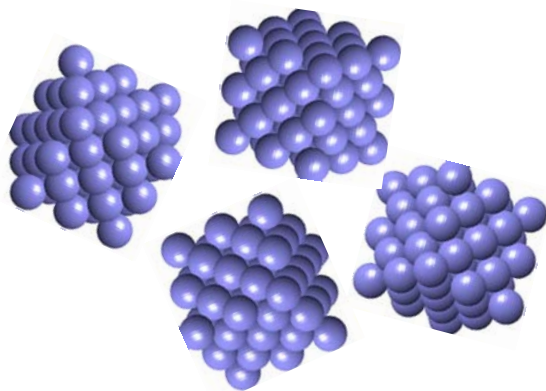


# Monolayers: ultrathin films on liquids & solids

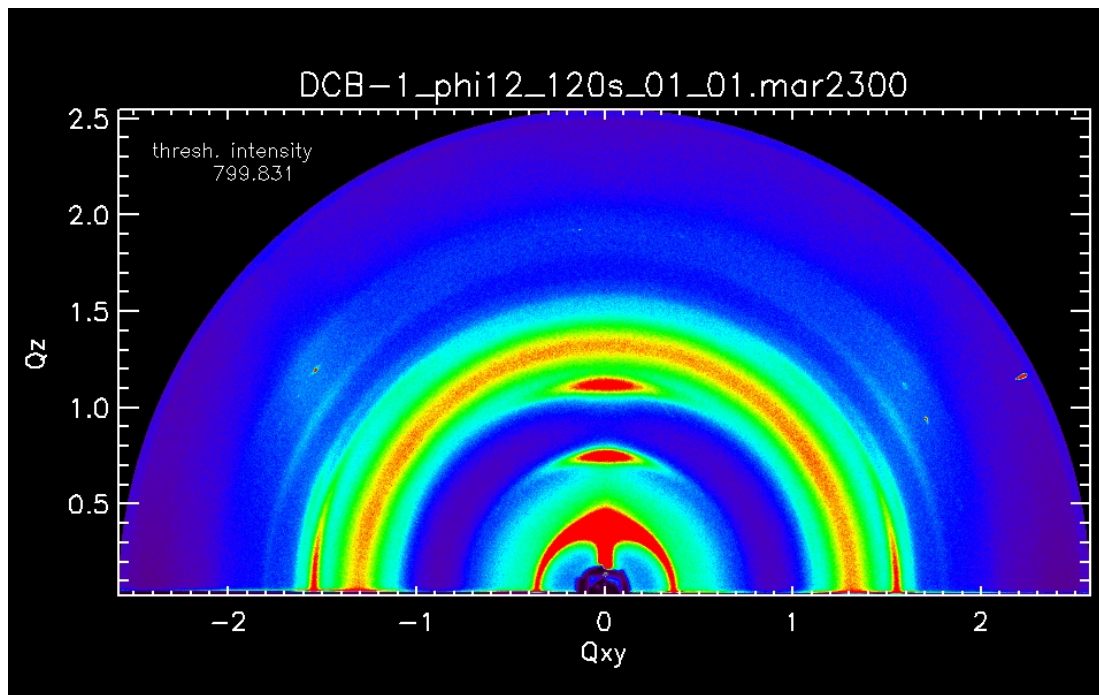
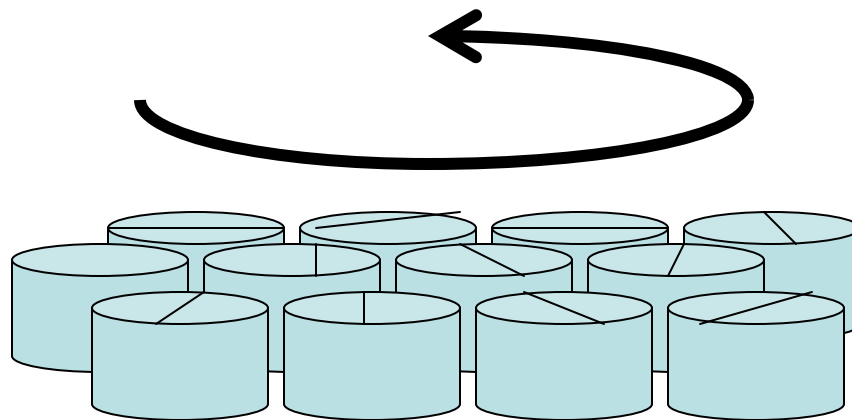
Chad Miller & Stefan Mannsfeld



# 3D vs. 2D powders

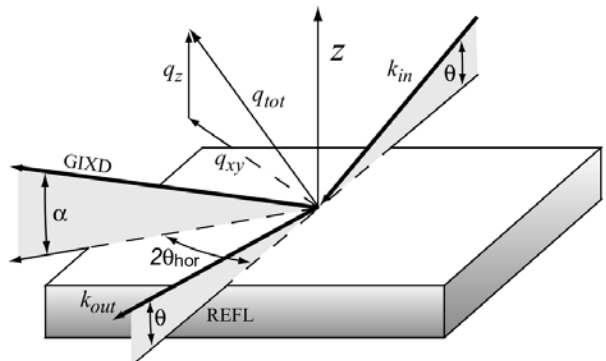
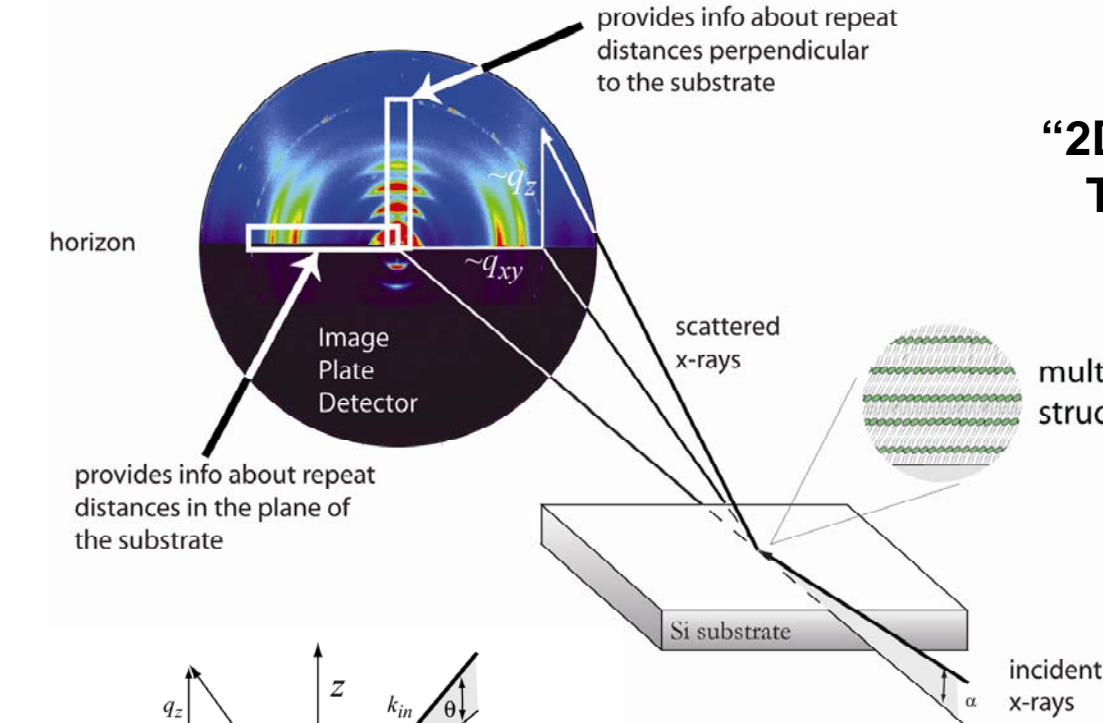


