Continuum simulations of cholesteric blue phases: effect of an applied electric field

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We study the orientational profiles and defect structures of cholesteric blue phases(1) (BPs) using computer simulations based on a continuum description (Landau-de Gennes theory). We pay particular attention to how an applied electric field ***E*** deforms the unit cell of the blue phase structure, and topological disclination lines.

We find that, depending on the original structure of blue phases (BP I and BP II), the strength and direction of ***E***, and the sign of the dielectric anisotropy (ε_a), the electric field can deform the unit cell and disclination lines in a various fashion. Figure 1 shows the resultant structures of BP II after the application of relatively weak field. The 4 disclination lines connected at the center of the unit cell detach to form 2 separate disclination lines. How the 2 disclination lines separate depends on the sign of ε_a. In the presentation, we discuss quantitatively how the unit cell deforms in response to an electric field and argue that our findings reproduce previous experimental results(2) and numerical ones(3).

References
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Here only the cases with positive ε_a are discussed.

Figure 1. Bright lines represent disclination lines.