Adhesion of membranes in confined environments

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We have studied the dynamics of membranes confined between two walls. This simple model is used in order to grasp the relevance of membrane bending rigidity in cellular adhesion, or in biolubrication.

We obtain effective nonlinear evolution equations for the membrane dynamics in the lubrication limit. The resulting dynamics is very rich and complex.

In the cases relevant to cell adhesion, the dynamics is arrested after a finite time, leading to a frozen configuration. These results suggest a novel scenario for the appearance of finite-size patches during cell adhesion. In addition, we obtain an order-disorder transition when increasing the permeability of the surrounding media. Finally, we show that fluctuations (thermal or resulting from biological activity) restore a coarsening behavior which is similar to that observed in usual phase separation.