SYCL 1: Curvilinear condensed matter 1

Time: Wednesday 10:00–11:00 Location: Audimax 2

Invited Talk SYCL 1.1 Wed 10:00 Audimax 2
Curvature Effects and Topological Defects in Chiral Condensed and Soft Matter — •Avadh Saxena — Theoretical Division, Los Alamos National Lab, USA

The interplay of geometry and topology underlies many novel and intriguing properties of a variety of hard and soft materials including chiral magnets, nematic liquid crystals, and biological vesicles. These materials harbor a gamut of topological defects ranging from domain walls, dislocations, disclinations, solitons, vortices, skyrmions and merons to monopoles, Dirac strings, hopfions and boojums among many others. I will illustrate this rich interplay with three distinct physical examples. (i) Curvature induced quantum potential on minimal surfaces such as helicoids and catenoids (ii) Controlled motion and confinement of liquid crystal skyrmions near curved boundaries using the Q-tensor (as opposed to director) based free energy where the twist acts as the analogue of Dzyloshinskii-Moriya interaction in chiral magnets. (iii) Deformation of biological membranes and vesicles using Canham-Helfrich free energy and Bogomolnyi decomposition technique to determine equilibrium shapes. Finally, I will briefly describe specific applications of these ideas in memory devices, drug delivery systems as well as active matter and nonlinear relativistic systems.

Invited Talk SYCL 1.2 Wed 10:30 Audimax 2
Topology and Transport in nanostructures with curved geometries — •Carmine Ortix — Institute for Theoretical Physics, Utrecht University, Princetonplein 5, 3584 CC, Utrecht Netherlands — Dipartimento di Fisica "E. R. Caianiello", Universita' di Salerno, I-84084 Fisciano (Salerno), Italy

Recent advances in nanostructuring techniques have enabled the synthesis of compact three-dimensional nanoarchitectures: constructs of one- or two-dimensional nanostructures assembled in curved geometries, such as nanotubes and nanohelices. In this talk, I will discuss examples of unique geometry-driven topological and transport properties. These include the appearance of a non-linear Hall effect with time-reversal symmetry due to the Berry curvature dipole in corrugated bilayer graphene [1,2], the geometric control of spin transport properties in curved metallic nanochannels [3], the prediction of a strongly directional magnetotransport in carbon nanoscrolls [4], and the generation of topological insulating phases in shape-deformed semiconducting nanowires [5].

[1] R. Battilomo, N. Scopigno, C. Ortix, Physical Review Letters 123, 196403 (2019). [2] S.-C. Ho, C.-H. Chang, Y.-C. Hsieh, S.-T. Lo, B. Huang, T.-H.-Yen Vu, C. Ortix, T.-M. Chen, Nature Electronics 4, 116 (2021). [3] K. S. Das, D. Makarov, P. Gentile, M. Cuoco, B. J. van Wees, C. Ortix, I. J. Vera-Marun, Nano Letters 19, 6839 (2019). [4] C.-H. Chang, C. Ortix, Nano Letters 17, 3076 (2017). [5] P. Gentile, M. Cuoco, C. Ortix, Physical Review Letters 115, 256801 (2015).