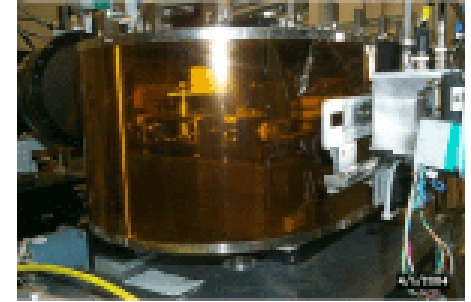


# LSXS School

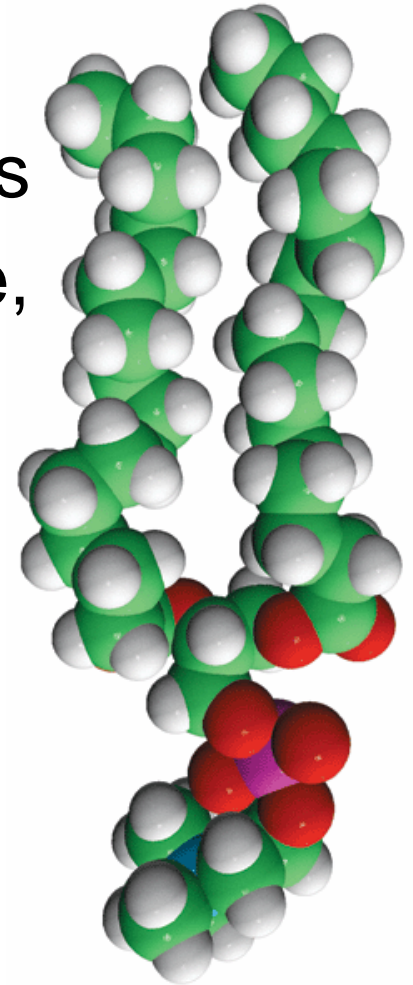
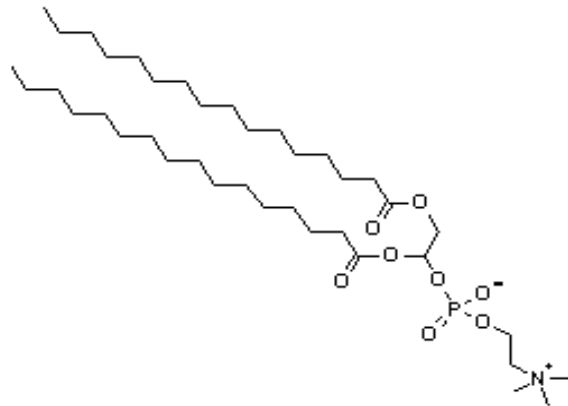
9 November 2007



Specular X-ray Reflectivity from  
DPPC Langmuir Monolayer  
*APS Beamline CMC 9 ID-C*

