Inclusion-induced boundary layers in lipid vesicles

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Abstract

Rigid inclusions perturb the equilibrium shapes of lipid vesicles. In a two-dimensional vesicle, that may also model a cylindrically elongated tubule, the shape modifications can be determined analytically, and turn out to be significant even far from the inclusion. On the contrary, previous numerical work has given evidence that in the three-dimensional case the shape perturbations decay quite rapidly and are negligible after a few inclusion radii. In this paper we use the tools of asymptotic analysis to derive analytically the shape of the boundary layer induced by the inclusion. As a result, we are able to determine the dominant part of the free energy perturbation that, in turn, allows to identify the vesicle points where the inclusion prefers to sit.

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