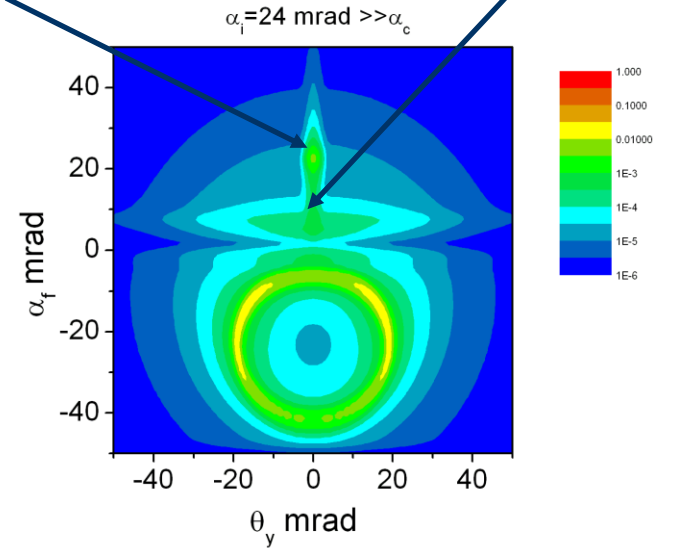
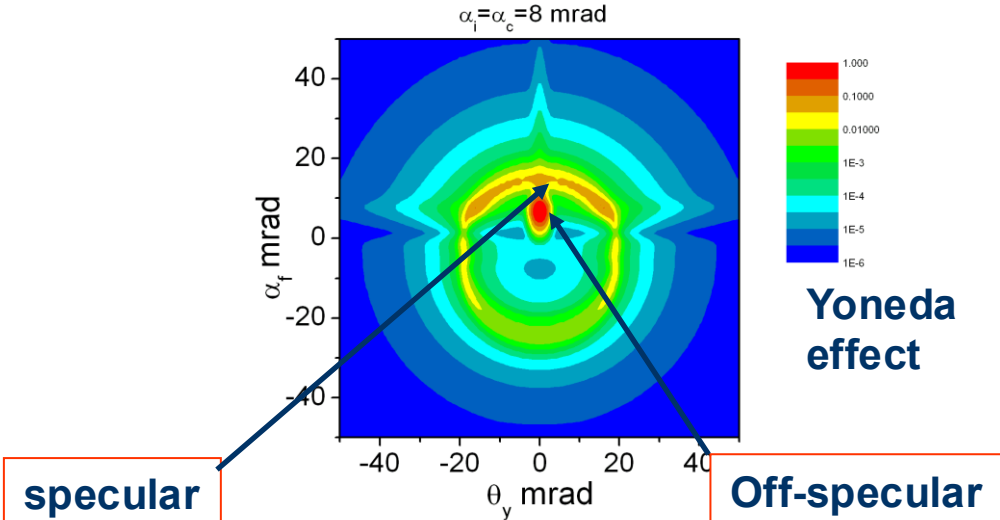
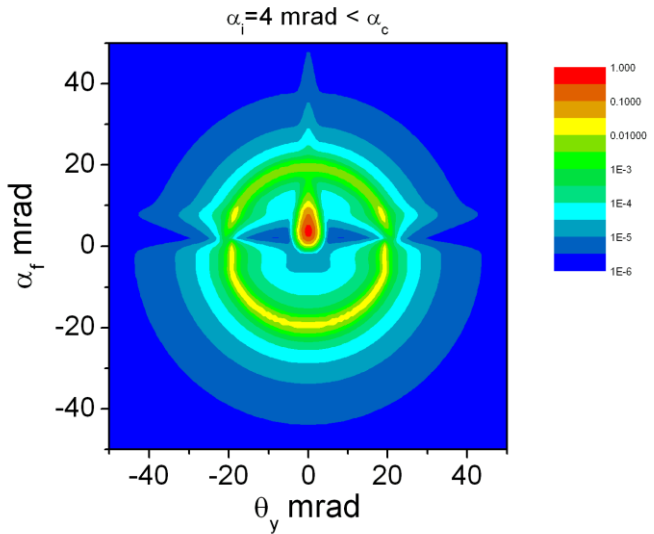
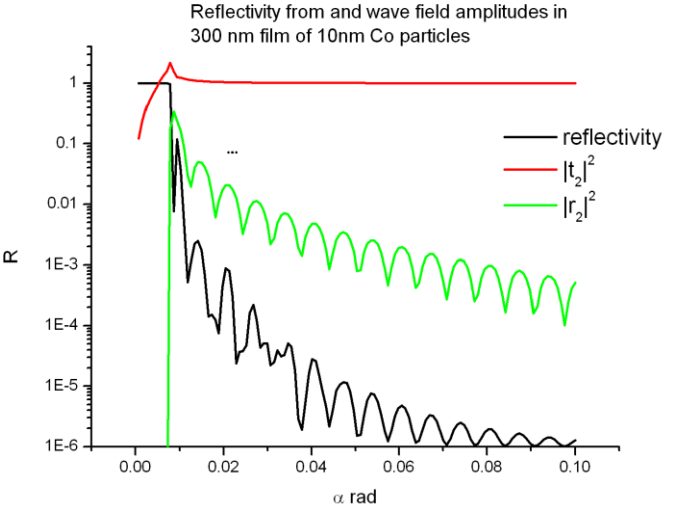