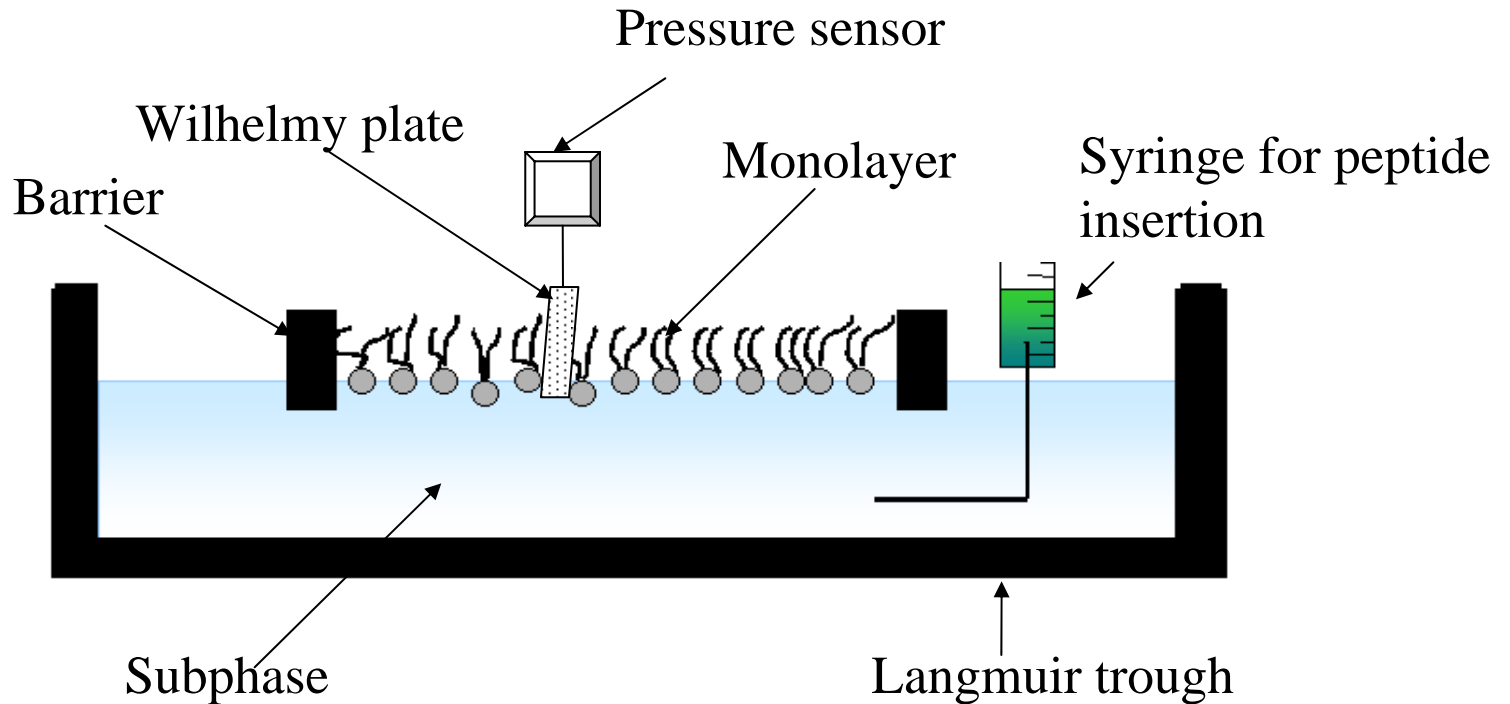
# Introduction

- Langmuir monolayers of lipids are important for modeling cell membranes
- DPPC: Dipalmitoylphosphatidylcholine, a phospholipid
- X-Ray Reflectivity (XRR) studies will determine monolayer structure at interface



