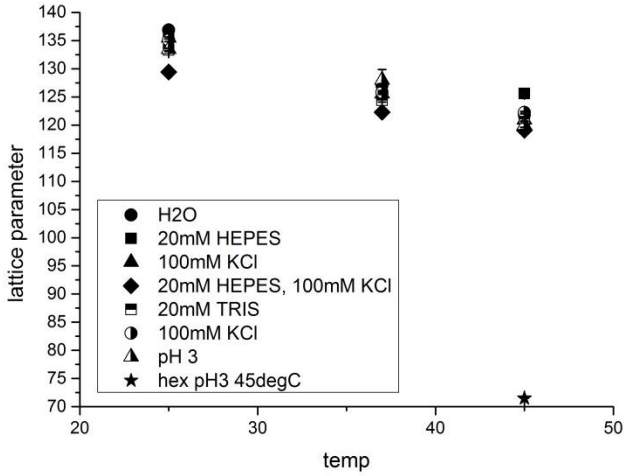
Experimental report for ESRF Experiment SC 4081

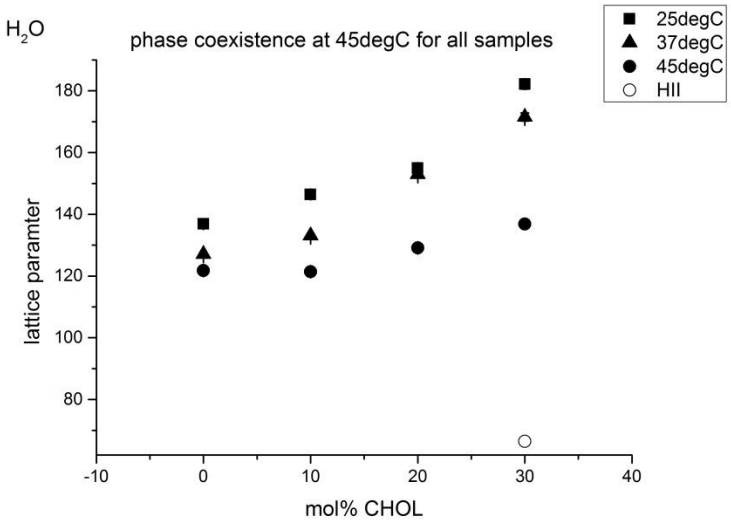
Tuning pore sizes in cubosomes using electrostatic swelling and pressure

Lipid nanoparticles with an internal bicontinuous cubic structure (cubosomes) were prepared from mixtures of moolein (MO), cholesterol (CHOL) and charged lipids (either DOPG, DOPS or DOPA). Despite the dilute nature of these samples (up to 98% water in some cases), we were able to resolve diffraction patterns from many of the dispersions and extract lattice parameters for the internal cubic structure of the cubosomes.
By incorporating charged lipids and cholesterol, we have been able to create significantly larger pore sizes than previously available in similar systems.
Which the data analysis is ongoing, the following pages give an overview of the results obtained (note that all y-axes are lattice parameter in angstroms).

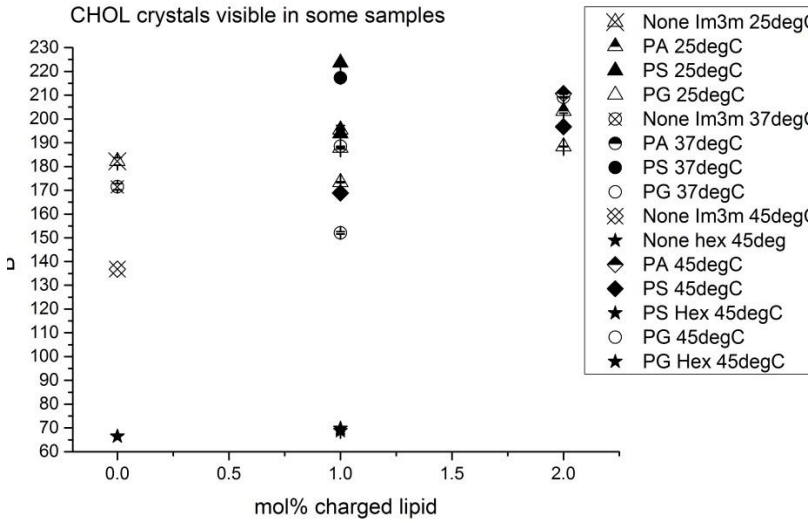
Pure MO samples – no chol or charged lipid

