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Quasi-two-dimensional Skyrmion lattices and other exotic structures in confined chiral nematic liquid crystals[1]

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Skyrmions are localized particle-like topological entities in a number of continuous fields that play important roles in various condensed matter systems, including two-dimensional electron gases exhibiting the quantum Hall effect, Bose–Einstein condensates, and chiral ferromagnets [1, 2]. Here we are using Landau - de Gennnes theoretical approach and numerical techniques to show that in a highly chiral nematic liquid crystal confined to a thin film between two parallel surfaces imposing normal alignment nematic director can exhibit thermodynamically stable states characterized by quasi-two-dimensional Skyrmion lattices of disclinations [3]. By confining a chiral nematic, that in bulk forms blue phases characterized by cubic lattices of nematic defect lines, to a layer with thickness comparable to the lattice constant of the blue phase [3-5], various quasi 2D defect lattices can be stable. Depending on the anchoring direction of the nematic director on confining surfaces, temperature, and layer thickness, beside skyrmion structures, lattices of double helical half-integer dislinations running along the layer [4], and lattices of ring defects [5] are the most interesting. A chiral nematic liquid crystal film can thus serve as a model system, allowing direct investigation of numerous defect lattices by a variety of optical techniques at conditions that are less demanding than used for other condensed matter Skyrmion systems.

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