Dr. Matthew Glaser, University of Colorado

Ferroelectric and Ferromagnetic Fluids

Abstract: Liquid crystal (LC) displays are the dominant mode of information display, ubiquitous in devices ranging from smartphones to flat panel computer displays and televisions. Most LC displays are based on the nematic phase, an orientationally ordered fluid phase of rod-shaped organic molecules that responds readily to aligning surfaces and external fields. The nematic phase is just one member of a diverse family of LC phases, partially ordered fluids with varying degrees and types of positional and orientational order whose richness and variety largely defies classification. Liquid crystalline self-organization has historically been a seemingly inexhaustible source of new phenomena and phases, including ferroelectric LCs, fluid phases that (by virtue of symmetry) possess a permanent electrical polarization. Recently, a new type of nematic phase, the twist-bend nematic (TBN) phase, has been discovered and structurally characterized in a family of bow-shaped organic compounds [[1],[2]]. In twist-bend nematics, molecules spontaneously organize to form a nanometer-scale twist-bend helix, resulting in a phase that is locally polar (helielectric) and chiral despite being composed of achiral molecules. The microscopic mechanisms responsible for the formation of the TBN phase remain poorly understood, and the stability of this phase is found to be highly sensitive to details of molecular structure. Dr. Glaser will describe our recent atomistic simulation studies of TBN materials, aimed at elucidating the molecular-scale structure and thermodynamics of these fascinating fluids. If time permits, Dr. Glaser will discuss the recent discovery of ferromagnetic nematic phases in colloidal suspensions of plate-like ferromagnetic particles [[3]], the first true ferromagnetic fluids.

Matt Glaser is a Research Professor in the Department of Physics at the University of Colorado at Boulder and a founding member of the Soft Materials Research Center, an NSF MRSEC. His research focuses on the physics and materials science of soft matter, including liquid crystals, colloids, and biomaterials. His research interests include self-assembly and emergent properties of molecular and macromolecular systems, self-organization and function of active biological matter, and development of computational and theoretical tools for predictive modeling of soft materials.

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