

Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Tunable Gaussian modulus directs catenoid formation from 2D colloidal membranes ANDREW BALCHUNAS, Brandeis University, PRERNA SHARMA, Indian Institute of Science Bangalore, ZVONIMIR DOGIC, Brandeis University — Monodisperse, chiral rod-like particles assemble into one rod-length thick smectic layers, named colloidal membranes, when mixed with a non-adsorbing depleting polymer. It has been shown, using polarization microscopy, that a membrane assembled from rods of similar chirality will exhibit a uniform twist along its edge, while the bulk remains untwisted. When rods of opposite chiralities are mixed, a membrane may have the edge twist of either handedness. This resolves itself as a membrane with scalloped edges, where two adjacent lobes exhibit opposite handedness. As a result, the membrane becomes a 3 dimensional structure. The energetic penalty for creating scalloped edges is compensated by the deformation energy due to Gaussian curvature. Since the overall mean curvature is zero but the structure exhibits an overall negative Gaussian curvature, the Gaussian modulus for a colloidal membrane must be positive to minimize its energy. In this research, we show that the Gaussian modulus can be tuned using a system of two rod types with different lengths and similar handedness. Using this system, self-assembly can be directed to form flat membranes, saddles, and catenoids by changing the Gaussian modulus. The magnitude of the modulus is controlled by varying the fraction of short to long rods, and depletant concentration.

Andrew Balchunas
Brandeis University

Date submitted: 15 Nov 2016

Electronic form version 1.4