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Localised States in Bounded Chiral Liquid Crystals

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Within the framework of Oseen-Frank
theory, we analyse the static configurations for chiral liquid crystals. In particular, we find numerical solutions for localised axisymmetric states in confined chiral liquid crystals with weak homeotropic anchoring at the boundaries. These solutions describe the distortions of two-dimensional skyrmions, known as either textit{spherulites} or textit{cholesteric bubbles}, which have been observed experimentally in these systems. Relations with nonlinear integrable equations have been outlined and are used to study asymptotic behaviours of the solutions. By using analytical methods, we build approximated solutions of the equilibrium equations and we analyse the generation and stabilisation of these states in relation to the material parameters, the external fields and the anchoring boundary conditions.

Because of the anisotropic
optical properties of the medium and the peculiar shape of such an excitation, we quantitatively evaluate the cross section for the axis-rotation of polarised light, by resorting to the Born approximation. The analysis suggests the use of the spherulites as elements of photonics circuits.

On the other hand the same confined
cholesteric liquid crystals admit special nonlinear static elongated configurations, described by integrable nonlinear equations with boundary conditions. Thus, confined helicoidal with disclination type singularities appear. Differently from the well known linear case, we explicitly find pi or $2pi$ helicoids and analyse their properties
both by analytical and numerical tools.

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