# Experimental Setup

- Langmuir trough
  - Pure water subphase
  - DPPC monolayer

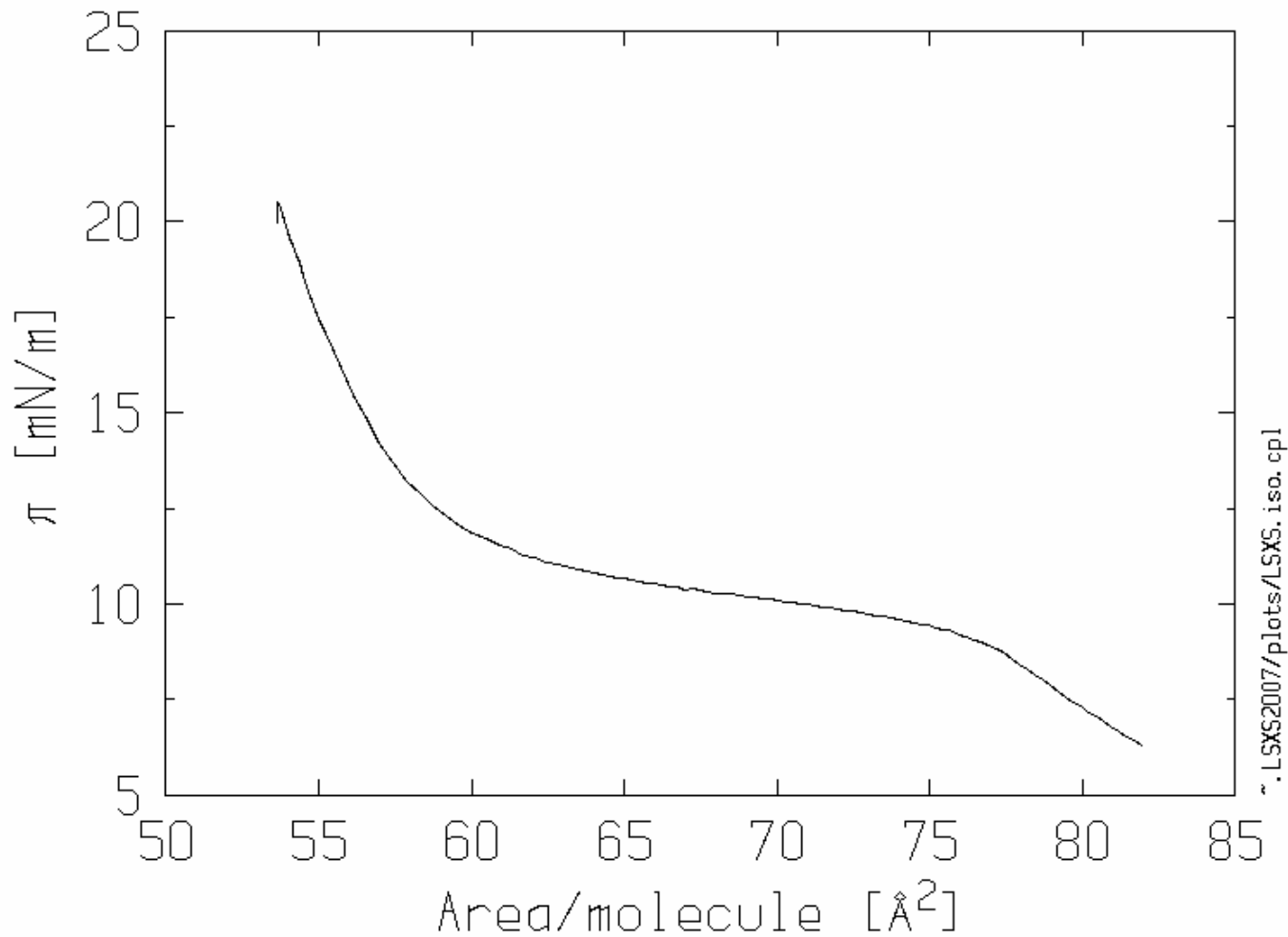


# Experiment

- Deposited 170  $\mu\text{L}$  of DPPC solution in chloroform in Langmuir trough
  - Initial surface pressure  $\sim 5.5$  mN/m
- Allowed chloroform to evaporate
- Measured surface pressure as a function of area per molecule
  - Compressed sample up to  $\sim 21$  mN/m at  $\sim 55$   $\text{\AA}^2/\text{molecule}$
- Performed XRR experiment