“3D Powder”

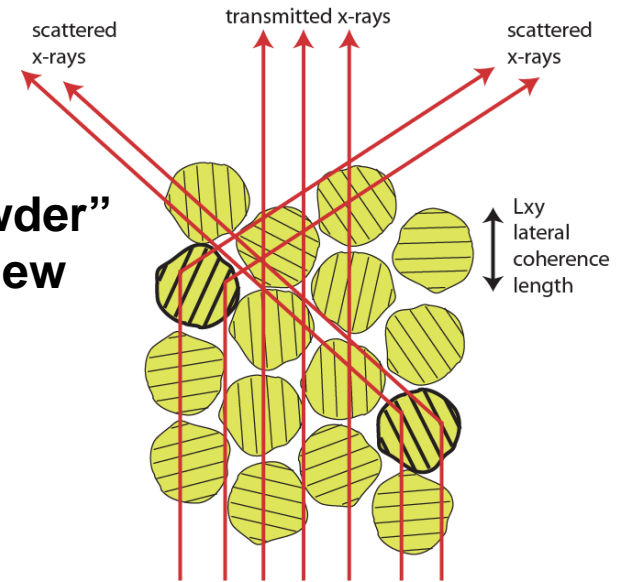


# Grazing Incidence X-Ray Diffraction (GIXD)

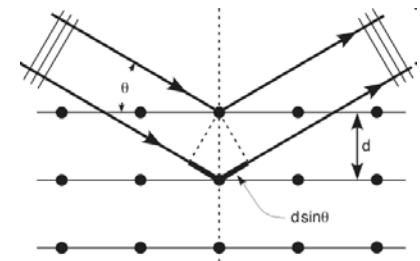
GIXD can provide information about any lateral or normal ordering within the system. For the GIXD experiments, the x-ray beam was adjusted to strike the surface at a grazing angle incident angle.



“2D Powder” Top view

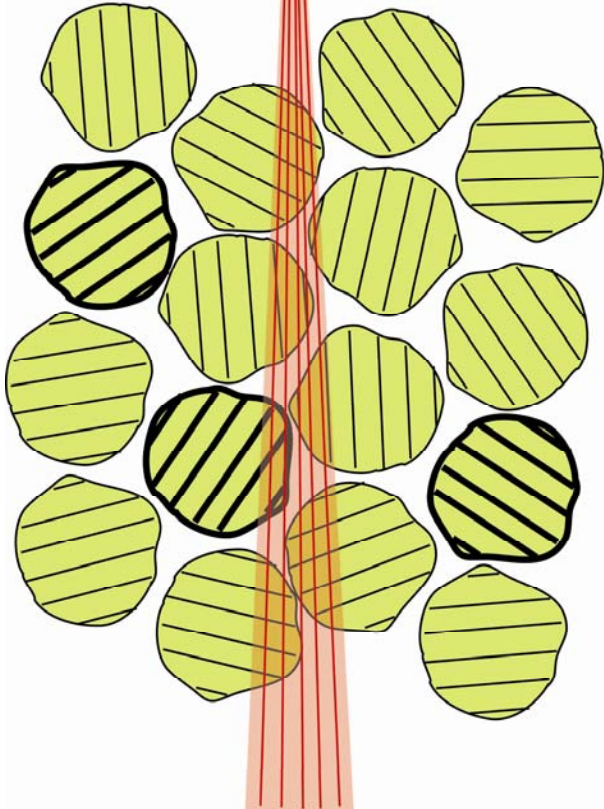


Bragg Diffraction



# 2D powders

Well collimated  
beam

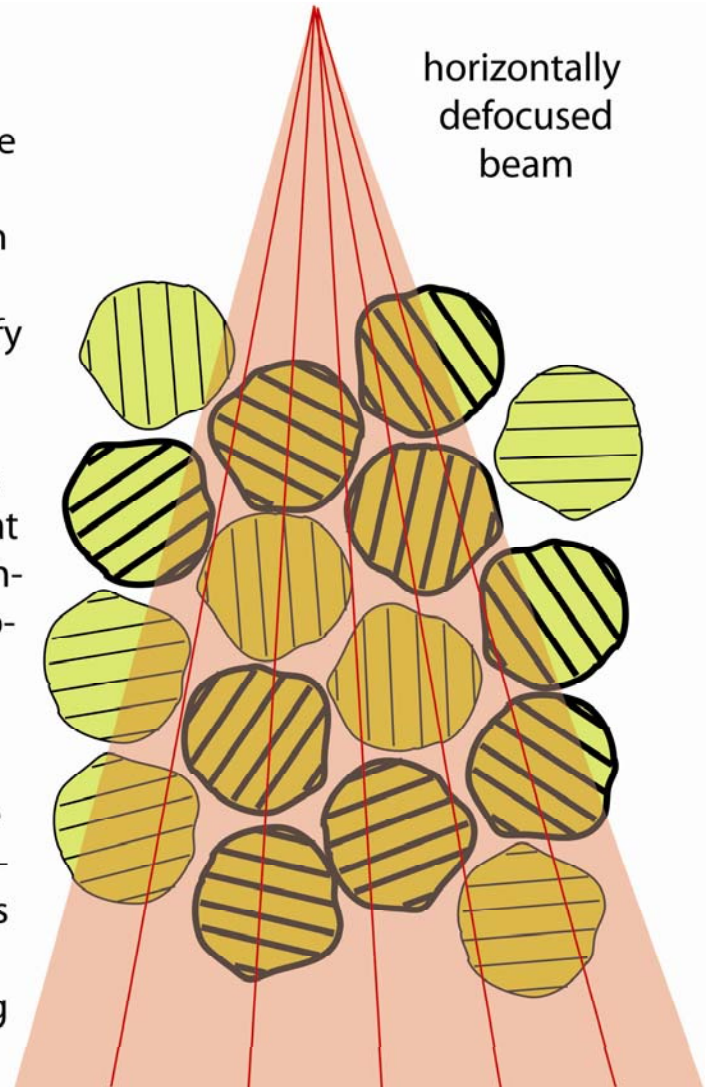


Two identical  
2D powders where  
the molecules in  
each region are in  
registry and the  
parallel lines signify  
their d-spacing.

The bold regions  
signify regions that  
fulfill the Bragg con-  
dition and contrib-  
ute to the GIXD  
signal.

