Dynamic Effects of Broken Parity in Chiral and Octupolar Phases

Helmut R. Brand 1,*, Harald Pleiner 2, and Daniel Svensek 3

1 Theoretical Physics III, University of Bayreuth, Germany
2 Max Planck Institute for Polymer Research, Mainz, Germany
3 Department of Physics, Faculty of Mathematics and Physics, University of Ljubljana, Ljubljana, Slovenia

We analyze dynamic effects of broken parity in various liquid crystalline phases. Topics covered include Lehmann-type effects as well as inverse Lehmann-type effects, which can be used as a microscopic pump [1]. Recently we have demonstrated that such effects can also arise in liquid crystalline systems made of achiral molecules provided the overall structure has macroscopic chirality [2]. In such a situation we predict that Lehmann-type effects as well as rotatoelectricity are possible [2]. Over the last few years it has become clear that octupolar (tetrahedral) order could come into play for various types of nematic liquid crystal phases. We investigate the resulting macroscopic behavior of non-polar tetrahedral nematic liquid crystals [3] and discuss ambidextrous chirality versus ambidextrous helicity for nonpolar nematic phases of sufficiently low symmetry [4].

Using these results we make contact with selected recent experimental results. For Lehmann-type effects we analyze experimental results on free-standing chiral smectic films [5]. We also critically compare our analysis with recent reports of octupolar nematic order in at least two different systems [6,7].

References:

* presenting author; E-mail: brand@uni-bayreuth.de