Knotted nematic fields: recent developments

Slobodan Zumer

University of Ljubljana and Jozef Stefan Institute

Email: slobodan.zumer@fmf.uni-lj.si

Abstract:

High geometrical constrains and intrinsic chirality may lead to stable and metastable knotted nematic fields. Recently it was demonstrated that knots and links of arbitrary complexity can be formed with laser micro-manipulation of nematic braids of -1/2 disclinations entangling colloidal particles. Understanding stability, ordering, and assembly of such topological soft matter systems requires a synergy of theoretical, simulation, and experimental approaches. In this overview of our recent achievements I first describe an extension of the conventional topological description of nematic defects by including the self-linking number as a topological invariant useful in classifying nematic disclination networks. This approach is then illustrated with four numerically modeled nematic braids: i) knotted 2D nematic colloidal crystals, ii) 3D opal structures permeated by nematics, iii) knots in cholesteric droplets, and iv) mutually tangled colloidal knots and defect loops in nematic fields.