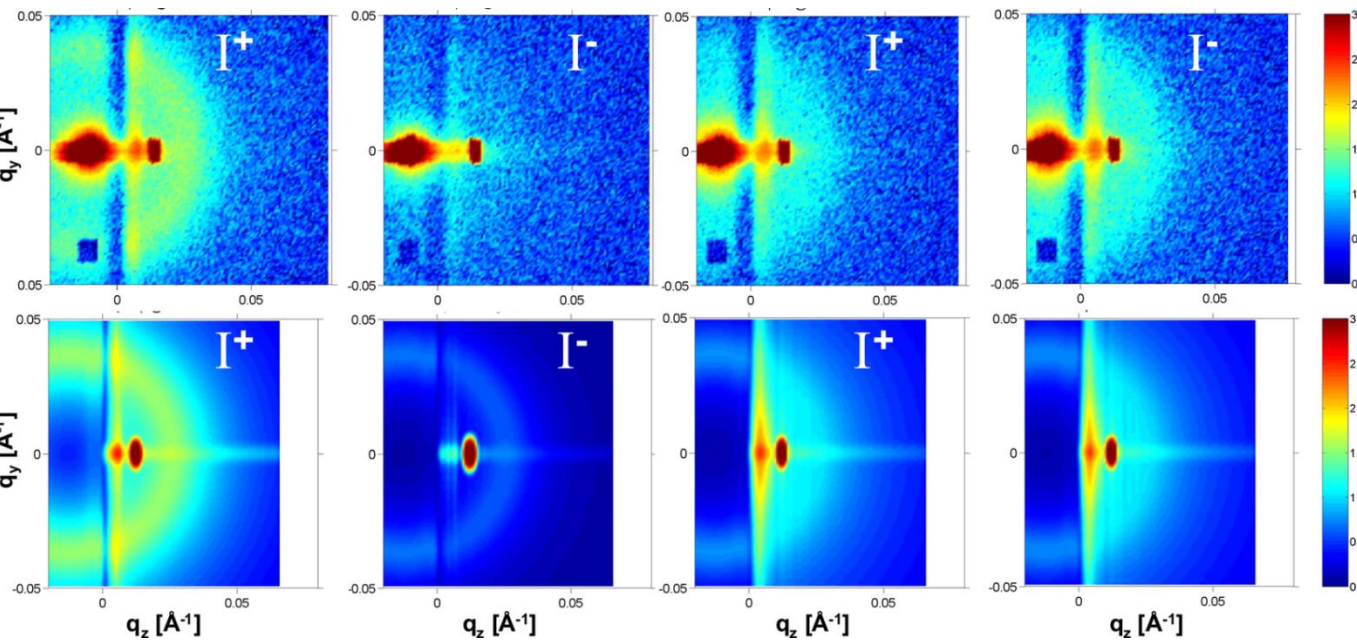
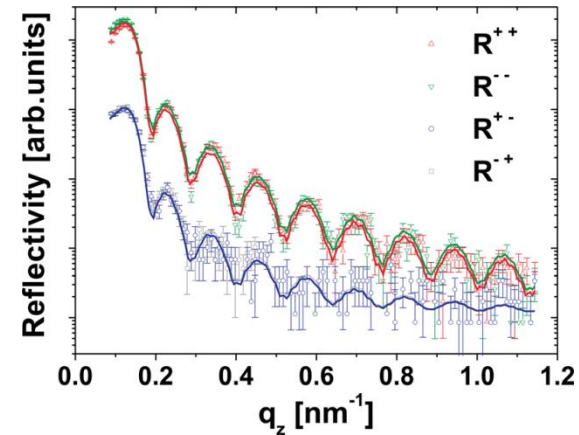
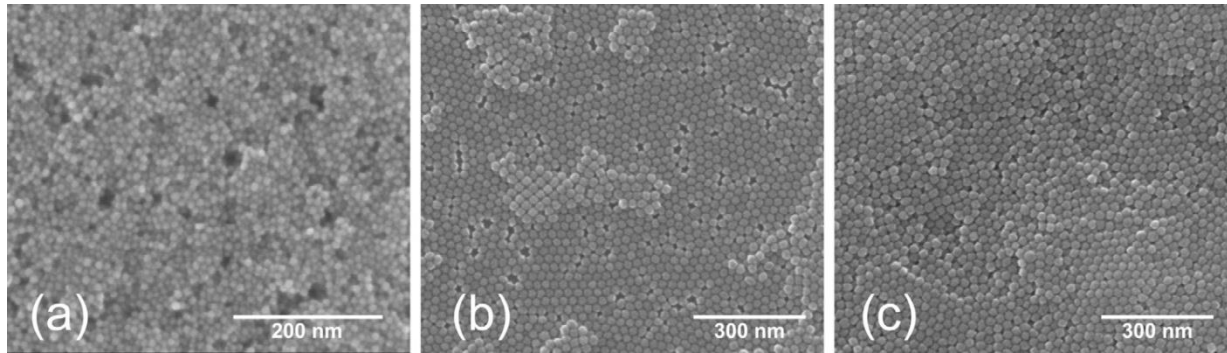


