Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Distorted tetrahedral shapes of nematic vesicles[1] THANH SON NGUYEN, JONATHAN SELINGER, Liquid Crystal Institute, Kent State University — In membranes with internal orientational or crystalline order, there is a geometric coupling between 2D internal order and 3D shape. Nonuniformity in internal order tends to induce curvature, and curvature provides an effective potential acting on internal order. For a closed vesicle with nematic liquid-crystalline order, there must be a total topological charge of +2, which normally occurs as four defects of +1/2 each. Previous research has suggested that these four defects form a regular tetrahedron, leading to a tetrahedral shape of the vesicle, which may be useful in colloidal crystals for photonic applications. Here, we develop an explicit model to calculate energies of defect structures in nematic vesicles. When the liquid-crystal interaction energy is a purely 2D intrinsic interaction, we find that the perfect tetrahedral shape is stable only up to a maximum interaction strength (Frank constant), where it changes to an elongated rectangular configuration. When the interaction energy is a 3D extrinsic and intrinsic interaction, the perfect tetrahedral shape is never stable; the vesicle is a distorted tetrahedron for small Frank constant and a highly elongated rectangle for larger Frank constant. These results show the difficulty in designing tetrahedral structures.

[1]This work was supported by NSF DMR-1106014.

Jonathan Selinger
Kent State University

Date submitted: 09 Nov 2012 Electronic form version 1.4