ESRF	**Experiment title:** One-dimensional crystallization in Langmuir monolayers	**Experiment number:** SC - 445
Beamline: ID 10B	**Date of experiment:** from: 15.04.1998 to: 21.04.1998	**Date of report:** 22.07.1998
Shifts: 17	**Local contact(s):** Detlef Smilgies	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

H. Möhwald, MPI of Colloids and Interfaces, Rudower Chaussee 5, D-12489 Berlin, Germany
V. M. Kaganer, MPI of Colloids and Interfaces, Rudower Chaussee 5, D-12489 Berlin, Germany
G. Brezesinski *, MPI of Colloids and Interfaces, Rudower Chaussee 5, D-12489 Berlin, Germany
C. DeWolf *, MPI of Colloids and Interfaces, Rudower Chaussee 5, D-12489 Berlin, Germany
R. Lauter *, MPI of Colloids and Interfaces, Rudower Chaussee 5, D-12489 Berlin, Germany
D. Smilgies *, ESRF , B.P. 220, F-38043 Grenoble Cedex, France
N. Boudet *, ESRF , B.P. 220, F-38043 Grenoble Cedex, France

Report: The aim of the present work was to characterise the low temperature phases of fatty acid monolayers at the air/water interface with a high resolution. Using behenic and stearic acids it is possible to investigate the phases CS, L_2'', S, L_2', LS and L_{2d} in a temperature range between 5 and 25 °C. The wavelength of the monochromatic beam was 1.508 Å. The resolution function is a Gaussian with a FWHM of 0.0032 $Å^{-1}$. With the current setup additional intensity was observed on the right side of the peak profile while scanning the direct and reflected beams.

Phase CS: All peaks are broader than the resolution limit. The widths of the main peaks (11) and (02) are close to each other and correspond to a finite size of the domains of about 1000 Å. The (12) peak which is "forbidden" for a centred rectangular unit cell is observed with a FWHM similar to that of the main peaks. Thus the herringbone order extends over the same length scale. The (01) peak which also results from a herringbone packing could not be observed. The larger width of the (20) peak may be due to the effect of distortions (in addition to the finite size effect). In order to conclude on this matter additional higher order peaks would have to be measured. However the geometrical constraints of the trough used did not allow measurements at higher 2Θ values.

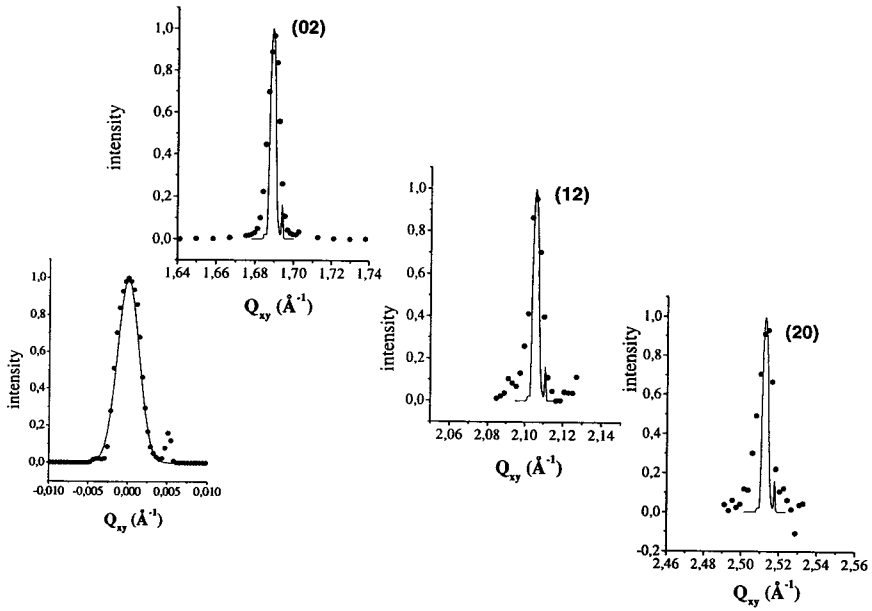

Fig. 1: Resolution function (left) and peaks (indicated) for the CS phase of behenic acid monolayer at 5 °C and 17 mN/m. The resolution function is plotted with the peaks for comparison.

Phase L_2'': The peaks are still close to Gaussian, i.e. correspond to finite sizes of domains (which may be separated by small-angle grain boundaries). There is a large anisotropy in correlations in different directions (with the longest correlations perpendicular to tilt direction, as usual). The herringbone-order correlations extend on a similar scale as the lattice in the tilt direction.

Phase S: The shapes of the peaks essentially differ from those in the phase CS and are similar to the peaks of the phase S of octadecanol. Algebraic decay of positional correlations is found. The correlation functions may be conveniently interpolated by $G(x) = [1 + [x/L)^2]^{-\eta/2}$ which contains a characteristic size L. In contrast to (the LS phase of) octadecanol, the higher order peak (20) is only slightly broader than the 1st-order peaks.

Phase L_2': This phase exhibits diffraction peaks very similar to those of the S-phase. The peak (20) also is not noticeably broader than (02).

Phase LS: The positional correlations are well described by an algebraic decay and the peaks are very similar to those of the phase LS of octadecanol.

Phase L_{2d}: Again this phase is well described by an algebraic decay of positional correlations and exhibits a large difference in the parameters L and η for two peaks.