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10:30 AM - 11:30AM

Steele 006

“Polarization Patterns of Ferroelectric Nematic Liquid Crystals”

Abstract:

A ferroelectric nematic liquid crystal is formed by achiral molecules with large dipole moments. Its orientational order is universally described as unidirectionally polar, which raises the question of how the structure avoids a strong depolarization field and splay deformations that bring about a bound charge. We demonstrate a rich plethora of polarization patterns in ferroelectric nematics not constrained by crystallographic axes. In particular, domain walls take on the shapes of conic sections, separating domains with uniform and circular polarization, when the polarization is not guided by internal and external “easy directions” (1). When a flat ferroelectric nematic slab is unidirectionally anchored only at one bounding plate, its ground state becomes optically active, with left- and right-hand twists of polarization. In other words, polar order triggers chirality that does not require chemically induced chiral centers in molecules (2). An external electric field applied to create a splay produces patterns with a splay of opposite polarity in the orthogonal plane. The corresponding space charges of opposite signs compensate each other, thus solving the electrostatic problem by purely geometrical means (3). Polar order allows one to switch large birefringence within a microsecond, paving the way for practical applications (4). The work is supported by NSF grant DMR-2341830.

Bio: Oleg D. Lavrentovich received his Ph.D. (1984) and Doctor of Science (1990) degrees in Physics and Mathematics from the Ukrainian Academy of Sciences. In 1992 he joined the Liquid Crystal Institute at Kent State University, Kent, Ohio, USA. His current research focuses on electro-optics of liquid crystals, topological defects, colloids in liquid crystals, structural colors, liquid crystals and elastomers to control biological systems. He is the editor of *Liquid Crystals Reviews* (Taylor & Francis), an honorable member of the International Liquid Crystal Society, a fellow of the International Society for Optical Engineering (SPIE) and a fellow of the American Physical Society.