

Experimental report

15/01/2024

Proposal: 9-13-1086

Council: 4/2023

Title: Coexisting planar and curved model membranes

Research area: Soft condensed matter

This proposal is a new proposal

Main proposer: Marite CARDENAS

Experimental team: Filip MEHLER
Maximilian WOLFF
Gvaramia MANUCHAR
Bert NICKEL
Olena KYZYMA
Hirona NAKAMURA

Local contacts: Alexei VOROBIEV

Samples: tail deuterated POPC
SiO₂ coated Si blocks
C18:1 cardiolipin

Instrument	Requested days	Allocated days	From	To
SUPERADAM	5	4	06/12/2023	10/12/2023

Abstract:

The vast majority of studies published in the literature regarding the curvature of biological membranes and curvature-related phenomena are based on fluorescence microscopy techniques which, in the best cases, are limited to a spatial resolution of hundreds of nanometres and require the use of lipids chemically modified with fluorophores to enable their detection. To increase the resolution down to sub nanometre distances, real-space techniques such as microscopy must be complemented with reciprocal-space methods such as neutron scattering. However, there are currently very few model membranes amenable to be used in the study of curvature-related lipid sorting using scattering techniques. Our goal is to tackle this open challenge by creating a supported lipid bilayer on top of an ordered array of hexagonally packed silica nanospheres and use them to study lipid demixing as a function of curvature. We have shown that we can make such samples by microscopy and neutron reflection and now we plan to study lipid demixing at different curvature using pi-gisans

Report

Proposal 9-13-1086 Super Adam ILL 5-10.12.2023

The specular NR data from initial silicon crystal coated with the NPs with diameter 100 nm and assembled into custom-built solid/liquid cells were measured in the presence of H₂O and D₂O and SiO₂ MW (58% D₂O and 42% H₂O). The NR data after lipids deposition of Cardiolipin and dPOPC at 1mM CaCl₂ and after rinse of EDTA are shown on Fig 1 A and B, correspondingly.

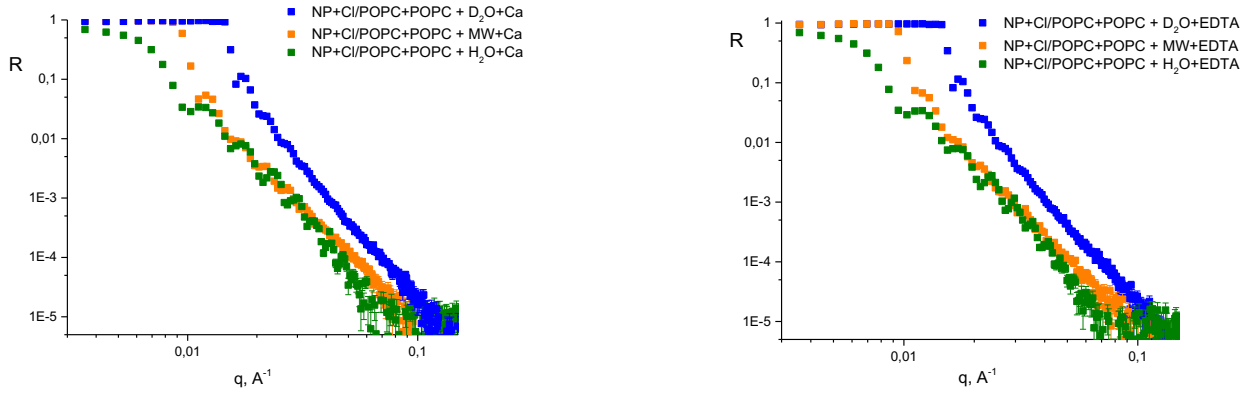


Fig. 1. Specular NR for 100 nm NP surface scaffolds in D₂O (blue), SiO₂ MW (orange) and H₂O (green) after second coating with dPOPC in the presence of CaCl₂ (left) and EDTA (right).

As it can be seen, lipids deposition as well as addition of EDTA lead to significant changes of NR (Fig. 2). These changes can be seen most clearly in the MW buffer (Fig.2A)

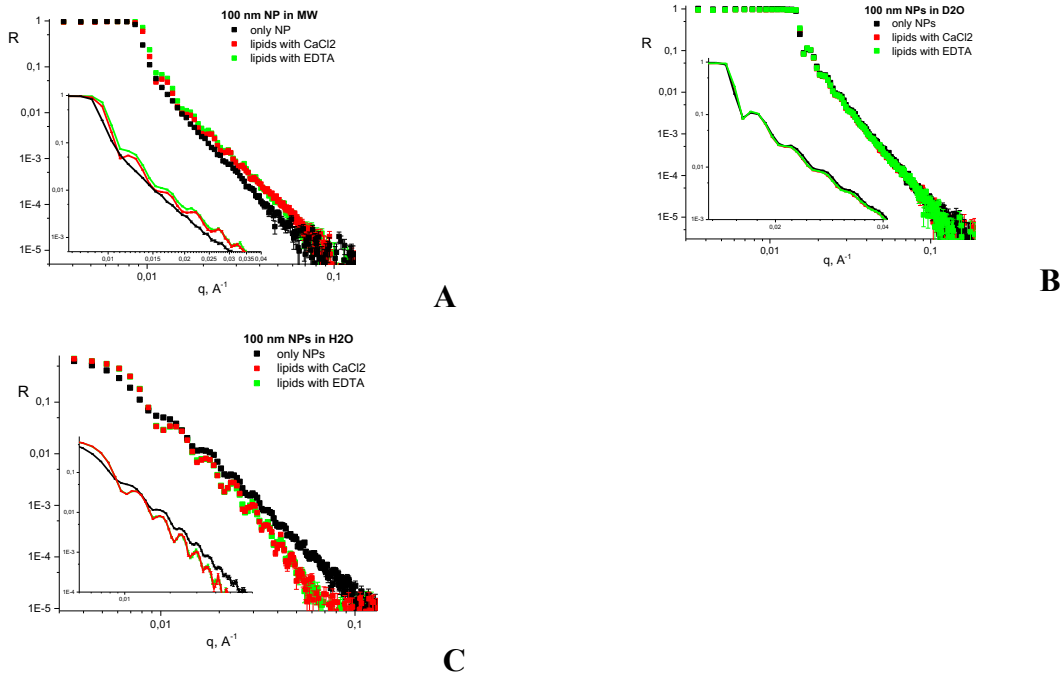


Fig.2. Specular NR for 100 nm NP surface scaffolds and covered by lipids bilayer in the presence of CaCl₂ and EDTA in SiO₂ MW (A), D₂O (B), and H₂O (C).

Thus, structural changes were identified in the lipid layer in the presence of salt and EDTA.