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Optical Rotation of Layered Liquid Crystalline Phases in the Absence of Helical Winding of Molecular Orientation L.E. HOUGH, NOEL CLARK, Department of Physics, University of Colorado Boulder — We show that periodic structures consisting of chiral layers can have significant optical activity. This optical activity is due entirely to the chiral structure of the individual layers, not to any chiral superlayer structure. In particular, we consider structures in which any large scale manifestations of chirality such as the helical winding of molecular orientation are either suppressed or absent. This optical activity has recently been observed in phases which lack any macroscopic birefringence - for instance orthoconic anticlinic smectics. Though very strong, the optical activity of such phases is still a small effect relative to the typical birefringence of liquid crystalline phases, and so is only apparent in such special cases. In this model we derive an expression for the optical rotation using a linear expansion of the induced polarization. We apply this simple model to the B2 phases of bent core liquid crystals and find that the magnitude of the calculated optical rotation is 0.1 to 1 deg/um. We find that the chiral SmCsPf and SmCaPa phases show strong optical rotation. In addition, the SmCaPf gives optical rotation but only for light propagation oblique to the layer normal and tilt plane.

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