A Theory for Depletion-induced Colloidal Membranes

(Talk #8)

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Depletion-induced formation of colloidal membranes has been recently observed in suspensions of hard rods [1, 2]. These membranes exhibit a variety of rich behaviors that must ultimately be driven by entropy alone. We propose an entropic model that can capture certain features of these membranes, including their curved edge shape and the presence of twist even with achiral rods. We calculate phenomenological parameters, such as the Frank twist constant and the Helfrich bending modulus, from physical quantities. Finally, we describe novel behaviors predicted by our model.

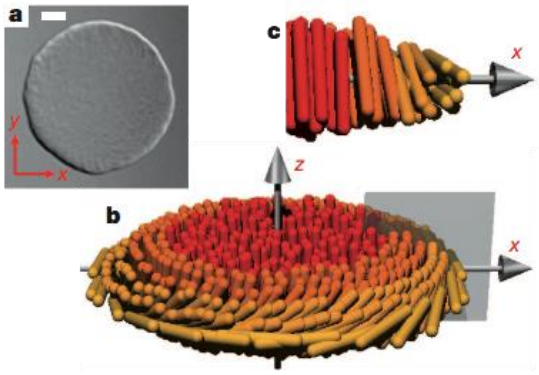

Figure 1. Adapted from [2]. (a) Differential interference contrast image of a colloidal membrane. Scale bar, 5 µm. (b) Schematic illustration of colloidal membrane that shows the twisting of rods near the membrane edge. For clarity, the aspect ratio of the rods has been reduced. (c) Cutaway illustration of the membrane containing only rods that intersect the gray plane in (b).

References:

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[2] T. Gibaud, E. Barry, M. J. Zakhary, M. Henglin, A. Ward, Y. Yang, C. Berciu, R. Oldenbourg, M. F. Hagan, D. Nicastro, R. B. Meyer and Z. Dogic, Nature 481 348 (2012).