

Colloidal Liquid Crystals

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This tutorial focuses on liquid crystal formation in suspensions of anisometric nanoparticles, such as nanorods, nanotubes and nanodisks. I will very briefly introduce some key concepts from colloid science, mainly regarding colloidal stability/instability and the importance of ion content in the host liquid, before introducing the Onsager theory, explaining why colloidal nematics arise. In this context I will dwell somewhat on the behavior of the colloid in the concentration range where nematic and isotropic phases coexist. The significance of particle size dispersity will be addressed, and I will demonstrate how the liquid crystal formation can be used to reduce the dispersity. The abstract concepts discussed in the tutorial will be illustrated with practical examples from suspensions of cellulose nanocrystals. While the main focus will be on how and why nematic order spontaneously arises in colloidal liquid crystals, we will also touch upon the peculiarities of chiral nematics and non-equilibrium gelation via percolation.

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