared using nanolithography, can be used to prepare single crystalline, *polymeric photonic crystals*. The polymeric single crystals we prepare could be of broad interest for sensing and photonic applications. We also discuss the directed self-assembly of discotic liquid crystals, which are mesophases observed in systems with an aromatic "disk-like" core and alkyl side chains. We demonstrate the alignment of discotic liquid crystals in lithographically defined microchannels, and the growth of biaxial crystals from the aligned mesophases. As discotic liquid crystalline phases are observed among important organic semiconductor classes such as Porphyrins, Phthalocyanines and Hexabenzocoronenes, we expect our results to be of broad interest for organic electronic applications. Finally, future directions are discussed for harnessing liquid crystallinity to prepare novel organic materials, such as anisotropic polymers and molecular glasses. The proposed work aims to create solids that combine the most desirable properties of crystalline and amorphous solids and could have broad implications for applications such as organic electronics, photonics, and sensing.