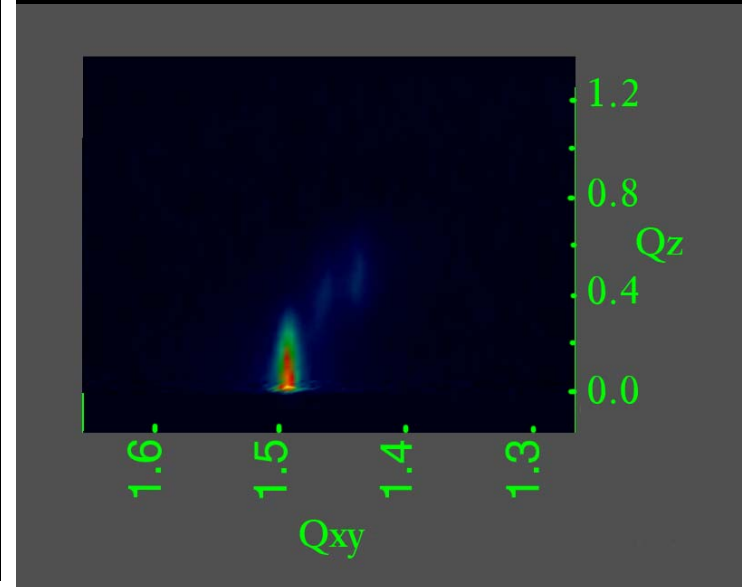
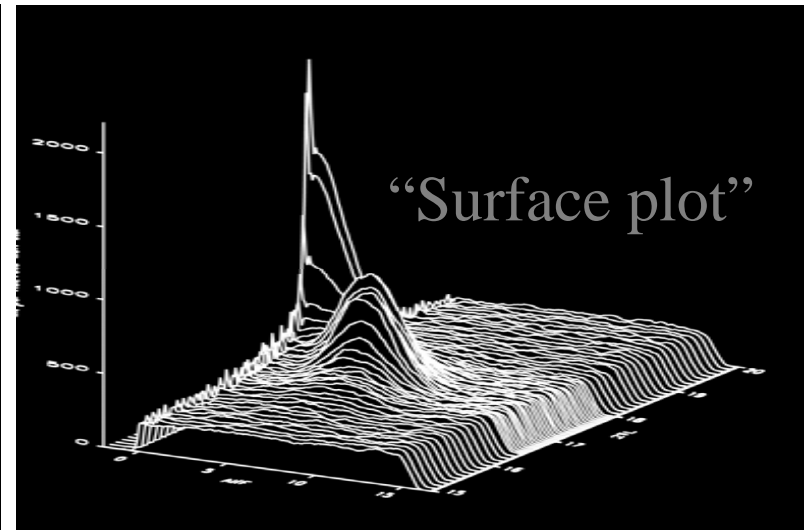
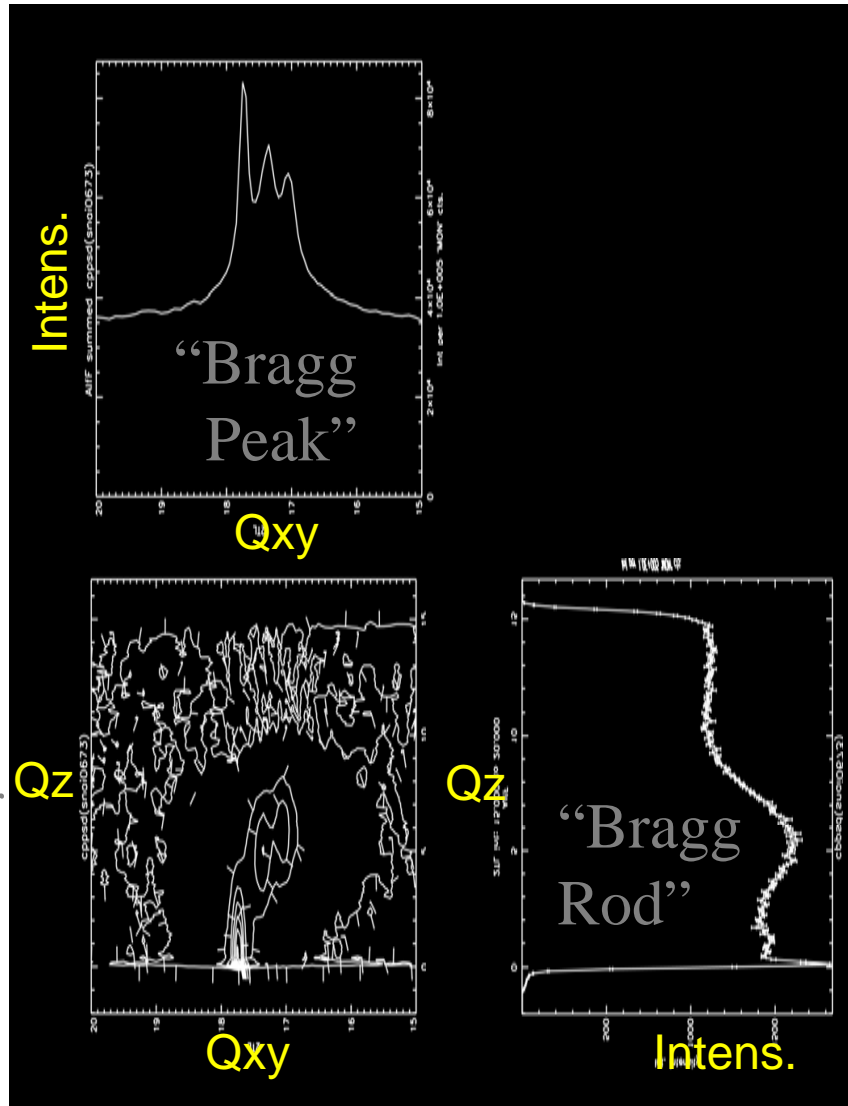
By increasing the  
divergence (ie de-  
focusing) it allows  
more regions to  
scatter, increasing  
the GIXD signal.

