Liquid Crystals at Interfaces: Novel Soft Micro- and Nanostructures

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Structural features of thermotropic liquid crystal phases comprise a wide range of length scales, ranging from few nanometers (smectic density wave) to hundreds of micrometers (cholesteric helix) and can be influenced in many ways, e. g., by external fields, spatial confinement, anchoring on substrates, etc. In recent years, the concept has emerged to use liquid crystals, e. g., by employing their characteristic defect structures, as matrices or templates to control the self-assembly of new micro- and nanosystems. For instance, the distortion of the director field $\vec{n}(\vec{r})$ ($\vec{n}$ designating the preferred direction of the long axis of the rod-like molecules) in a nematic phase by small water droplets or solid particles leads to special colloidal interactions between the droplets or particles which may be used for the design of new self-assembling colloidal systems [1].

Our current research focuses on the behaviour and structure formation of liquid crystals at interfaces. The talk will present two examples for the control of liquid crystal structures by the modification of specific surface or interface properties: (a) the formation of smectic focal conic domains, which are self-organizing defect structures in μm-thick films on solid substrates [2], and (b) the formation of molecular mono- and multilayer structures at surfactant-laden liquid crystal/water interfaces [3].

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