# Results

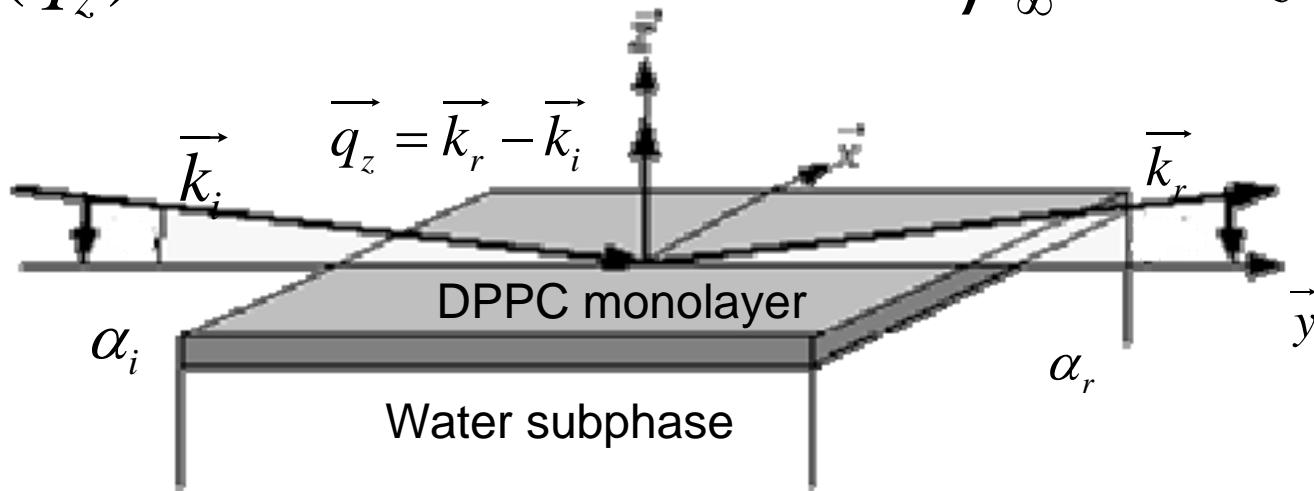
- DPPC  $\Pi$ -A Isotherm



# Reflectivity

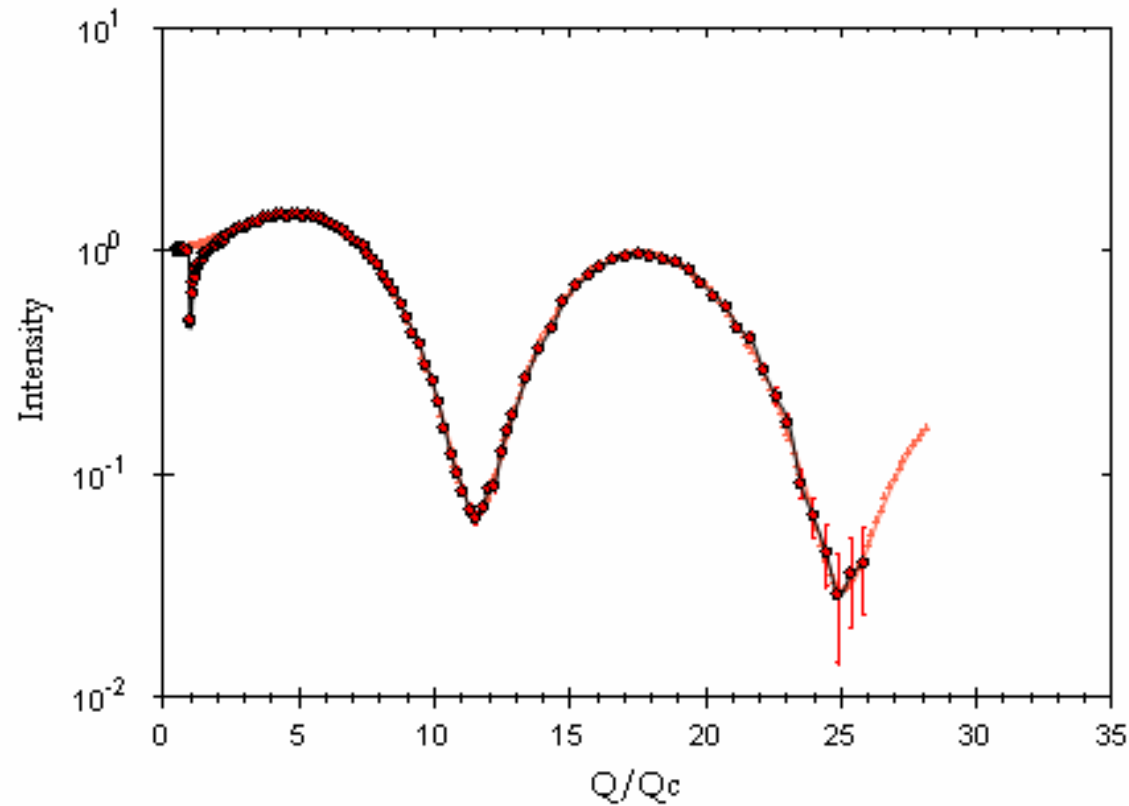
- Key equations:

