Master 2 Internship

Title: Directed-assembly of liquid crystal soft memories.

Supervisor(s): Delphine Coursault & Etienne Brasselet

Email(s): delphine.coursault@u-bordeaux.fr; etienne.brasselet@u-bordeaux.fr

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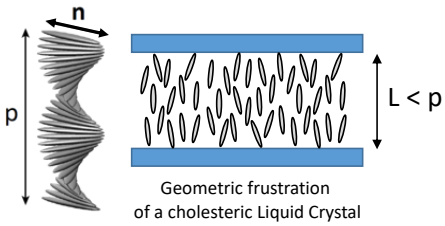
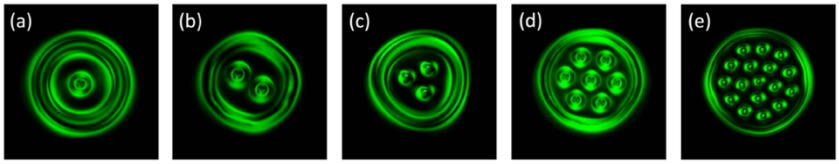
Project:

Topological defects and solitons are universal features in condensed matter physics. Liquid crystals are prime choice materials to investigate those concepts thanks to their molecular properties of long range orientational order. In the case of cholesteric liquid crystals, they present an helicoidal order. When the orientational order is constrained or frustrated, under an external stimulus, one can thus write a local information in the form of a spatially localized elastic excitation.



This information is recordable and erasable at will. In our group, we are investigating the morphogenesis of such structures and their potential application in optics. Some examples of self-assembled chiral structures obtained in the lab are shown below [1]. So far, these structures are induced on-demand, one-by-one, by using a laser light beam. In contrast, in this experimental project, we aim to explore a new mechanism based on a photoelectric effect to write an arbitrary number of them simultaneously, while controlling their location over macroscopic area. To achieve this, we will use the so-called liquid-crystal light valve [2]. Concretely, we will explore the formation of non-trivial orientational liquid crystal structures (so-called topological solitons) trying to unravel the role of the intrinsic physical properties (mechanical, optical, electrical, thermal) of the chiral liquid crystal material.



Microscopy image between crossed polarizers of various assemblies of topological structures embedded in a chiral liquid crystal film. Scale bar : 15 µm.

[1] C. Loussert and E.Brasselet, Multiple chiral topological states in liquid crystals from unstructured light beams, Applied Physics Letters 104, 051911 (2014).
[2] P. Aubourg, J. P. Huignard, M. Hareng, and R. A. Mullen, Liquid crystal light valve using bulk monocrystalline $Bi_{12}SiO_{20}$ as the photoconductive material, Appl. Opt. **21**, 3706 (1982).

Possible PhD funding: this will depend upon results of various calls. Local call : Bordeaux University fellowship; National call : ANR research project; International call: collaborative fellowship (Uchicago-CNRS).