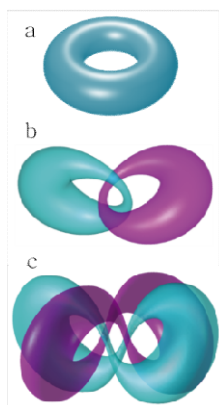


PROPOSITION DE STAGE

STABILISING KNOTS IN DROPLETS WITH HOLES

From a topological point of view, a sphere and a cube are equivalent, since we can transform one into the other through continuous deformations. Making holes or knots is a way to produce more complex



topological objects. For instance, we could make a hole in the sphere to produce a torus, Fig a, or could take two torii and link them together to produce knots, Fig b and c. These knotted structures are not only important in mathematics but are also relevant to many areas of physics, including cosmology, hydrodynamics, optics, condensed matter, particle, nuclear, and atomic physics. They appear when studying fields and are called solitons, due to their particle-like behavior. Our goal is to create and study these topological knots in a chiral nematic liquid crystal, where rod-like molecules align with each other yielding an orientational director field. Recent simulations have shown that complex knots could be stabilized in toroidal droplets of this sort of liquid crystal (1). Here the stability of topological knots is

enhanced by the chiral medium's tendency to twist the director field (2) and the toroidal confinement (3). In the EC2M lab, we have recently set up a technique to produce droplets with holes (4). By the controlled injection of the liquid crystal in a moving stage, it is possible to produce droplets with one hole (toroidal), two holes (eight-shaped), three holes (pretzel-shaped), and so on. The internship will be focused on producing such a exotic droplets with different chiral nematic liquid crystals and studying the emerging structures by using polarizing optical microscopy. The internship is mostly experimental, with the possibility of interacting with theoreticians. No previous background is required. The internship will be at the ESPCI Paris, under the supervision of Teresa Lopez Leon, who is CNRS researcher at the EC2M lab, and Ivan Smalyukh from the University of Colorado, who will be at the ESPCI as an invited Professor. The internship could eventually be extended to a thesis.

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