horizontally  
defocused  
beam

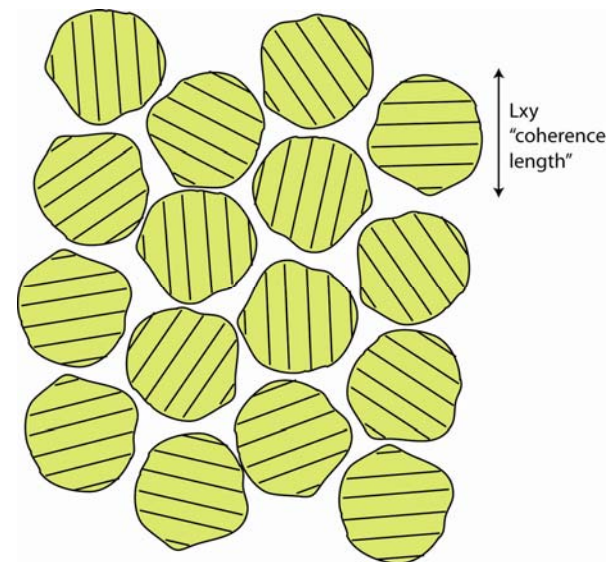
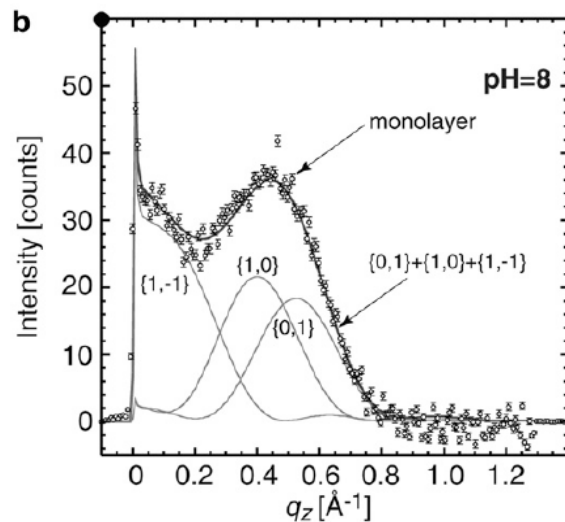
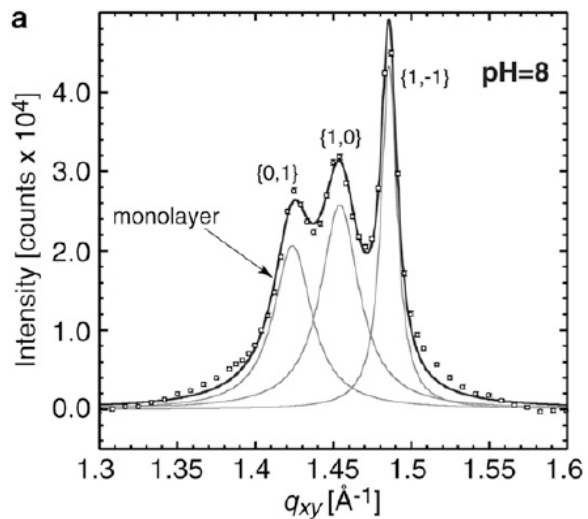




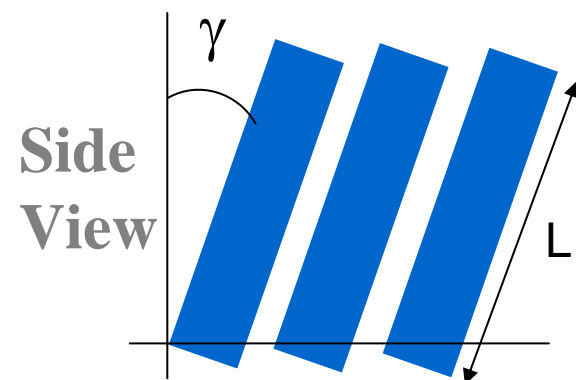
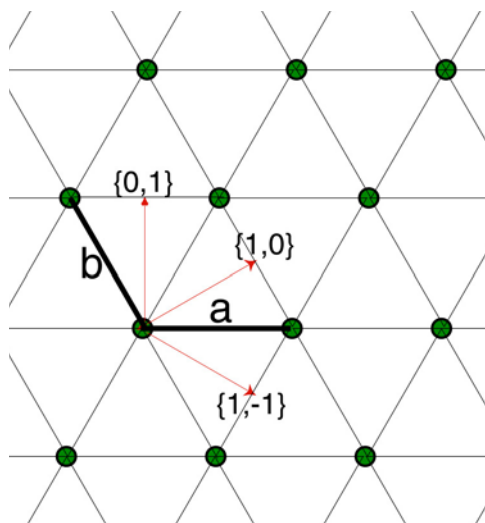
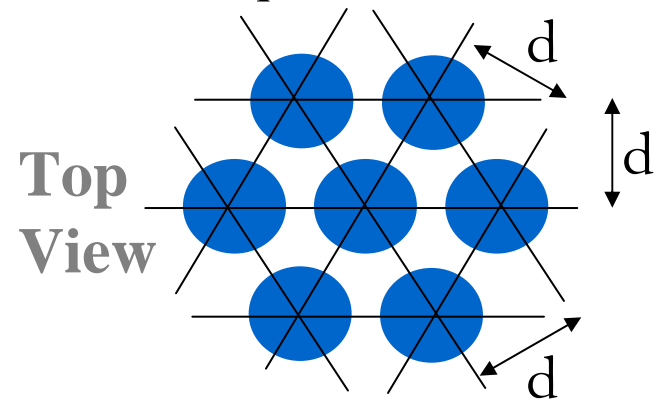
# Typical GID Data: Lipid Monolayers at the Air-Water Interface



“Contour Plot”

