Master 2 Internship

Title: **Birth, life and death of topological defects in liquid crystals**

Type: **experimental**

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Project: In systems subject to multiple disagreeing conditions the compromise is often found by minimizing the total cost of the disagreement. Imagine that you travel around the world and change the time setting on your phone according to the time zone. What time should you set at the North Pole? Or imagine a round pond in which fish should swim always parallel to the shore. In which direction a fish should swim right in the center? In liquid crystals (LCs), molecules locally align parallel to each other. Topological defects in LCs are the areas in which multiple different molecular orientations meet and local orientation cannot be defined. Just like direction of fish swimming in the center of the pond. Such defects naturally appear as result of spontaneous symmetry breaking when multiple orientations are equiprobable. Otherwise, defects can be intentionally generated directly imposing local orientation of liquid crystal molecules using electromagnetic fields. Depending on targeted application of generated defects their quantity, location and topological characteristics should be properly tailored.

In this internship, we will closely investigate major aspects of topological defects generation, their trapping by external excitations, their interaction with other defects as well as their environment and finally their disappearance. With help of optical polarization microscopy and image analysis we will describe observed processes. The main aim will be to identify fundamental laws of lifecycle of topological defects in liquid crystals. Besides fundamental interest, this will help us to optimize protocols for photonic applications of topological defects in LCs.

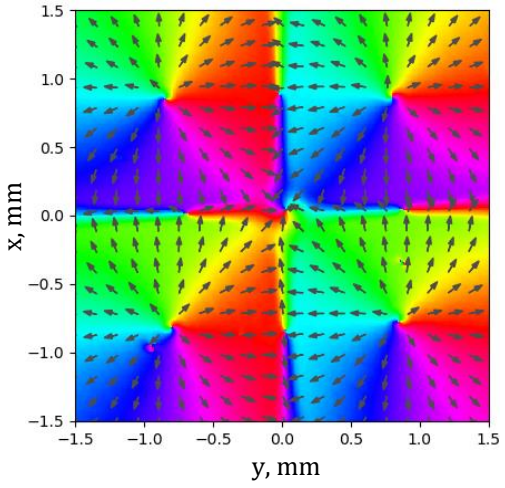

Figure 1. Ensemble of topological defects in LC imposed by magnetic

[1] N. Kravets, U. Mur, M. Ravnik, S. Žumer, E. Brasselet. *Active rejection-enhancement of spectrally tunable liquid crystal geometric phase vortex coronagraphs*. Applied Physics Letters. 121, 24 (2022)

[2] LL. Ma, CY. Li, JT. Pan et al. *Self-assembled liquid crystal architectures for soft matter photonics*. Light Sci Appl 11, 270 (2022).