

Vesicle formation induced by thermal fluctuations

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Vesicles are crucial in many biological processes like transport vesicles or secretory vesicles. However, the formation of a vesicle from a membrane requires a topological transition of the membrane. This is important, as the common method to model cellular membranes is to ignore the Gaussian curvature term of the energy because it is complex to compute and is a topological invariant.

In a previous work we have developed a model that takes into account this Gaussian curvature term to study the process of vesicle formation from a membrane tube [1]. The tube geometry was chosen because is found on nature and helps in the process of vesicle formation. However, there are shapes that instead of helping the fission process hinder it, like an infinitely flat membrane.

Here we present how by adding a thermal-like noise to mimic the temperature we can make a flat membrane to vesiculate for high enough temperatures. Moreover, we have computed the phase diagram for different spontaneous cur-

vatures where on can see the interplay between the Gaussian curvature modulus and the temperature, and depending on both we will see vesiculation or not at a given temperature.

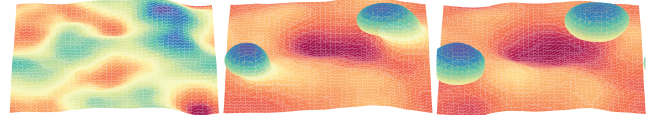


Fig. 1. Formation of two vesicles from a fluctuating flat membrane induced by thermal fluctuations.

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- [1] Rueda-Contreras, M. D., Gallen, A. F., Romero-Arias, J. R., Hernandez-Machado, A., & Barrio, R. A. (2021). On Gaussian curvature and membrane fission. *Scientific Reports*, 11(1), 1-10.