

Fluctuational shift of nematic-isotropic phase transition temperature

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In this work we discuss a macroscopic counterpart to the microscopic mechanism of the straightening dimer mesogens conformations, proposed recently by S.M. Saliti, M.G. Tamba, S.N. Sprunt, C. Welch, G.H. Mehl, A. Jakli, J.T. Gleeson (Phys. Rev. Lett. **116**, 217801 (2016)) to explain their experimental observation of the unprecedentedly large shift of the nematic – isotropic transition temperature.

Our interpretation is based on singular longitudinal fluctuations of the nematic order parameter. Since these fluctuations are governed by the Goldstone director fluctuations they exist only in the nematic state. External magnetic field suppresses the singular longitudinal fluctuations of the order parameter (similarly as it is the case for the transverse director fluctuations, although with a different scaling over the magnetic field). The reduction of the fluctuations changes the equilibrium value of the modulus of the order parameter in the nematic state. Therefore it leads to additional (with respect to the mean field contribution) fluctuational shift of the nematic – isotropic transition temperature: $\Delta T_c(H) \propto H^{3/2}$. This is our main result in the work, which is ready to be confronted with experimental data. Our mechanism works for any nematic liquid crystals, however the magnitude of the fluctuational shift increases with decrease of the Frank elastic moduli. Since some of these moduli supposed to be anomalously small for so-called bent-core or dimer nematic liquid crystals, just these liquid crystals are promising candidates for the observation of the predicted fluctuational shift of the phase transition temperature.

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