Spin-optical liquid crystal nonvolatile memory

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By focusing a laser beam inside a frustrated liquid crystal, it is possible to induce optical reorientation leading to the apparition of stable topological structures (TS) inside the system [1]. By observing these TS between crossed linear polarisers, we can distinguish two objects with opposite twisted feature at their centre (fig. 1 (a)). Here we show that we are able to control the twist direction of a given TS by tailoring the incident pump polarisation handedness. We are thus capable of imprinting the polarisation state of a given laser beam inside matter in the form of a topological object.

Secondly, we demonstrate that structures with opposite twisted features are actually one unique polar object, either turned upside or downside. This has multiple implications, notably on the symmetry of the system and on the mechanisms behind the genesis of the TS. Finally, we show that the refractive nature of the TS can be used to discriminate an upside from a downside structure unambiguously, allowing for robust reading of the structure polarity. It is then possible to write and read binary information inside the liquid crystal system, as shown in figure 1 (b) where UB is encoded using 8-bit ASCII alphabet.

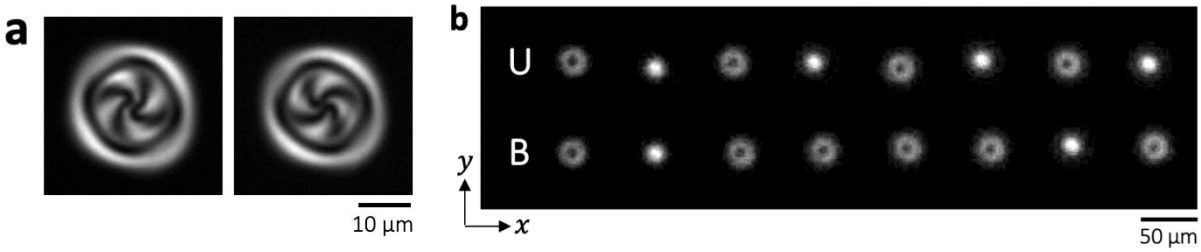

Fig. 1 (a) Image of upside and downside TS between crossed linear polarisers, generated using pump field with opposite polarisation handedness. (b) Image of an assembly of TS observed between crossed circular polarisers. By considering the donut-shaped structure to be a '0' and the point like structure to be a '1', the letters 'UB' are written using 8-bit ASCII alphabet.

Reference :

[1] : I. I. Smalyukh et al., Nat. Mater. 9, 139 (2010).