ESRF	**Experiment title:** Osmotic pressure effect on supported bilayer: an off-specular study	**Experiment number:** SC-3217
Beamline: BM32	**Date of experiment:** from: 06 avr. 2011 to: 12 avr. 2011	**Date of report:**
Shifts: 18	**Local contact(s):** Micha Jean-Sébastien	*Received at ESRF:*

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Report:

Interactions of lipid membranes are not only crucial for membrane fusion and trafficking, endo- and exocytosis...[1], they are also fascinating from the physical point of view. Membranes indeed exhibit extremely complex interactions with their environment where molecular scale enthalpic (electrostatic, van der Waals and hydration forces... [2]) and fluctuation related entropic contributions are inextricably involved as first realized by Helfrich [3]. Beyond theoretical issues, determining the interaction potential between bilayers is also challenging and was mainly achieved b. We have recently reported X-ray [4] coupled analysis of specular and off-specular reflectivity leading to a refine caracterization of membrane elastic parameters and interaction potential. These experiments

The aim of the experiment was to measure the elastic parameters of a supported bilayer for water thicknesses comparable to those one can find in multilamellar systems. In order to reach this goal, we applied an osmotic pressure with an hydrosoluble polymer (polyvinylpyrrolidone), to double supported bilayers of DSPC in both gel and fluid phases. We have also investigated the contribution of the electrostatic interaction due to the dissociation charges of our membranes. To do this, we added various concentrations of salt to our systems, and measured the curvature of the interaction potential by a coupled analysis of specular and off-specular reflectivity.

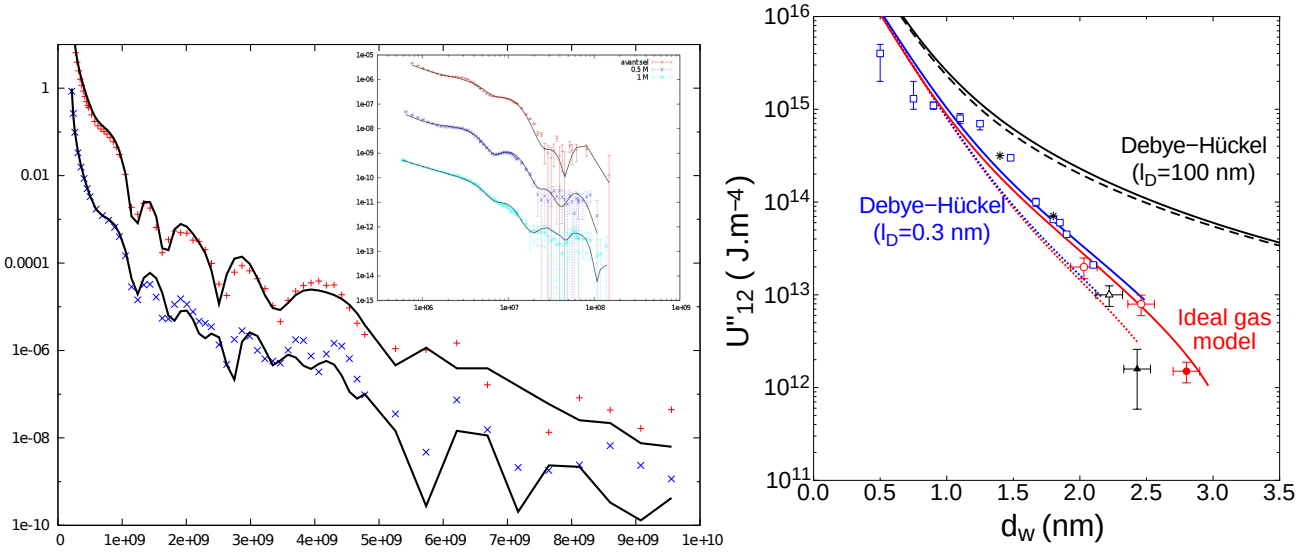

Fig. 1 : (left) Upper curve : specular reflectivity of a double bilayer in gel phase and best fit; lower curve : same sample

The experiments with added salt clearly showed that the electrostatic contribution to the interaction potential has to be taken into account. The salt screened the electrostatic interaction and led to smaller thicknesses and higher curvatures of the potential, as predicted by the theory.
The effects of the osmotic pressure has also been analyzed, and showed that we can access to smaller water thicknesses, thus access to the hydration part of the potential. We are now able to compare the results from multilamellar systems to our systems for equivalent hydration of samples.

The beamline BM32 was working well and the beamtime was used at 100%. Sample preparation was also satisfactory, according to both quantitative (transfer rates reproducibly $> 95\%$) and qualitative criteria.

References

[1] E. Sackmann. *Handbook of Biological Physics*, chapter Physical Basis of Self-Organization and Function of Membranes: Physics of Vesicles, pages 213–303. Elsevier Science B.V., 1995.

[2] R. Lipowsky. *Handbook of Biological Physics, vol. 1.* Elsevier, 1995.

[3] W. Helfrich. Elastic properties of lipid bilayers: theory and possible experiments. *Zeitschrift für Naturforschung*, 28:693–703, 1973.

[4] L. Malaquin, T. Charitat, and J. Daillant. Supported bilayers: Combined specular and diffuse x-ray scattering. *Eur. Phys. J. E*, 31(3):285–301, 2010.