# Example: GISANS from 300 nm paracrystalline film of 10 nm Co nano-particles



# Self organization of magnetic Co nanoparticles: polarized grazing incidence small angle neutron scattering

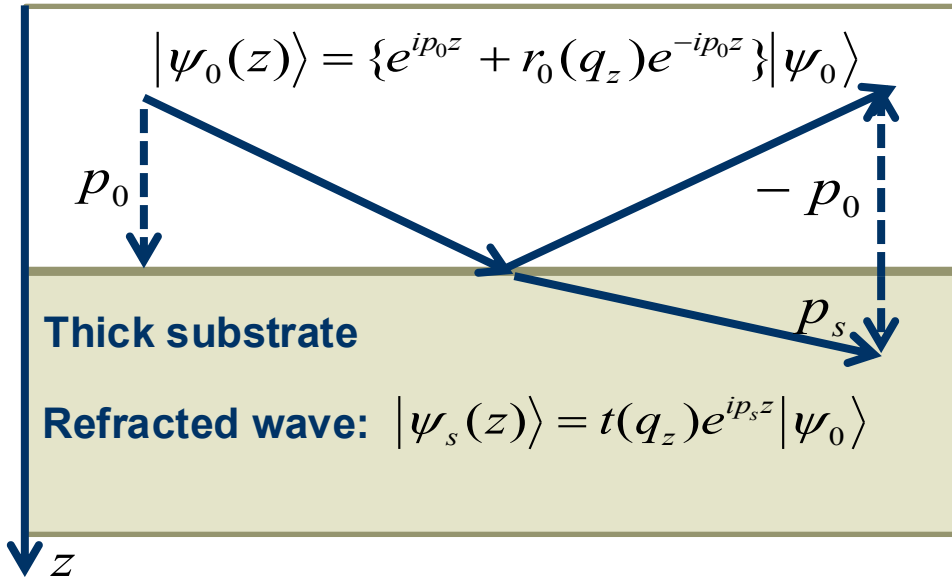


reflectometry  
ADAM, ILL  
GISANS D22

simulations

# Specular reflection $\alpha_i = \alpha_f, \theta_y = 0$

Ideal surface: wave function is factorized  $\psi(\mathbf{r}) = e^{i(k_x x + k_y y)} \psi(z)$