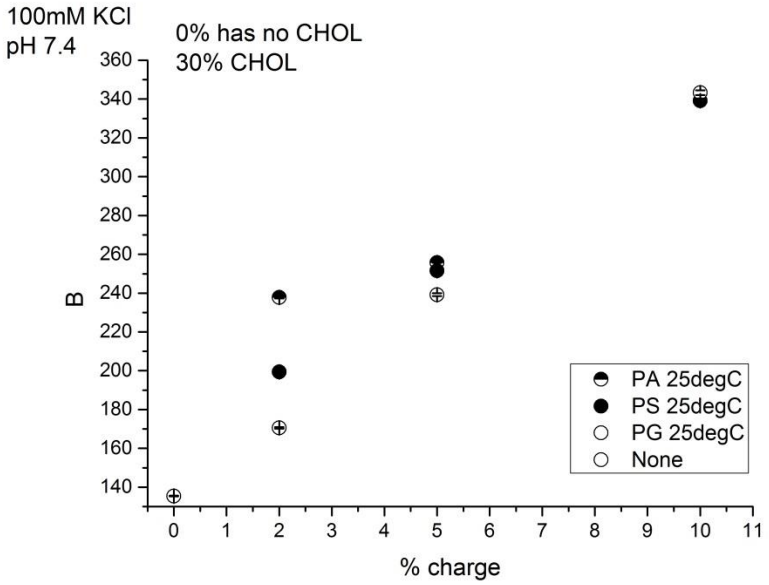


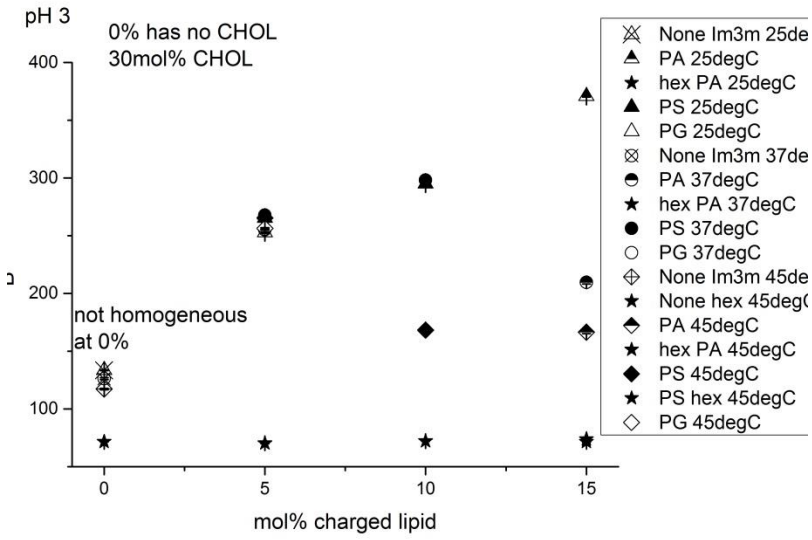
MO:CHOL

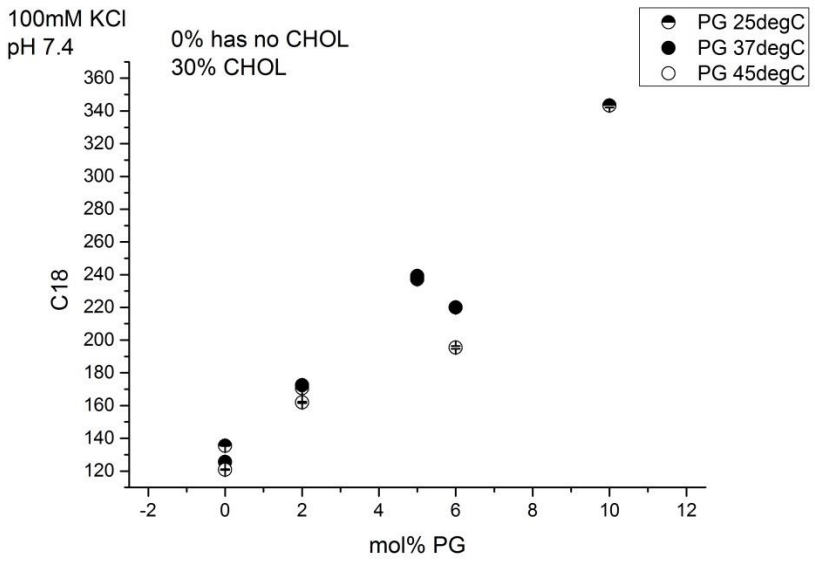


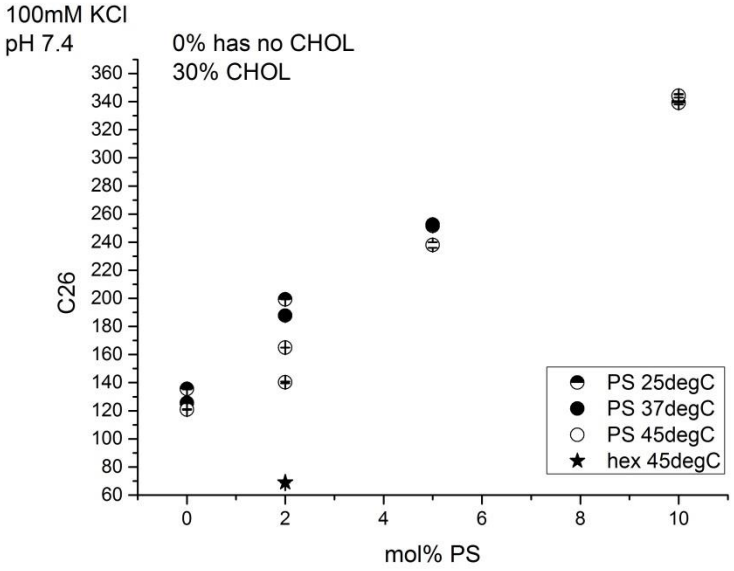
MO:CHOL:Charged lipid in H2O








100mM KCl
pH 7.4
0% has no CHOL
30% CHOL
PG 25degC
PG 37degC
PG 45degC
C18
mol% PG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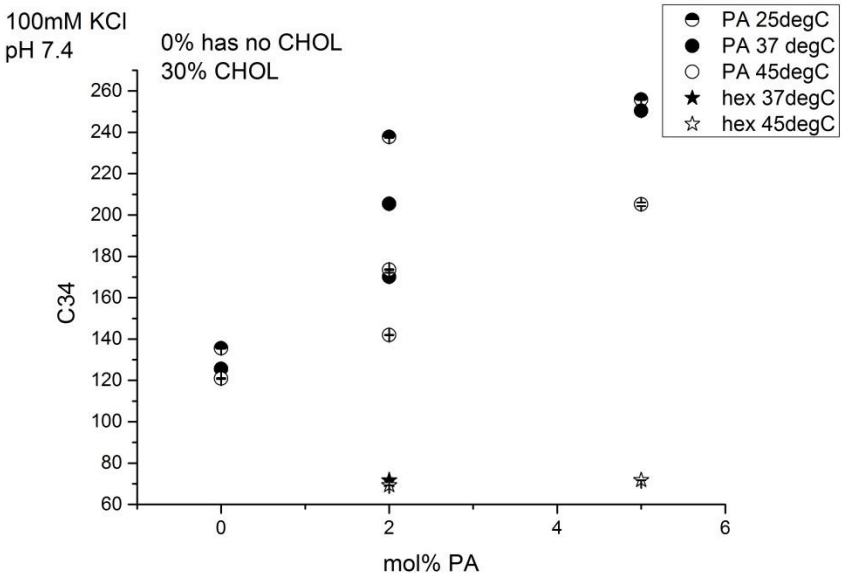
