Beitrag ID: **14** Typ: **Poster**

Vesicles adhered to flexible and adaptive surfaces

Montag, 5. Dezember 2022 16:00 (2 Stunden)

Vesicles play a fundamental role in many biological processes, such as the transport of neurotransmitters between synapses. Another example, involving much larger vesicles, is trees, where vesicle-surface interaction is implicated in regulating their nutrient intake. During these processes, the adhesion behavior of vesicles to soft biological surfaces is crucial. Consequently, it is important to understand the factors, which determine whether a vesicle adheres and what shape it will adopt in contact with a flexible and adaptive surface.
Here, we systematically study the adhesion of a vesicle to planar, undeformable surfaces, vesicles, and droplets of various sizes. We assume an axially symmetric system with finite-range interactions throughout our simulations. Previous studies often considered a contact potential of zero range. However, as synaptic vesicles (d~40nm) are relatively small, the effect of the potential range has to be considered. The contact of the vesicle is characterized by the balance between bending and adhesion energy, which scale differently with the vesicle size. Additionally, in the case of vesicle-vesicle or vesicle-droplet contact, the size ratio is of importance as is the ratio between the bending rigidity and bending rigidity/rescaled intrinsic surface tension. The interplay of these different characteristics gives rise to a complex diagram of shapes.

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Sitzung Einordnung: Poster Session