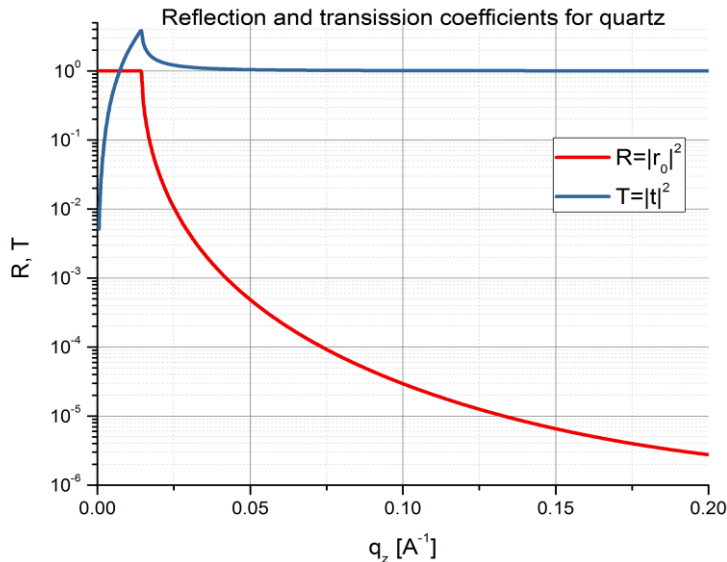


wave vector transfer :  $q_z = 2p_0$ ,  
 reflection & transmission amplitudes :  
 $r_0(q_z)$  &  $t(q_z)$

refracted wave number :  $p_s = \sqrt{p_0^2 - p_c^2}$

critical wave number :  $p_c = \sqrt{4\pi Nb}$

scattering length density (SLD) :  $Nb$



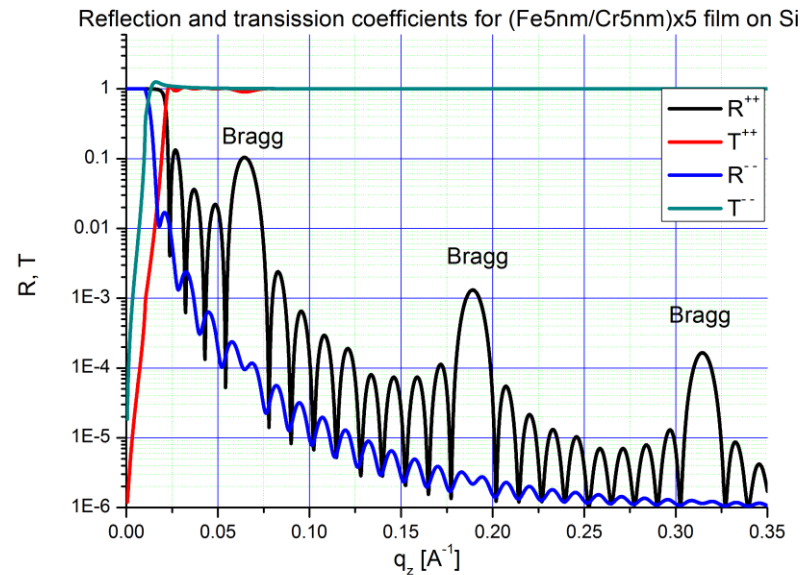
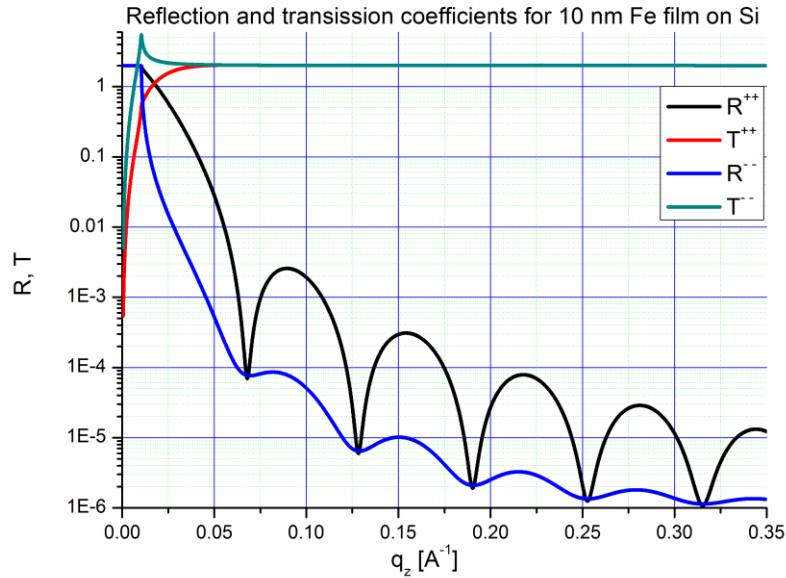
## Fresnel formulae:

$$r_0 = \frac{p_0 - p_s}{p_0 + p_s}, \quad t = \frac{2p_0}{p_0 + p_s}$$

$R(q_z) = |r_0(q_z)|^2$  is the reflection coefficient

$T(q_z) = |t(q_z)|^2$  is the transmission coefficient

# Specular reflection obligatory for determination of wave field parameters



$$|\psi_0(z)\rangle = \{e^{ip_0z} + r_0(q_z)e^{-ip_0z}\}|\psi_0\rangle$$



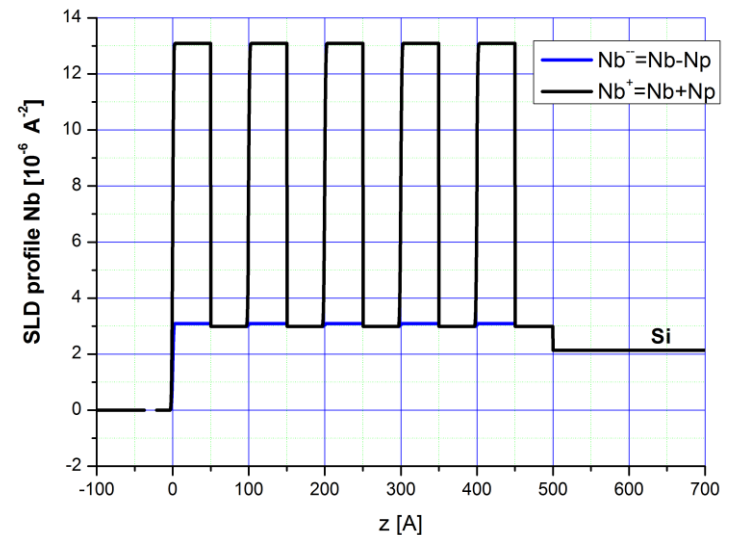
$$|\psi_{N+1}(z)\rangle = t(q_z)e^{ip_{N+1}z}|\psi_0\rangle$$

$$|\psi_n(z)\rangle = \{t_n e^{ip_n(z-z_{n-1})} + r_n e^{-ip_n(z-z_{n-1})}\}|\psi_0\rangle$$

