

Experimental report

01/10/2025

Proposal: 9-13-1197

Council: 4/2025

Title: Impact of the degree of curvature on the phase separation in lipid bilayer

Research area: Biology

This proposal is a new proposal

Main proposer: Marite CARDENAS

Experimental team: Olena KYZYMA
Claire BUCHANAN

Local contacts: Philipp GUTFREUND
Lionel PORCAR

Samples: d-POPC
SiO₂ NP coated Si block
C18:1:cardiolipin

Instrument	Requested days	Allocated days	From	To
D22	2	1	25/09/2025	26/09/2025

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 nanometers and require the use of lipids chemically modified with fluorophores to enable their detection. Moreover, these give no information on the structure of such membranes.

The use of partially deuterated lipids in combination with neutron reflectometry and GISANS will allow us to gain a deeper understanding of the lipid distribution and membrane structure around the nanoparticle and at the transition to the coexisting flat region. Here we will complete our previous results, in which we have studied mixtures of d-POPC and cardiolipin, the four-legged lipid, demonstrating that indeed there is curvature-induced phase separation in this system that is dependent on the presence of divalent ions, and also the structural asymmetric nature of the curved bilayer.

Report

Proposal 9-13-1197

Impact of the degree of curvature on the phase separation in lipid bilayer

Using a split cell, GiSANS measurements were taken on a block coated with 100 nm nanoparticles (Fig. 1, black curve). Next, a continuous pre-deposited curved and flat supported lipid bilayer with tail-deuterated POPC and CL in the presence of 1 mM CaCl_2 was measured (Fig. 1, red curve).

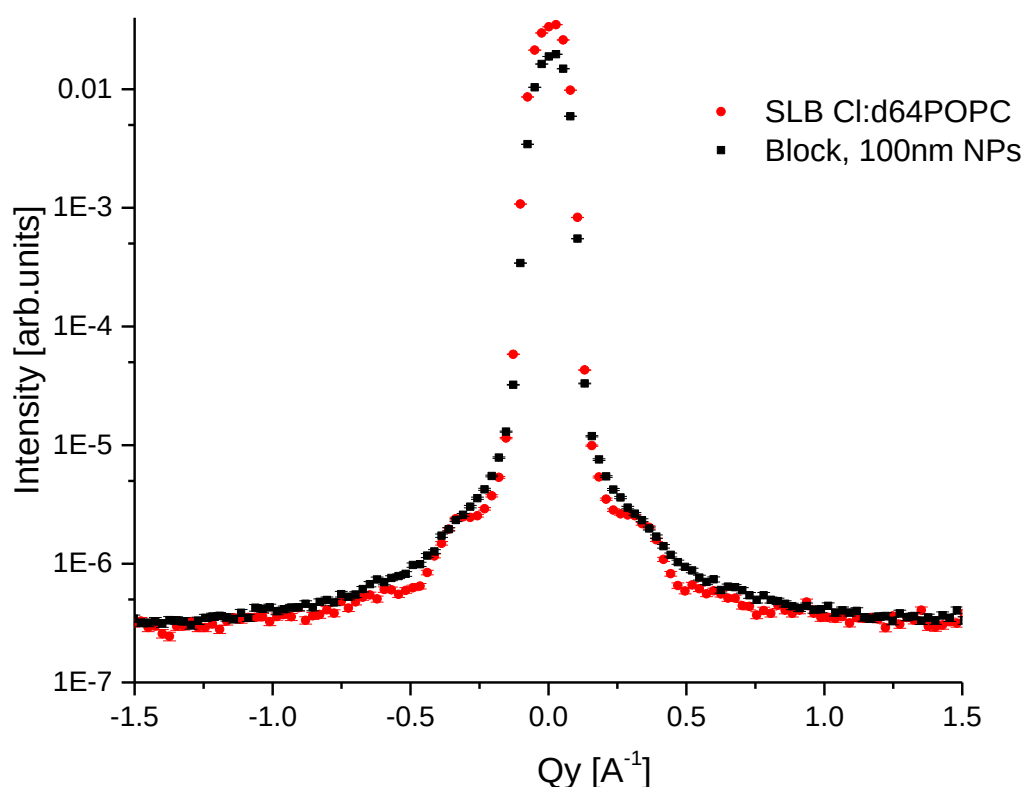


Fig 1. GiSANS signal from the 100 nm NPS coated block (black curve) and supported lipid bilayer (red curve).

Further data analysis will be conducted using a model that accounts for the coexistence of flat and curved bilayers, considering both the inner and outer leaflets. This approach will reveal the separation of lipid phases in bilayers with different curvatures.