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Nematic order on curved spherical spaces[1]

ALBERTO FERNANDEZ-NIEVES, TERESA LOPEZ-LEON, SHARAN DEVAIAH, EKAPOP PAIRAM — When nematic liquid crystals are confined to spherical shells, complex defect structures emerge. These structures are characterized by a varying number of point defects and disclination lines, depending on the elastic energy of the liquid crystal, the thickness of the shell, and the boundary conditions for the director at the confining spheres. Topology establishes restrictions that must be fulfilled, but it is the energy landscape that ultimately determines the final state of the system. By using double emulsion droplets, we can experimentally address this fascinating interplay between topology and energy. We find a wealth of defect structures in our shells and propose that the shell thickness inhomogeneity is the key parameter enabling the broad range of configurations we observe; these include long-time predicted configurations, as well as new structures and transitions between them that where never considered before. In addition, we hope to extend our studies to non-spherical surfaces, such as the torus and higher-genus surfaces. For this purpose, we have recently generated toroidal droplets and have studied their hydrodynamic stability. On these closed surfaces, the nature of the defect structure is expected to be qualitatively different from that of the spherical case.

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