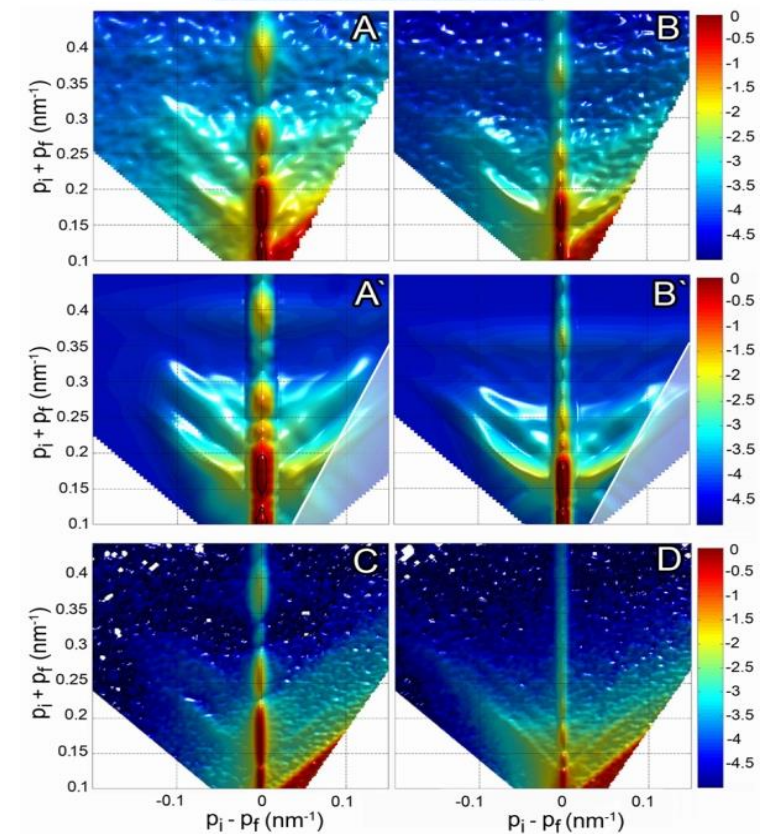
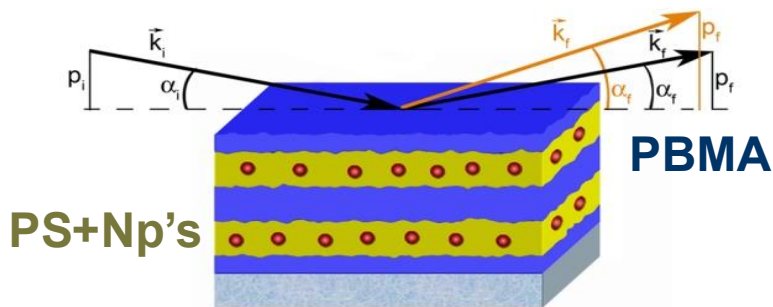
$$p_n = \sqrt{p_0^2 - p_{cn}^2}, \text{ in layers } 0 < n \leq N$$

**Flux continuity:**

$$|\psi_n(z_n)\rangle = |\psi_{n+1}(z_n)\rangle \ \& \ |\psi'_n(z_n)\rangle = |\psi'_{n+1}(z_n)\rangle$$



