

Equilibrium and non-equilibrium studies of uniaxial and biaxial Liquid Crystals and their mixtures



Formulation of discrete Hamiltonians and coarse-grained Ginzburg-Landau free energy models for these complex fluids



Monte Carlo (MC) simulations of discrete models to identify phases and phase diagrams



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Phase ordering studies after a thermal quench via MC simulations and the time-dependent Ginzburg-Landau (TDGL) equations (for coarse-grained models)

Statistical Physics & Non-Linear Phenomena – Domain Growth, Phase Ordering

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Statistical & Computational Physics – Monte Carlo, Graph Cut, Parallel Tempering, Gradient Descent

Nematic and bent-core liquid crystals (LCs) are complex liquids with directions i.e. the constituent rod-like or banana-shaped molecules align along certain locally preferred directions exhibiting long-range orientational order. This leads to directional optical, mechanical and electro-magnetic properties i.e. at least two refractive indices, multiple viscosities and strong coupling to external fields with different responses in different directions. Notably, they form the basis of the multibillion dollar LCD (liquid crystal display) industry.



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