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Numerial simualtion of droplets on membranes

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Biological cells use membranes and droplets to compartmentalize their interior. As every structure within a cell is either enclosed by a membrane or by a liquid interface it is fundamental to ask what happens if these two come into contact. Recent studies suggest that membrane-droplet interactions are involved in various key biological processes. As experimental image resolution is limited at the corresponding length and time scales, we provide a first numerical method to shed some light on the dynamics on the process.
We derive a mathematical model to describe the interplay of an thin elastic membrane with a two-phase fluid. Using a combination of sharp and diffuse interface models, we develop a robust numerical strategy for this 3-phase multiphysics problem. The model is validated by analytical solutions of stationary morphologies. Finally, we demonstrate that the interplay between wetting dynamics and membrane elasticity leads to a range of fascinating phenomena like droplet wrapping, endocytosis and an inverted cheerios effect.

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Sitzung Einordnung: Short Talks