Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Macroscopic Behavior of Nematics with D_{2d} Symmetry HARALD PLEINER, MPI Polymer Research, Mainz, Germany, HELMUT R. BRAND, Theoretische Physik III, Universitaet Bayreuth, 95440 Bayreuth, Germany — We discuss the symmetry properties and the macroscopic behavior of a nematic liquid crystal phase with D_{2d} symmetry. Such a phase is a prime candidate for nematic phases made from banana-shaped molecules where the usual quadrupolar order coexists with octupolar (tetrahedratic) order. The resulting nematic phase is non-polar. While this phase could resemble the classic $D_{\infty h}$ nematic in the polarizing microscope, it has many static as well as reversible and irreversible properties unknown to non-polar nematics without octupolar order. In particular, there is a linear gradient term in the free energy that selects parity leading to ambidextrously helical ground states when the molecules are achiral. In addition, there are static and irreversible coupling terms of a type only met otherwise in macroscopically chiral liquid crystals, e.g. the ambidextrous analogues of Lehmann-type effects known from cholesteric liquid crystals. Finally, we discuss certain nonlinear aspects of the dynamics related to the non-commutativity of three-dimensional finite rotations as well as other structural nonlinear hydrodynamic effects.

Harald Pleiner
MPI Polymer Research, Mainz, Germany

Date submitted: 23 Dec 2009 Electronic form version 1.4