Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Statistical mechanics of the flexoelectric effect in nematic liquid crystals[1] SUBAS DHAKAL, JONATHAN V. SELINGER, Kent State University — Flexoelectricity is the phenomenon in which polarization is induced by imposed deformations of the director field in nematic liquid crystals. Recent experiments [1,2] have found that the flexoelectric effect is three orders of magnitude greater for bent-core liquid crystals than for conventional rod-like liquid crystals. To understand this experimental result, we develop a lattice model for the statistical mechanics of the flexoelectric effect. We perform Monte Carlo simulations and mean-field calculations to find the behavior as a function of interaction parameters, temperature, and applied electric field. The resulting phase diagram has four phases: isotropic, uniaxial nematic, biaxial nematic, and polar. In the uniaxial and biaxial nematic phases, there is a large splay or bend flexoelectric effect, which diverges as the system approaches the nematic-polar transition. This model may explain the large bend flexoelectric coefficient observed in bent-core liquid crystals, which have a tendency toward polar order. [1] J. Harden, B. Mbanga, N. Eber, K. Fodor-Csorba, S. Sprunt, J. T. Gleeson, and A. Jakli, Phys. Rev. Lett. 97,157802 (2006). [2] J. Harden, R. Teeling, J. T. Gleeson, S. Sprunt, and A.Jakli, Phys. Rev. E 78, 031702 (2008).

[1]This work was supported by NSF Grant DMR-0605889.

Jonathan V. Selinger
Kent State University

Date submitted: 20 Nov 2008 Electronic form version 1.4