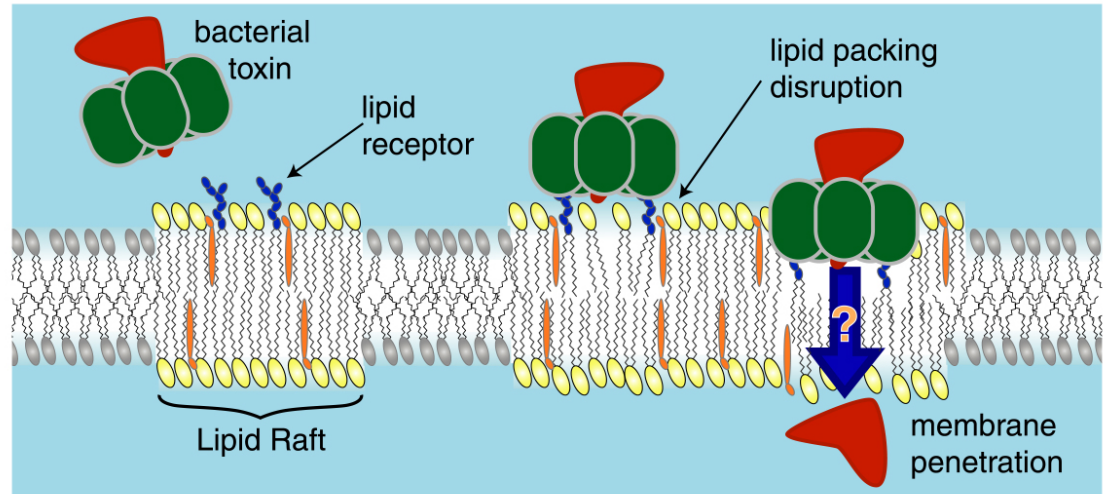


Oblique Unit Cell

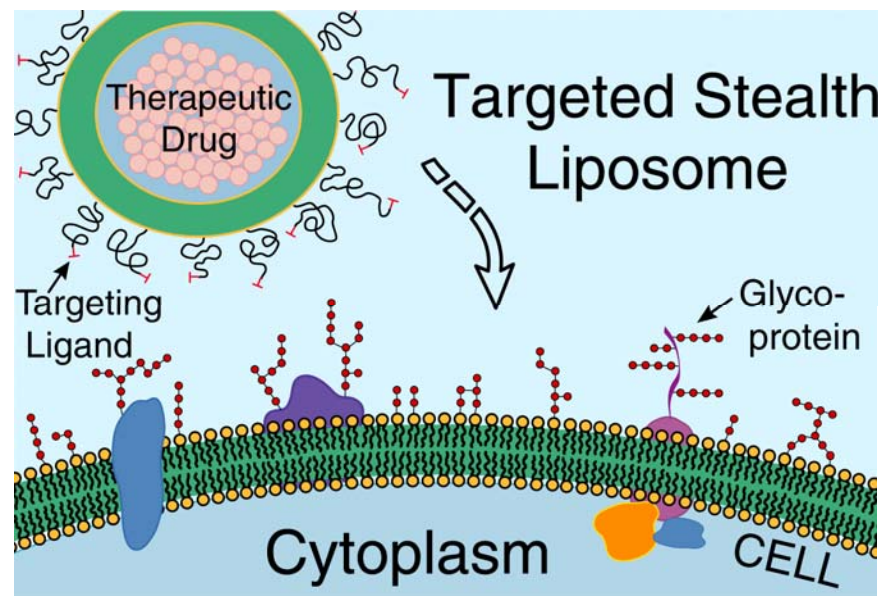


# Example: Lipid Membranes

Bio-toxin assault

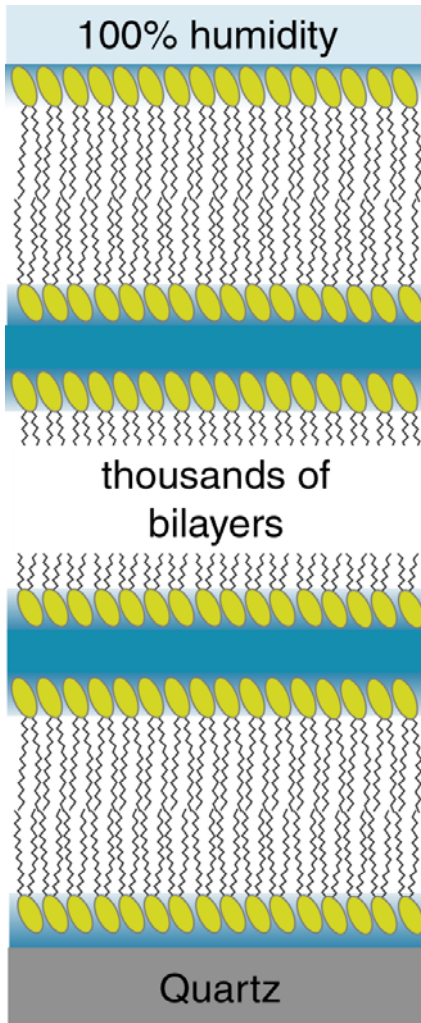


Drug Targeting  
~80% of pharmaceuticals target membrane proteins.

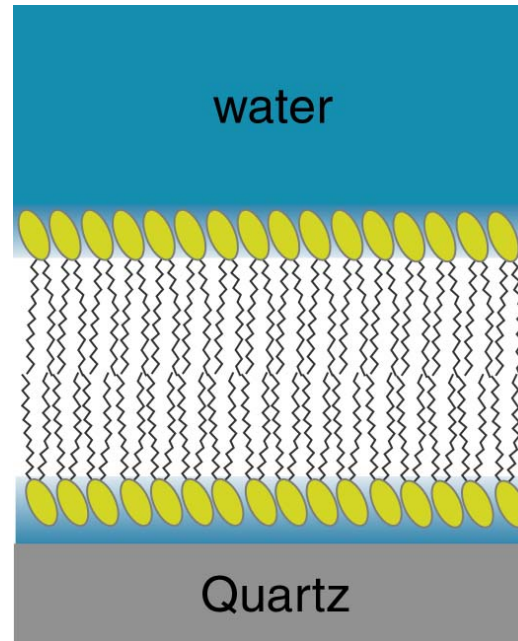


# Model Membranes

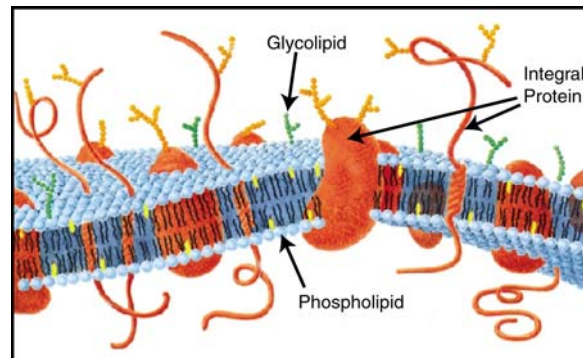
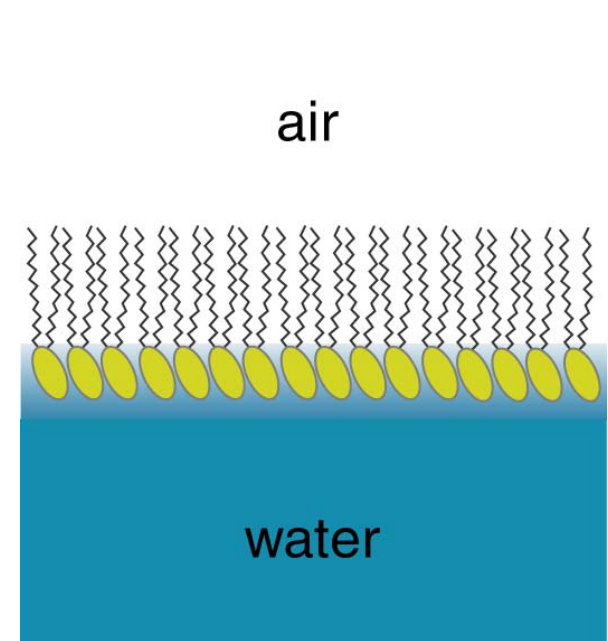
## Multilayers



