Hierarchical self-assembly of nematic colloidal superstructures

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We have shown experimentally and theoretically that colloidal particles in a nematic liquid crystal can be self-assembled by delocalized topological defects and entangled disclinations (1). Furthermore, we have used scaffold of topological defects as a trapping site for small particles (2). In colloidal mixtures of smaller and larger particles, the smaller ones are spontaneously attracted into the topological defects, formed around the larger colloidal particles and this allows us to assemble predetermined colloidal superstructures with hierarchically chosen interactions ranging from micrometer to nanometer scale (Figure 1). The attraction is driven by the long-range structural forces in liquid crystals and could provide robust self-assembly of metamaterials by using conductive small colloidal particles.

(1) M. Ravnik et al., *Phys. Rev. Lett* **2007**, *99*, 247801
(2) M. Škarabot et al., *Phys. Rev. E* **2008**, *77*, 061706

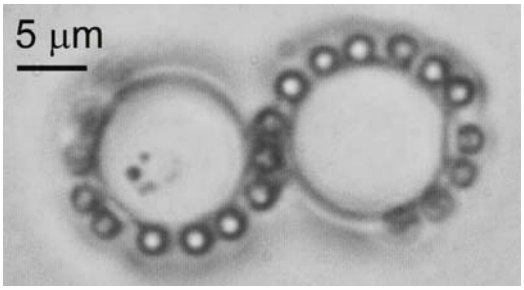

Figure 1. Smaller colloidal particles are trapped into the topological defect loop, twisting around a larger colloidal pair.