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Force vs. extension of colloidal membranes[1] LEROY JIA, ROBERT PELCOVITS, THOMAS POWERS, Brown University, MARK ZAKHARY, ZVONIMIR DOGIC, Brandeis University — In experiments, disk-shaped colloidal membranes composed of long rod-like viruses will take on a twisted ribbon shape under the application of a diametric stretching force. We use an effective model valid for membranes with small twist penetration to study this phase transition and calculate the force necessary to stretch the membrane to a given extension. The model predicts that for small deformations, the force is linear with spring constant depending on the effective edge bending stiffness of the membrane, while for large extensions, the force is found to saturate to a constant value. Surprisingly, the force is not a monotonic function of the extension. Finally, we use simple numerical calculations to find a power law that accurately describes the critical stretch at which the membrane starts to twist, which may be used to estimate the value of unknown parameters by comparison with experimental data.

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