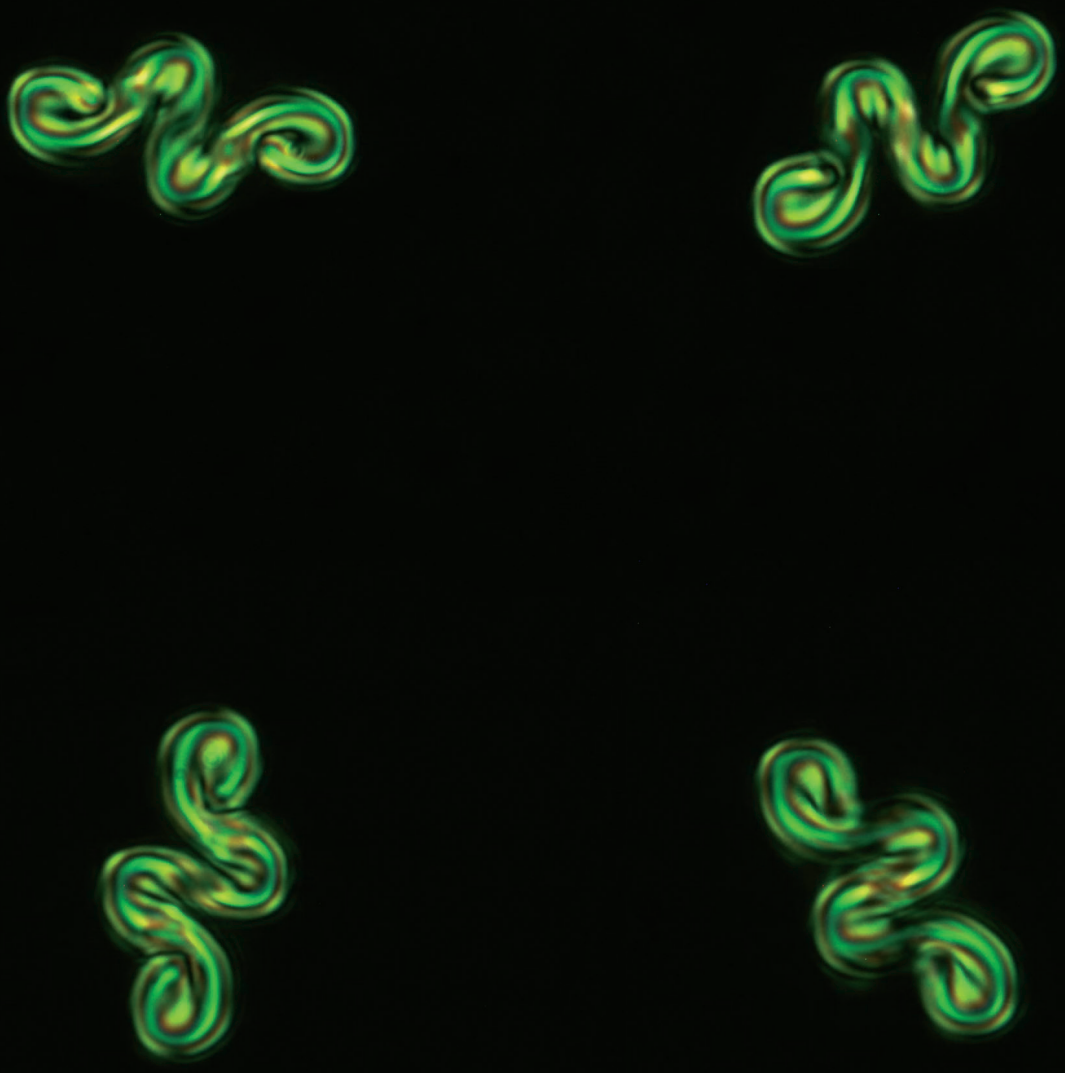

Structures like Möbius strips

A Möbius strip defies orientation. If a two-dimensional asymmetric object were to travel around such a strip, it would return to the starting point but as a mirror image of itself. During the course of their topological soft-matter research, PhD student Hanqing Zhao and his adviser Ivan Smalyukh of the University of Colorado Boulder generated 3D structural defects reminiscent of a Möbius strip. Shown here are four of what the researchers call möbiusons, each about 10 μm long. They form in certain nonpolar, chiral liquid crystals when line defects, also known as vortices, self-assemble with topological solitons, the continuous localized twists that form when molecules align.

Liquid crystals are composed of rod-shaped molecules that align in an orientational order—most of the molecules point in the same direction. But möbiusons have nonorientable structures that can spontaneously fold into a diverse set of spatially localized configurations. When Zhao and his colleagues applied an electric field, they observed self-propelled möbiusons that were stable through various rotational and translational motions. Such behavior could potentially be harnessed to transport nano-sized cargo. The researchers suspect that the topology-based design of their möbiusons could also organize nanoparticles into mesoscale spatial patterns. (H. Zhao et al., *Nat. Phys.*, 2023, doi:10.1038/s41567-022-01851-1; images courtesy of Hanqing Zhao.) —AL