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Topological defects and shapes of triatic liquid crystal vesicles[1]
FRANCESCO SERAFIN, OKSANA MANYUHINA, Syracuse Univ, MARK BOWICK, KITP — Is shape the manifestation of function, or does shape determine function? Since the time of Aristotle, the study of shape has proven to be a fruitful way to understand the behavior of physical systems, from atomic to biological systems scales. Two dimensional soft membranes are a perfect setting to understand the emergence of shape. An interesting possibility is to control and design new self-assemblable supramolecular shapes by coating the surface of soft closed vesicles with liquid crystals (LC) of various symmetries. The microscopic geometry of the liquid crystal molecules, in particular the structure of topological defects, when combined with the topology of the vesicle's surface, ultimately determines the vesicle's shape. Recent work has shown that the minimal energy shapes of smectic and nematic vesicles are faceted polyhedra. A very soft smectic vesicle develops sharp creases and forms a faceted tetrahedron. When the coating LC has the symmetries of the square, the vesicle forms a cube. In this work we extend these results to a 3-fold symmetric LC, proving that the vesicle's ground state is an octahedron. This gives a systematic way of predicting vesicle's shapes as we change the liquid crystal's symmetry.

[1]Soft Matter Program of Syracuse University

Francesco Serafin
Syracuse Univ

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