$$\frac{R(q_z)}{R_F(q_z)} = |\phi(q_z)|^2 \quad \phi(q_z) = \frac{1}{\rho_\infty} \int \frac{d\rho(z)}{dz} e^{iq_z z} dz$$



$$q_z = 4\pi \sin \alpha_i / \lambda$$

# Results



## Model Independent Parameters

Surface density: 1.09

Surface layer height: 25

Surface layer MW: 734

Surface layer electron count: 403

The surface layer was treated as transparent

Subphase density: 0.996

Subphase layer MW: 18

Subphase layer MW: 10

The subphase layer was treated as transparent

Number of layers in the reflectivity: 40

Iterations completed: 2793040

Critical edge offset: 0

High Q offset: 0

Roughness Search Percentage: 20 %

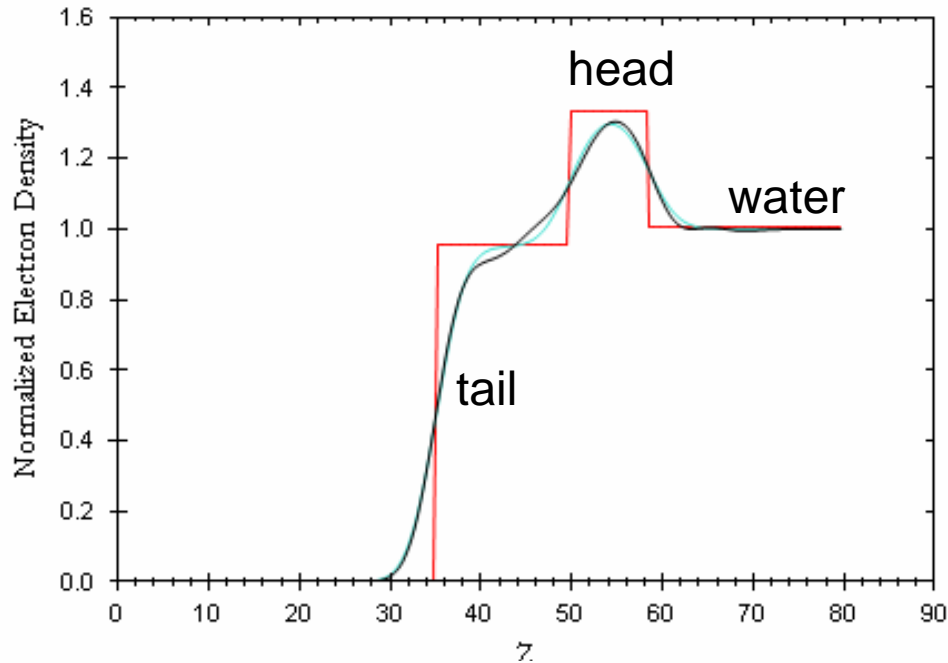
X-ray wavelength: 0.92

Fit Score for the reflectivity: 2.9348

E000

# Results

- Density profile with 2-box model



The electron density profile was fit with a single roughness parameter

Chi Square for reflectivity fit:  
21.492 E-5

Subphase roughness: 2.519 E0  
± 2.904 E-2

Layer #	Length	Rho/Rho(infinity)	Sigma
1	1.473 E1 ± 2.295 E-2	9.501 E-1 ± 8.811 E-2	2.519 E0 ± 2.904 E-2
2	8.723 E0 ± 2.506 E-3	1.327 E0 ± 1.629 E-1	2.519 E0 ± 2.904 E-2

# Acknowledgments

- We gratefully acknowledge Ivan Kuzmenko, Binhua Lin, Mati Meron, Oleg Shpyrko, Ka Yee Lee, Pulak Dutta, Jim Viccaro, and Steve Danauskas for teaching us
- We thank Jane Andrew for all of her support
- LSXS classmates

The End