## Single Bilayer



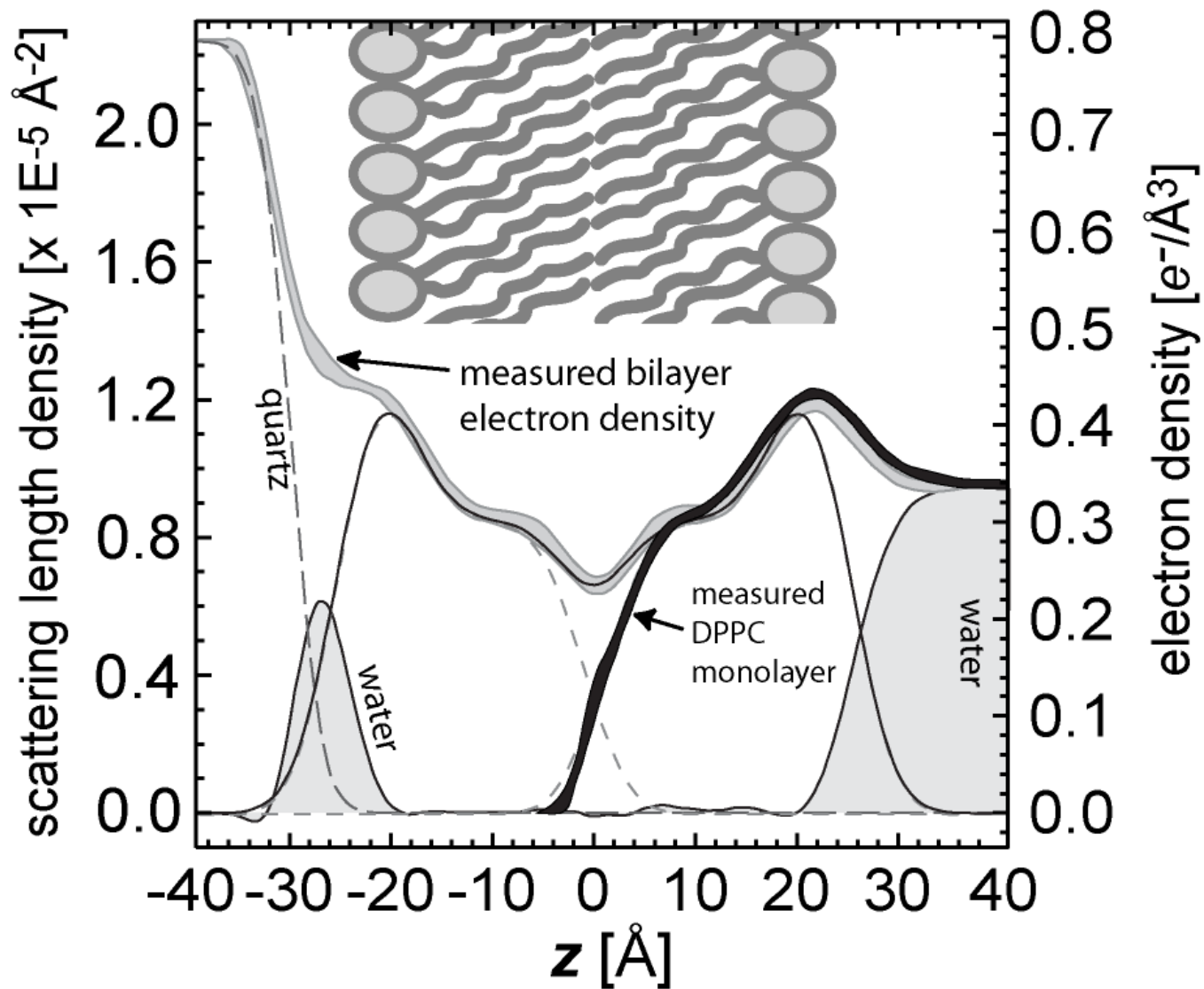
## Monolayer



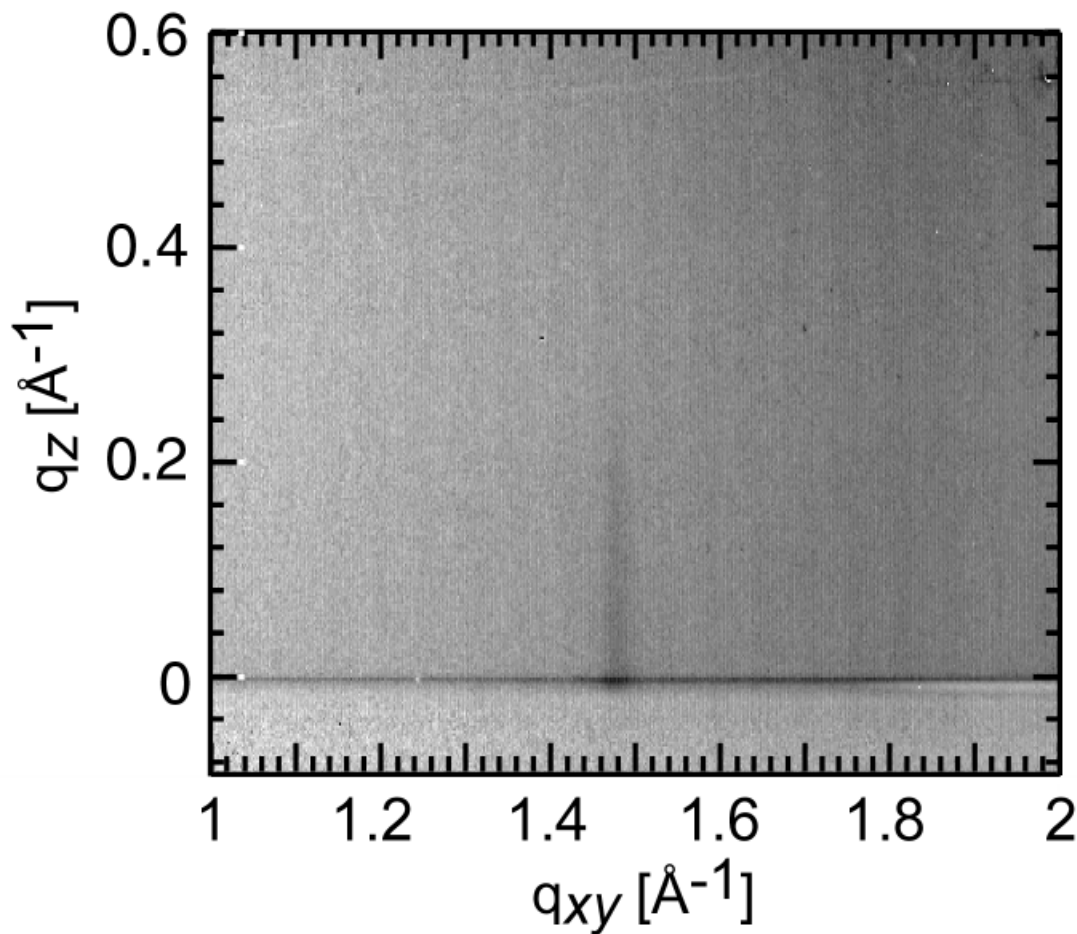
## Real Cell Membrane



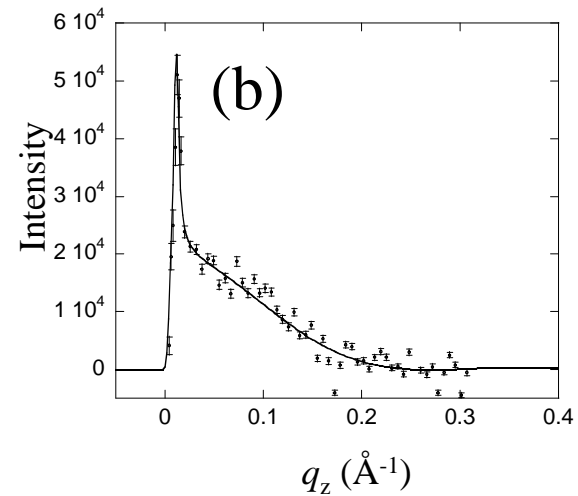
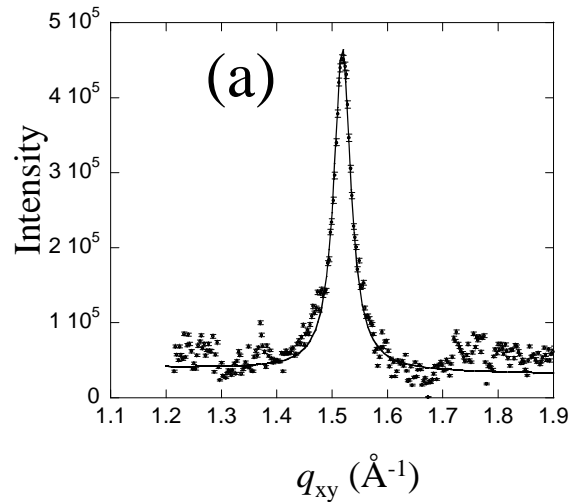
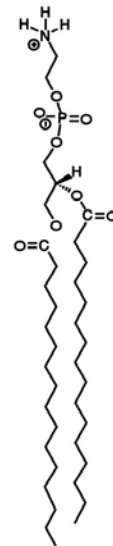
# Bilayer vs. Monolayer



