

## Master 2 Internship

**Title:** Addressable topological actuator for structured light sensing

**Type:** experimental

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**PhD funding (if any):** yes

**Project:** We showed recently that the angular momentum of a pump light can be imprinted and recorded as quasi-elastic particles (see Figure 1a) in chiral liquid crystal. [1] 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 electromagnetic field (a light beam) to reorient the molecules. Localized topological structures with particular properties may appear thanks an asymmetric transfer of angular momentum from the light to the liquid crystal medium. The phenomenon 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 in analogy with optically controlled magnetic memories [2]. In this experimental project, we will extend our investigation to imprinting and recording not only homogeneous polarization state, but also textured polarization, phase and amplitude of structured beams [3]. We will also explore the dynamic of the imprinting thanks to new imaging techniques.

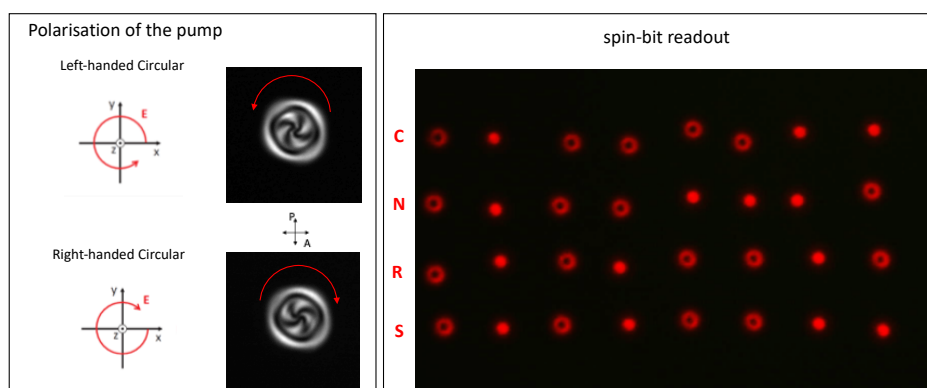


Figure 1: Optical microscopy images between crossed polarizers. Dark areas show no reorientation of the liquid crystal molecules. (Left Panel) (top) left-handed topological structure (bottom) right handed topological structure. (Right Panel) 8-bit readout of the word "CNRS" using the left handed and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

**References:** [1] N. Bruni, C. Loussert, M. Rafayelyan, T. Orlova, D. Coursault and E. Brasselet, *Physical Review Letters* 134 (22), 223804 (2025). [2] A. V. Kimel and M. Li, *Nature Reviews Materials* 4 (3), 189-200 (2019). [3] V. Hakobyan and E. Brasselet, *Physical Review Letters* 134, 083802 (2025).