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Reconfigurable Knots and Links in Chiral Nematic Colloids

The journal Science published, on July 1st 2011, a scientific manuscript entitled "Reconfigurable Knots and Links in Chiral Nematic Colloids", contributed by Slovenian scientists Uroš Tkalec, Miha Ravnik, Simon Čopar, Slobodan Žumer and Igor Muševič, from Jožef Stefan Institute and Faculty of Mathematics and Physics, University of Ljubljana. In their work, the authors report on knots and links, which are found and theoretically characterised in colloidal mixtures of liquid crystals and microscopic glassy beads. In such mixtures, knotted or linked defect loops are observed to form spontaneously, forming complex defect braids. Laser tweezers are used to analyse the structure of these microscopically small knots and links, and also to controllably reconfigure the knots and links one into another. Using theoretical approaches based on phenomenology and topology, all the observed structures are explained, complemented by predictions of knotted states in larger colloidal structures. Surprisingly, the authors find that in sufficiently large colloidal structures knots and links or *arbitrary* complexity can be knotted or linked.

Knots and links are objects studied within the mathematical discipline of topology. However,, knots and links play a prominent role in people's lives already since the dawn of human history, being used in masonry, seafaring, manufacture, and art. Also, we all use knots and links in our everyday lives: knots to tie shoelaces or arrange a necktie, and links to make chains from individual metallic rings. The published work on knots and links in liquid crystal colloids demonstrates one of the few practical representations of topological theory in physics and indicates new interesting applications. The authors plan to use the produced liquid crystalline knots and links for an assembly and manufacture of »photonic soft matter«, to be used for steering and control of light-encoded-information currents in optical microchips.

The published results are in the same journal issue highlighted with a *Science Perspectives* paper "Knot Your Simple Defect Lines?" – a commentary paper-, written by Professor Randall Kamien from University of Pennsylvania (USA), one of the world-leading experts in the field of the topology of soft matter. This indicates the impact of the research by Slovenian scientists, already immediately when just published.

in to the paper: http://www.sciencemag.org/content/333/6038/62.abstract

link to commentary by R. Kamien:
http://www.sciencemag.org/content/333/6038/46.summary