Points, Disclinations and Walls – Defects in Confined Passive and Active Nematics

Alberto Fernandez-Nieves

[a] *Department of Condensed Matter Physics. U Barcelona. Barcelona, Spain.*
[b] *ICREA – Catalan Institution for Research and Advanced Studies (ICREA). Barcelona, Spain.*
[c] *Institute for Complex Systems, U Barcelona, Barcelona, Spain.*

a.fernandeznieves@ub.edu

Nematics have orientational but not positional order, and often consist of elongated particles that align, on average, along a common axis or director. When confined within curved surfaces, the geometry and topology of the confining surface, together with the boundary conditions for the director field, all affect and often dictate how the material organizes. In this talk I will focus on the 3D confinement of nematics. In particular, I will discuss how we generate non-trivial confining spaces and how we quantify the order of the nematic inside them, paying special attention to the topological defects that we often observe. Inside tori with tangential anchoring, structures with broken reflection symmetry, as well as with pairs of point defects, are both observed. Applying magnetic fields results in the formation of inversion (Helfrich) walls, including splay-bend and twist walls, and a new wall type not previously classified before. Driving the nematic out-of-equilibrium results in spatio-temporal dynamics, where defects move, create and annihilate. These effects all conspire to result in anomalous number fluctuations, akin to hyperuniformity, in finite-size systems.

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Topological defects, liquid crystals, active nematics, inversion walls