Master 2 Internship

Title: Optomechanics in chiral liquid crystals
Type: Experimental
Supervisor(s): Delphine Coursault & Etienne Brasselet
Email(s): delphine.coursault@u-bordeaux.fr
PhD funding (if any): to be discussed

Project: Liquid crystals are viscoelastic anisotropic fluids known for the diversity and versatility of the orientational order of their molecules. One can play with boundary conditions (normal, planar…) at the interfaces to control liquid crystal elastic distortion, and thus constrain or frustrate the orientational order. The constraint can then be released by applying an external stimulus, such as an electric field or a light beam, to reorient the molecules. Localized topological structures with particular properties may appear.
Hence our team showed recently that the helicity of a pump light can be imprinted and recorded within liquid crystal topological structures (see Figure 1a). This rises from momentum conservation principle with an asymmetric transfer of spin angular momentum from the light to the liquid crystal medium. The phenomenon actually leads to record polar topological structures. As such, the nature of the imprinted light polarization can be readout as the probe light passing through the structures focuses at different planes. We created spin-controlled soft-memories (Figure 1-right panel) [1] in analogy with optically controlled magnetic memories [2].
In this project, we will extend our investigation: (1) to unraveling the influence of material chirality and helicity over optical reorientation, (2) to imprinting and recovering not only polarization, but also phase and amplitude of structured beams.

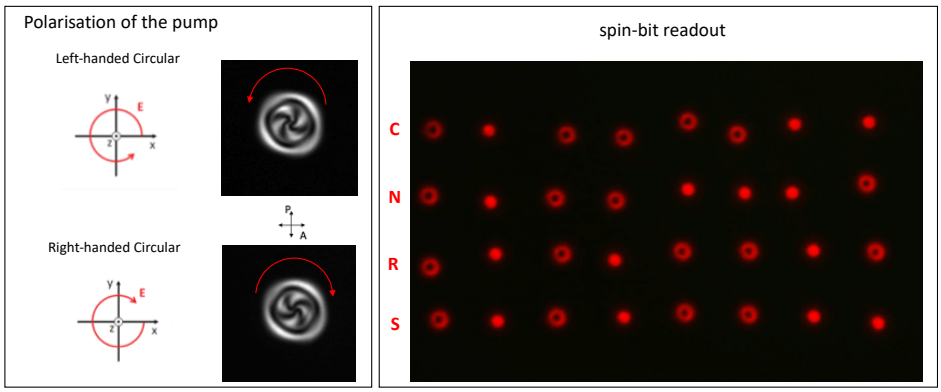

Figure 1: Optical microscopy images between crossed polarizers. Dark areas show no reorientation of the liquid crystal molecules. (Left Panel) (top) left-handed topological structure (bottom) right handed topological structure. (Right Panel) 8-bit readout of the word "CNRS" using the left handed and right handed imprinted topological structures.

[1] N. Bruni, C. Loussert, M. Rafayelyan, T Orlova, D. Coursault and E. Brasselet, *submitted*. [2] Kimel & Li, Nat. rev. mat. 4, 189–200 (2019).