Iterative 1D phase retrieval for studying the structure of confined fluids

D. K. Satapathy[1], O. Bunk[1], ***A. Diaz*** [2], K. Jefimovs[1], E. Fuchsberger[1], M. Dierolf[1], F. Pfeiffer[1], C. David[1], H. Guo[3], G. H. Wegdam[3] and J. F. van der Veen[1,4].

[1]Department of Synchrotron Radiation and Nanotechnology, Paul Scherrer Institut, 5232 PSI Villigen (Switzerland), [2]European Synchrotron Radiation Facility, 7 rue Jules Horowitz BP 220, 38043 Grenoble (France), [3]Van der Waals-Zeeman Institute, University of Amsterdam, 1018 XE Amsterdam (the Netherlands), [4]ETH Zurich (Switzerland)

The study of the structure of a fluid under confinement is interesting from a fundamental and from a technological point of view. Theoretical studies have shown that the molecules of a confined liquid order in layers parallel to the confining surfaces, resulting in an oscillating density profile along the confinement direction. Experiments confirming this effect are scarce due to the difficult access to a small amount of fluid confined between two solid walls.

Microcavity Array Phase Profiling (MAPP) is a promising new technique for the direct determination of the 1D density profile of a confined fluid in the confinement direction [1,2]. The fluid is confined in an array of identical cavities and x-ray diffraction from the array is recorded in the far field with a strip detector. By means of a phase retrieval algorithm, the average density profile of the fluid in the confinement direction can be uniquely retrieved in a model independent way.

Different colloidal systems with a particle size of approximately 110 nm have been investigated with this method, showing an ordering of the colloidal particles in two dimensional sheets parallel to the confining walls, as predicted. Depending on the ionic strength and the volume fraction of the colloidal particles in the solution, different phenomena from liquid ordering to crystallization have been detected, even when the volume concentration of the bulk solutions remained lower than the freezing point. This poster comprises complementary information to the contribution by O. Bunk et al., which is submitted as an abstract for an oral presentation.

[1] O. Bunk et al., Phys. Rev. E **75** (2007) 021501.
[2] O. Bunk, submitted.