

Appearance of Broken Reciprocity in Cholesteric Liquid Crystals

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Reciprocity in light scattering is predicated on bounded scattering media with symmetric and linear permittivity, conductivity and permeability. Due to their anisotropy and chirality, cholesteric liquid crystal forms periodic dielectric structures. If the periodicity is comparable to the wavelength of light, these phases are self-assembled photonic band gap structures. There appear in the permittivity odd powers of the wave vector resulting from nonlocality and broken inversion symmetry. Evidence of non-reciprocity has been found in optically active crystals by Bennett¹ and in stacks of cholesteric and nematic liquid crystal cells by Takezoe². We present experimental data showing broken reciprocity in transmittance and reflectance in cholesteric cells with different pitches having overlapping but distinct reflection bands. We relate our results to simple analytic descriptions of the materials properties and of propagating modes and assess them in light of the requirements for reciprocity.

1. P.J. Bennett, S. Dhanjal, Yu. P. Svirko and N. I. Zheludev, *Opt. Lett.* **21**, 1955 (1996)

2. J. Hwang; M.H. Song; B. Park; S. Nishimura; T. Toyooka; J.W. Wu; Y. Takanishi; K. Ishikawa; H. Takezoe, *Nat. Mat.* **4**, 383 (2005).