pH 7.4
0% has no CHOL
30% CHOL
PS 25degC
PS 37degC
PS 45degC
hex 45degC
C26
mol% PS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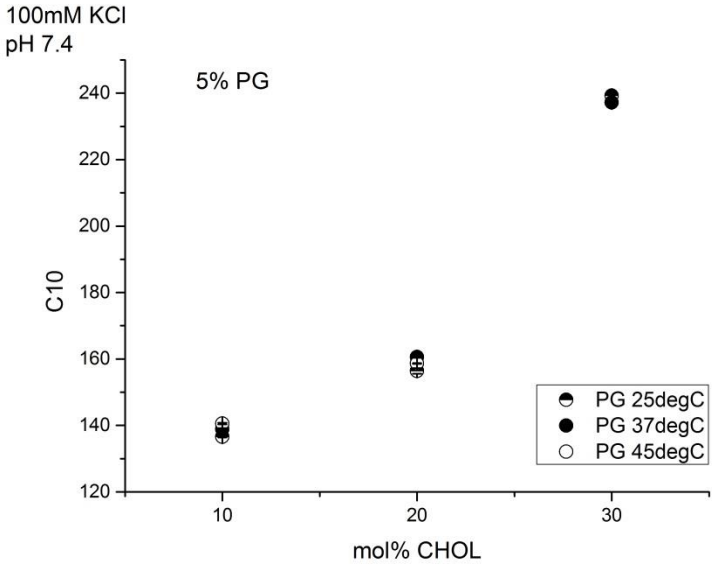
pH 7.4
0% has no CHOL
30% CHOL
PA 25degC
PA 37 degC
PA 45degC
hex 37degC
hex 45degC
C34
mol% PA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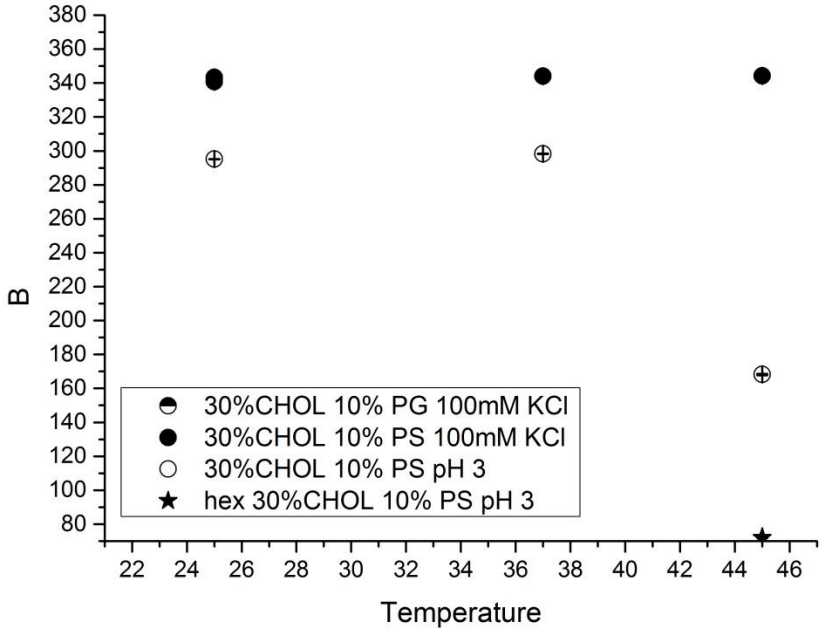
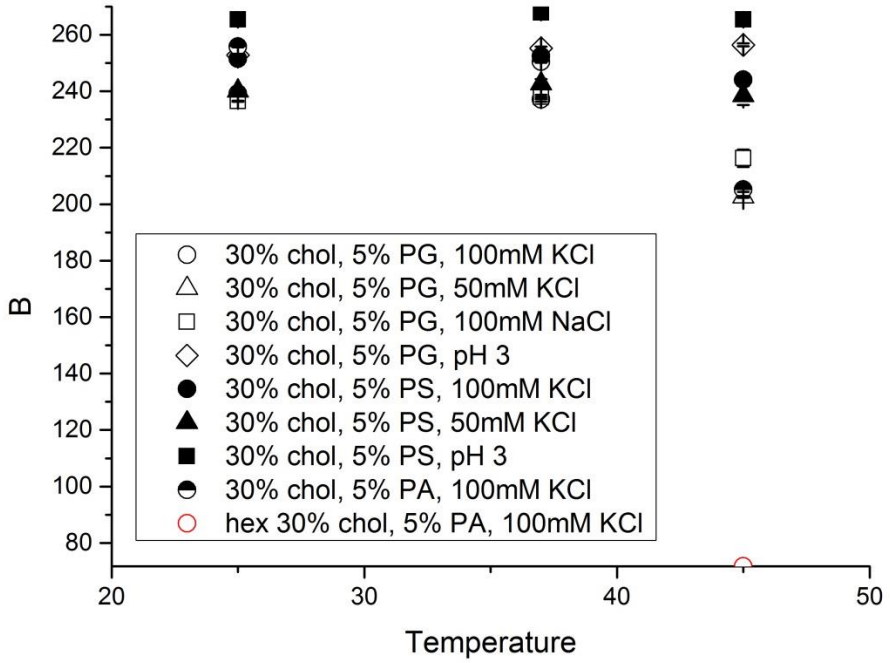
