Interactions Between Colloidal Knots in Liquid Crystals

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A continuing challenge in the development of novel metamaterials and photonic devices is the controlled self-assembly of three-dimensional structures that are simultaneously robust and widely tunable. Soft materials, such as liquid crystals, offer a promising setting for such developments, combining elasticity from orientational order with the flexibility of being a fluid. Indeed colloidal dispersions in liquid crystals have already been shown to form both two- and three-dimensional colloidal crystals [1]. The interactions that control these colloidal crystals are sensitive to the topological properties of the liquid crystal [2], which provides for both the robustness and desired tunability.

Recent developments in microfabrication have shown that it is possible to produce colloidal particles of arbitrary shape and topology [3]. The description and understanding of the material properties that can be generated by such arbitrary inclusions is an exciting challenge in applied topology and soft matter physics with wide ramifications for materials science. This project will develop the theoretical understanding of the interactions between knotted colloidal particles in nematics by combining the description of knotted nematic textures [4] with prior work on colloidal interactions for spherical particles [2].

References

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