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The Impact of Collective Molecular Dynamics on Physiological and Biological Functionalities of Artificial and Biological Membranes
MAIKEL RHEINSTADTER, University of Missouri-Columbia — We use neutron, X-ray and light scattering techniques to determine dynamical and structural properties of artificial and biological membranes. The combination of various techniques enlarges the window to length scales from the nearest-neighbor distances of lipid molecules to more than 10^{-6}m, covering time scales from about 0.1 ps to 1 s. The main research objective is to quantify collective molecular fluctuations in these systems and to establish relationships to physiological and biological functions of the bilayers, such as transmembrane transport. The motivation for this project is twofold: 1) By understanding fundamental properties of bilayers at the microscopic and mesoscopic level, we aim to tailor membranes with specific properties such as permeability and elasticity. 2) By relating dynamical fluctuations to physiological and biological functions, we can gain a deeper understanding of the bilayers on a molecular scale that may help optimizing the transmembrane transport of certain drugs. We show how bilayer permeability, elasticity and inter protein excitations can be determined from the experiments. M.C. Rheinstädter et al., Phys. Rev. Lett. 93, 108107 (2004); Phys. Rev. Lett. 97, 048103 (2006); Phys. Rev. E 75, 011907 (2007);J. Vac. Soc. Technol. A 24, 1191 (2006).

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