Master 2 Internship

Title: Liquid crystal encoding of optical angular momentum

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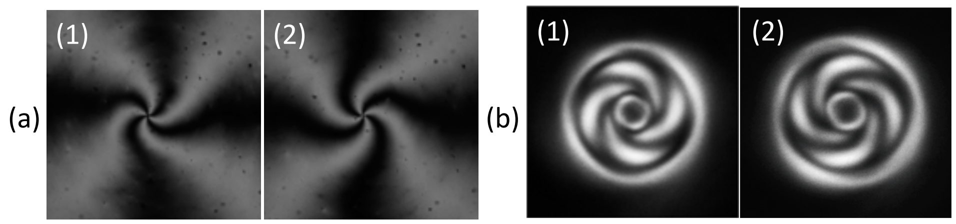
Project:

Liquid crystals are viscoelastic anisotropic fluids known for the diversity and versatility of the orientational order of their molecules. When the orientational order is constrained or frustrated, one can use an external stimulus to reorient the molecules and nontrivial orientational structures characterized endowed with topological properties may appear, see Figure below. [1,2]

Recently, our team showed that the spin angular momentum of the light (aka the polarization of light) allows to impart a chiral character to the orientational structure of a non-chiral or chiral liquid crystal by twisting the medium by light. This results from the transfer of angular momentum from light to the liquid crystals.

Recalling that the mechanical effect of the angular momentum is independent on its nature, we aim to explore the influence of the orbital momentum of a laser light (associated with optical vortices) on the molecular reorientation. The underlying physics at work will deal with the interaction of light on thermal orientational fluctuations inherent to liquid crystals. By performing a parametric investigation (influence of the beam size, the power, the boundary conditions) this project will initiate a long-term research program on the light-matter interaction of inhomogeneous and anisotropic materials by manipulating both spin (polarization) and orbital (spatial degree of freedom) angular momenta, which is expected to take place within a PhD.



Right (1) and left handed (2) topological structures in frustrated achiral [2] (a) and chiral (b) liquid crystal observed between crossed polarizers

[1] C. Loussert and E.Brasselet, Multiple chiral topological states in liquid crystals from unstructured light beams, Applied Physics Letters 104, 051911 (2014).
[2] N.Kravetz and E.Brasselet, Taming the swirl of self-structured liquid crystal q-plates, Journal of optics 22, 034001 (2020)

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).