Energy Functional and Patterns of Cellular Membranes

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***Abstract*— The energy of cell membranes depends on their "shape". In this talk, I will discuss a theoretical framework for describing curvature-composition coupling in fluid lipid bilayers. I will introduce an energy functional for undulating 2-component lipid membrane and will There has been theoretically analyze instability of the flat membrane to patterning driven by composition curvature coupling. I will systematically explore the parameter space where the flat membrane becomes unstable and will talk about the effect of lipid segregation in one versus two leaflets. Finally, I will talk about future work going into studying the behavior of and fluctuations in asymmetric lipid bilayers (e.g., that of a eukaryotic cell).**

***Index Terms*— geometric analysis, eukaryotic cells,**

I. Purpose

A variety of experimental studies have highlighted the role of biological membranes in subcellular protein organization and protein function. They have led to the recognition that membrane curvature can guide the spatial organization of lipids and membrane-associated proteins and that spatial organization can in turn influence membrane shape. While there are a number of experimental and computational studies, theoretical studies of how curvature-composition coupling can lead to instabilities of the flat membrane and to spontaneous micro-organization, are still incomplete. Our model and results can provide a deeper understanding of lipid and protein organization in cell membranes

II. Conclusion

We show theoretically how, for a multicomponent lipid membrane, coupling to curvature can lead to micro-organization and pattern formation even in cases where the components would be mixed for a flat membrane.

III. References

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