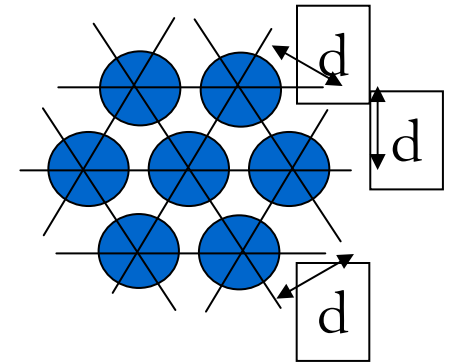
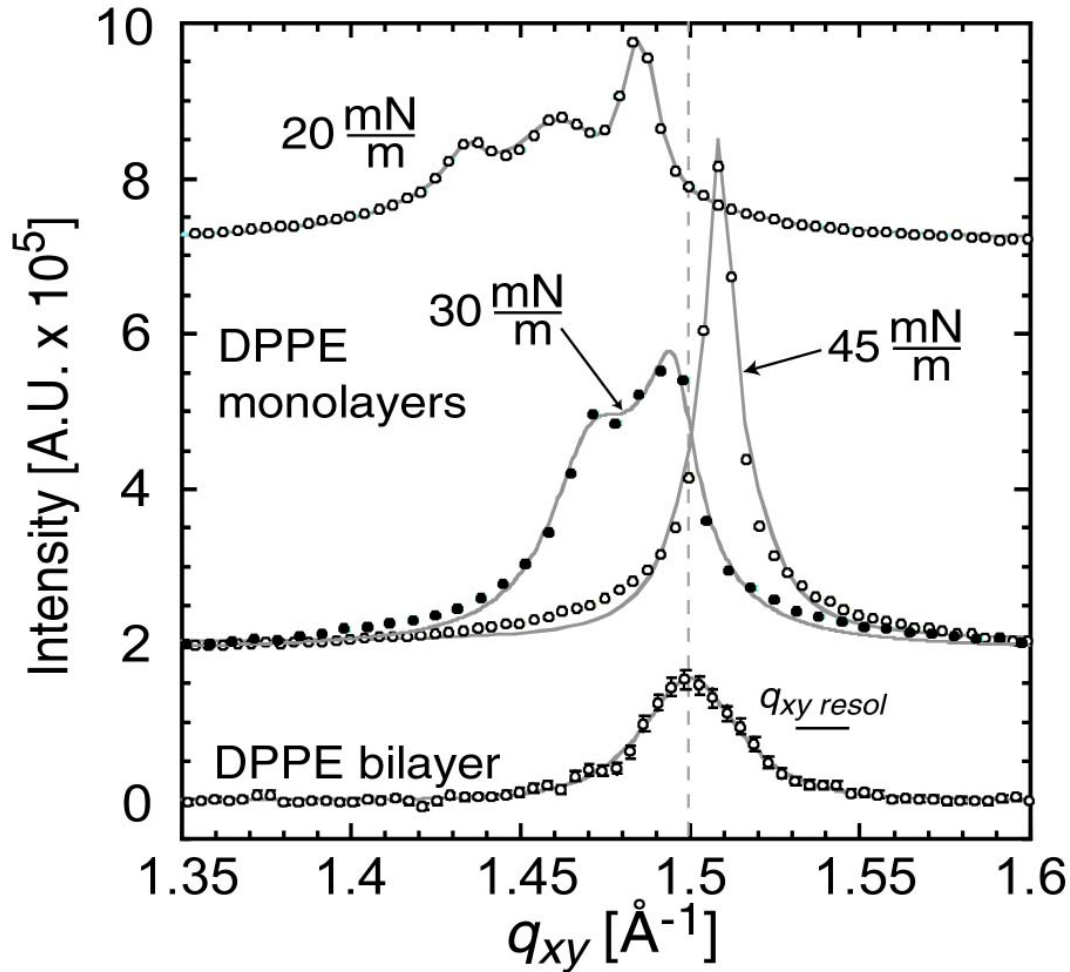
# GIXD Scattering from DPPE Bilayer at the Solid-Liquid Interface



DPPE  
(16:0)



# DPPE Bragg Peaks

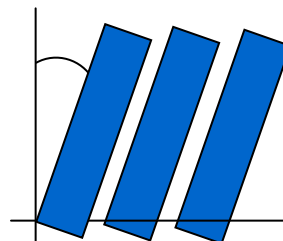
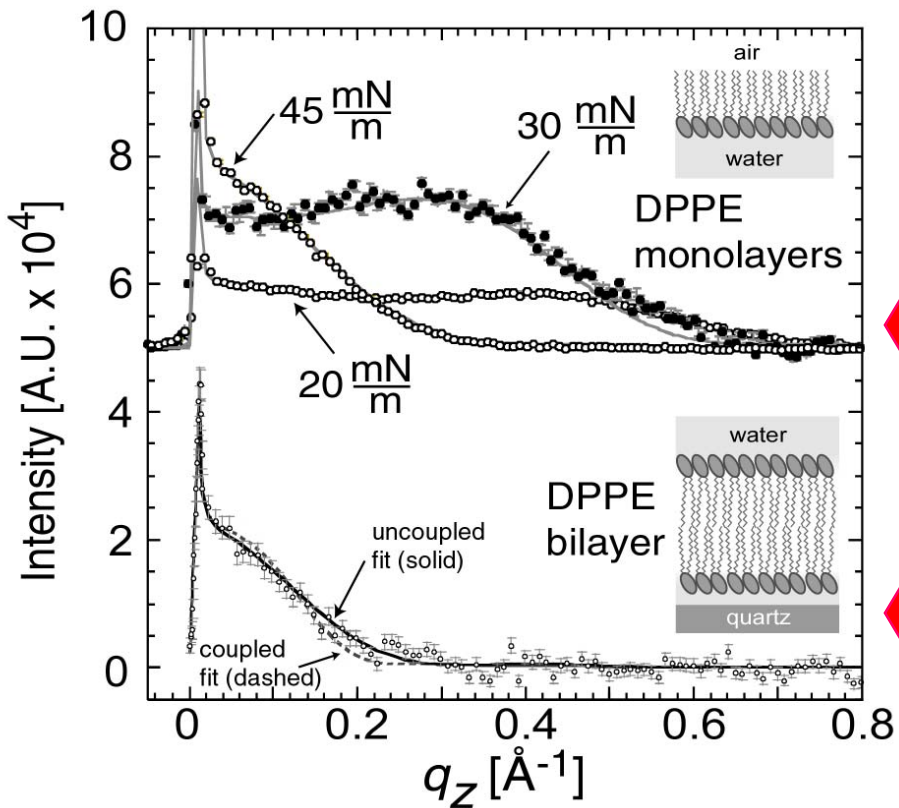