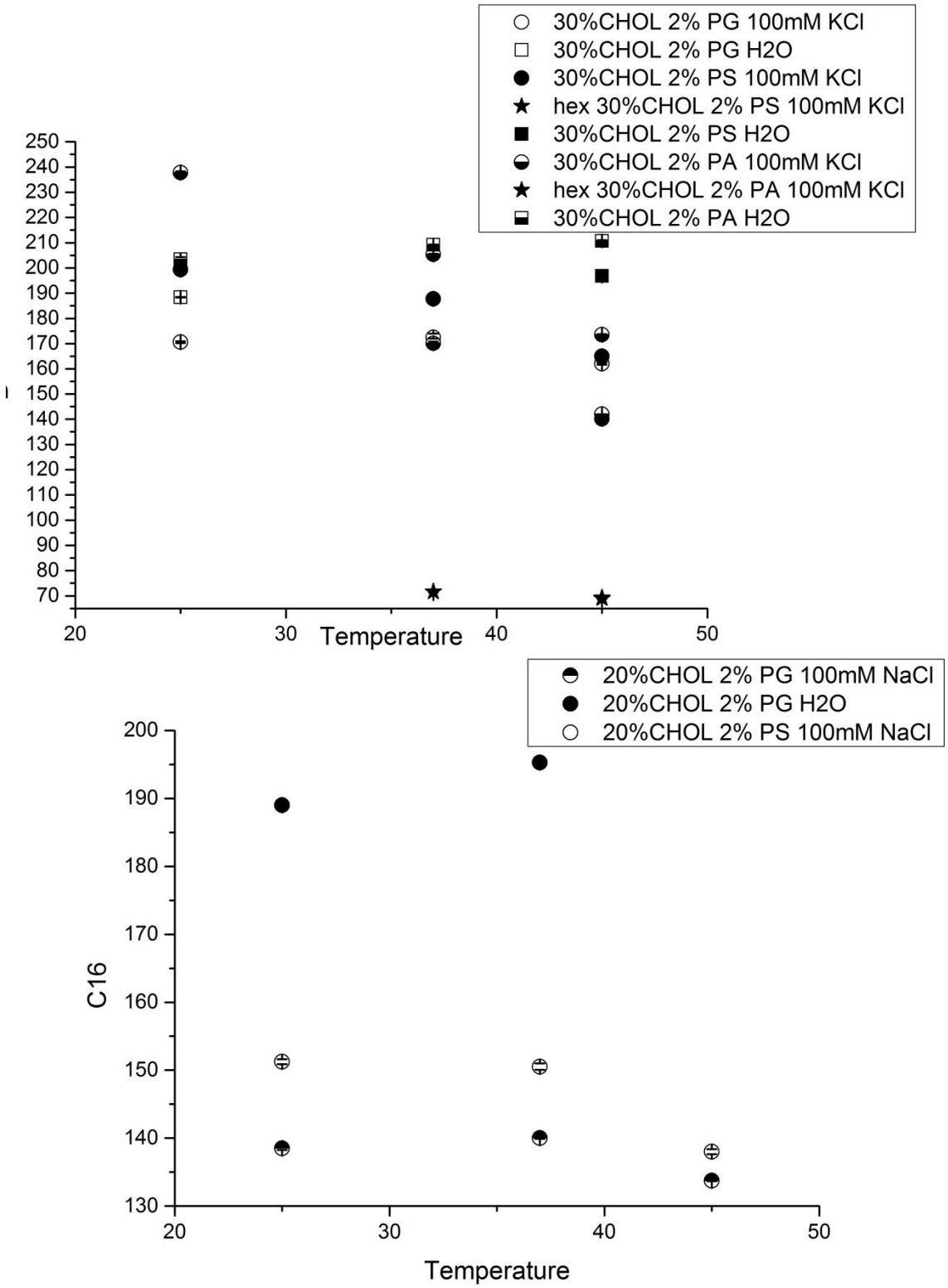
pH 7.4
5% PG
C10
240
220
200
180
160
140
120
10
20
30
mol% CHOL
PG 25degC
PG 37degC
PG 45degC


B
Temperature
30%CHOL 10% PG 100mM KCl
30%CHOL 10% PS 100mM KCl
30%CHOL 10% PS pH 3
hex 30%CHOL 10% PS pH 3


B
Temperature
30% chol, 5% PG, 100mM KCl
30% chol, 5% PG, 50mM KCl
30% chol, 5% PG, 100mM NaCl
30% chol, 5% PG, pH 3
30% chol, 5% PS, 100mM KCl
30% chol, 5% PS, 50mM KCl
30% chol, 5% PS, pH 3
30% chol, 5% PA, 100mM KCl
hex 30% chol, 5% PA, 100mM KCl


30%CHOL 2% PG 100mM KCl
30%CHOL 2% PG H2O
30%CHOL 2% PS 100mM KCl
hex 30%CHOL 2% PS 100mM KCl
30%CHOL 2% PS H2O
30%CHOL 2% PA 100mM KCl
hex 30%CHOL 2% PA 100mM KCl
30%CHOL 2% PA H2O
Temperature
20%CHOL 2% PG 100mM NaCl
20%CHOL 2% PG H2O
20%CHOL 2% PS 100mM NaCl
C16
Temperature