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Nematic Colloidal Crystals, Superstructures and Optical Microresonators

Dispersions of particles in liquid crystals show several novel classes of anisotropic forces between inclusions, which result in an amazing diversity of assembled patterns, such as linear chains [1] and 2D colloidal crystals of microspheres [2]. The forces between the particles in nematic colloids are extremely strong, anisotropic and long-range. This leads to a broad variety of colloidal assemblies in liquid crystals, which cannot be observed in isotropic solvents: colloidal wires, assembled by entangled topological defects [3], superstructures in the mixtures of large and small colloidal particles [4] and a broad variety of 2D nematic colloidal crystals. In all cases, the colloidal binding energy is several orders of magnitude stronger compared to water based colloids. The mechanisms of self-assembly in nematic colloids are discussed, showing this is a novel paradigm in colloidal science, which can lead to new approaches to colloidal self-assembly for photonic devices. Tunable optical microresonators, based on whispering gallery modes in nematic droplets are presented.

References

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