**Bilayer peak position @  
~30mN/m for monolayer**

**In-plane structure of bilayer  
is more disordered.**

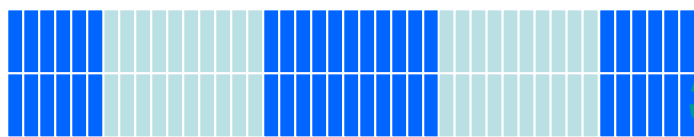
**Little distortion of the  
hexagonal unit cell**

# GID (Bragg Rods) of Single DPPE Bilayers

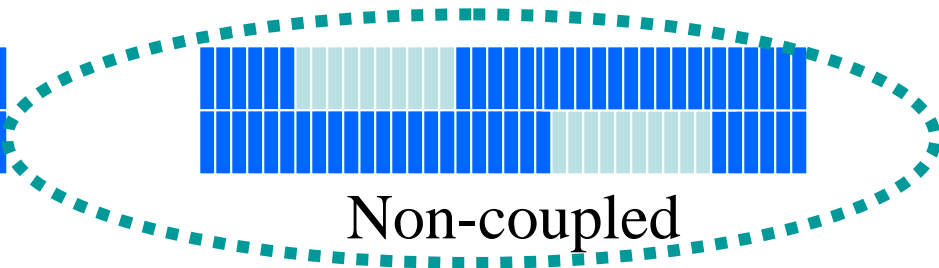


<b>Monolayers</b>	<b>H</b>	<b>tilt</b>
DPPE @ 20mN/m	21Å	21°
DPPE @ 45mN/m	21Å	5°

<b>Bilayer</b>	<b>H</b>	<b>tilt</b>
DPPE model	21Å	0-5°



coupled

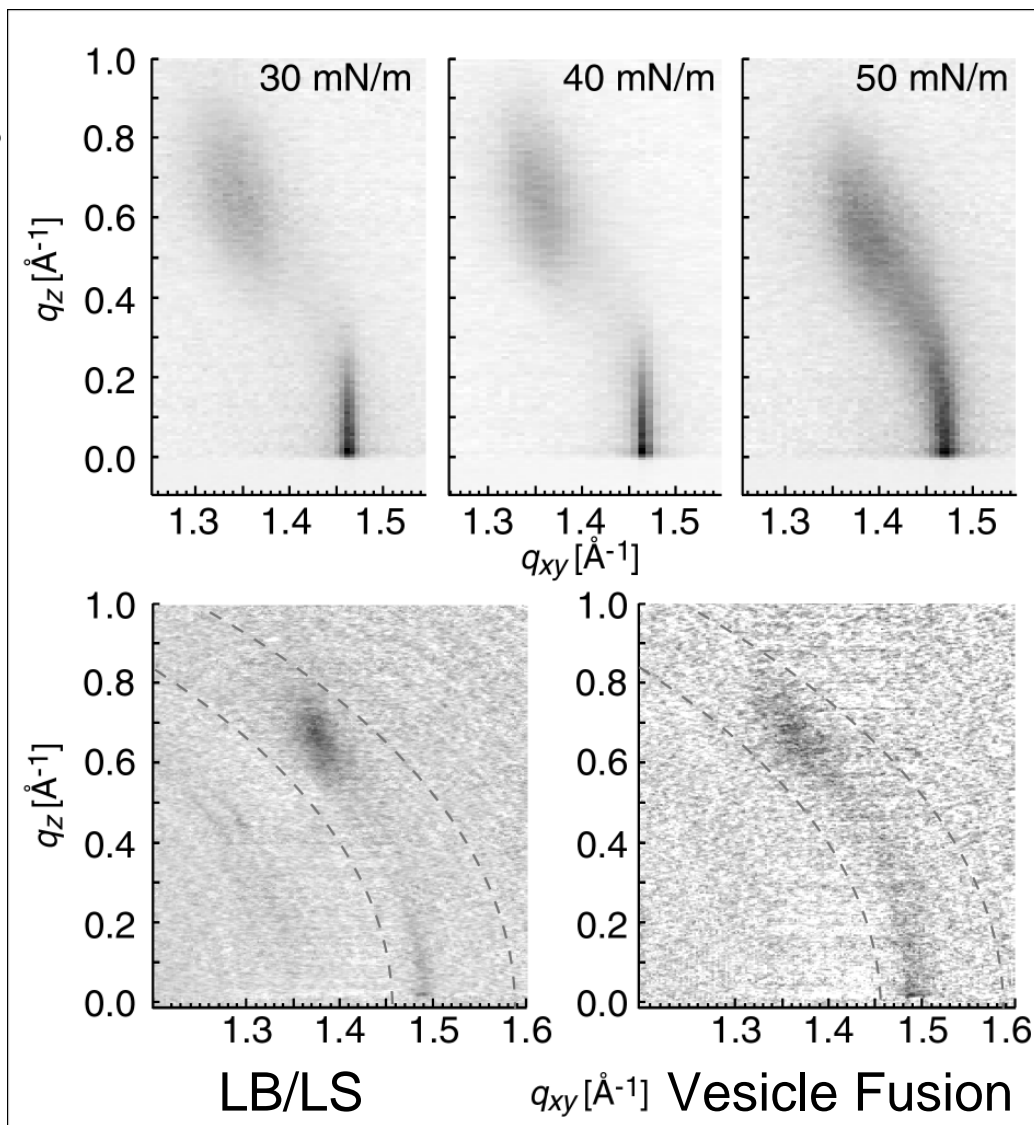


Non-coupled

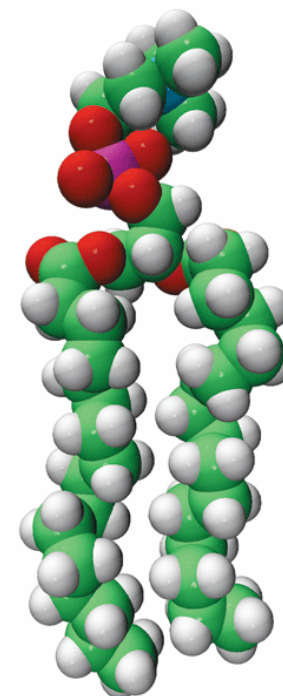
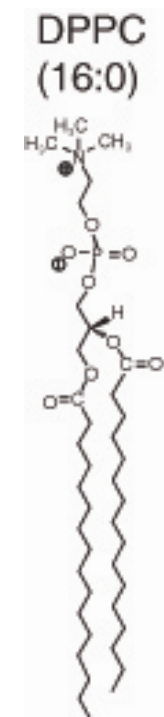


# GIXD of DPPC Mono- and Bi-Layers

Mono-Layers  
Air-Water  
Interface



Bi-Layers  
Solid-Liquid  
Interface



# DPPC Bragg Peaks