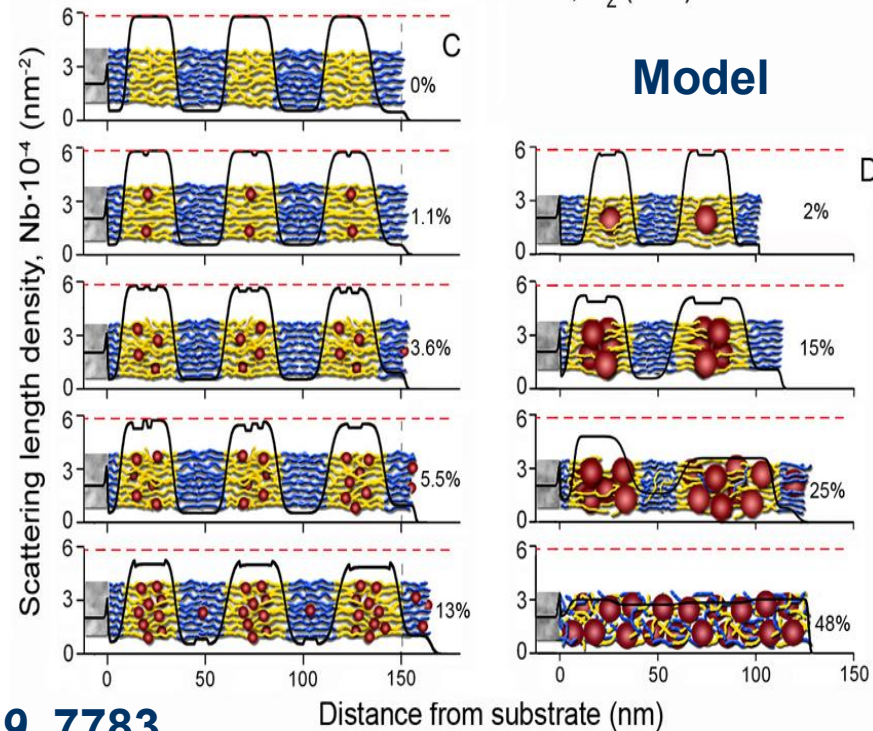
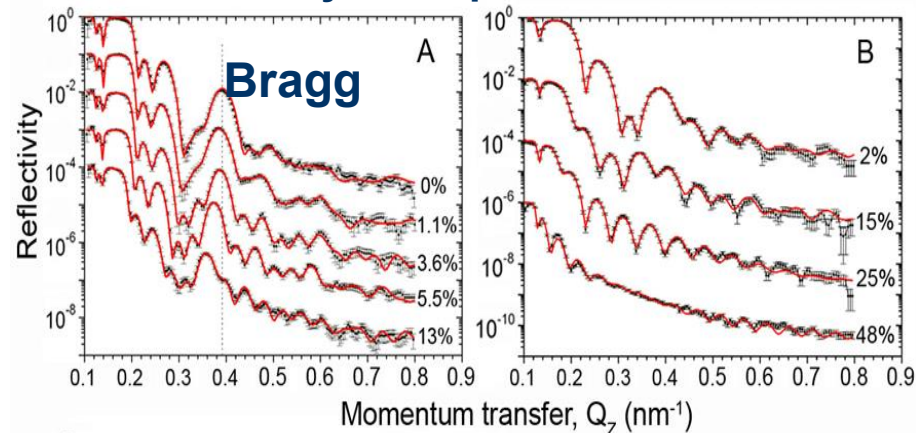
# Self assembling of PS coated nanoparticles in symmetric P(Sd-b-BMA) lamellar films



OSS:  
@IBR-2  
Dubna

Theory

## Reflectivity v.s. Np's concentration



Model

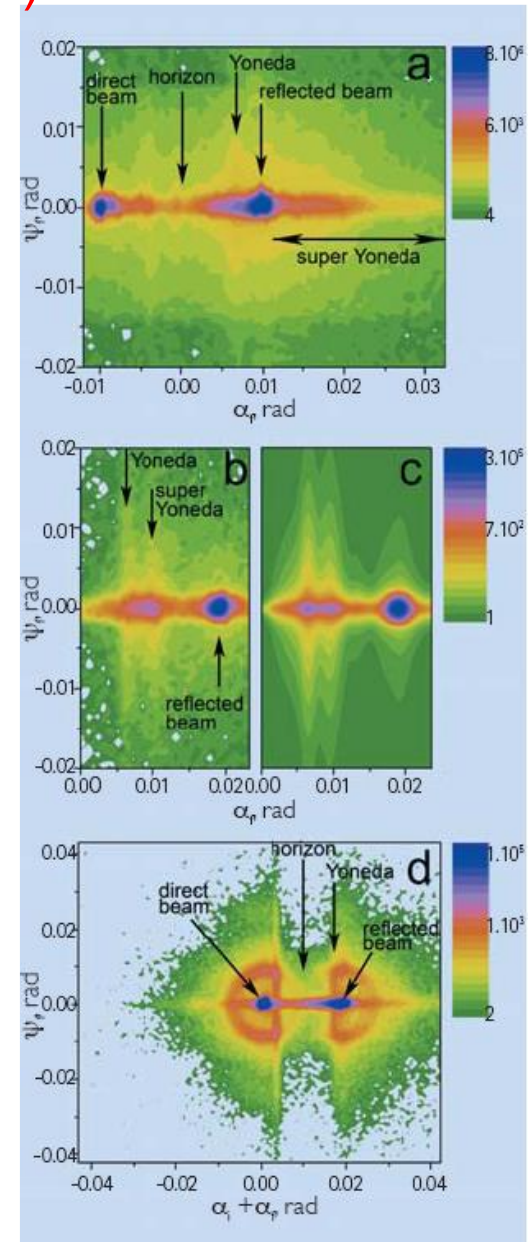
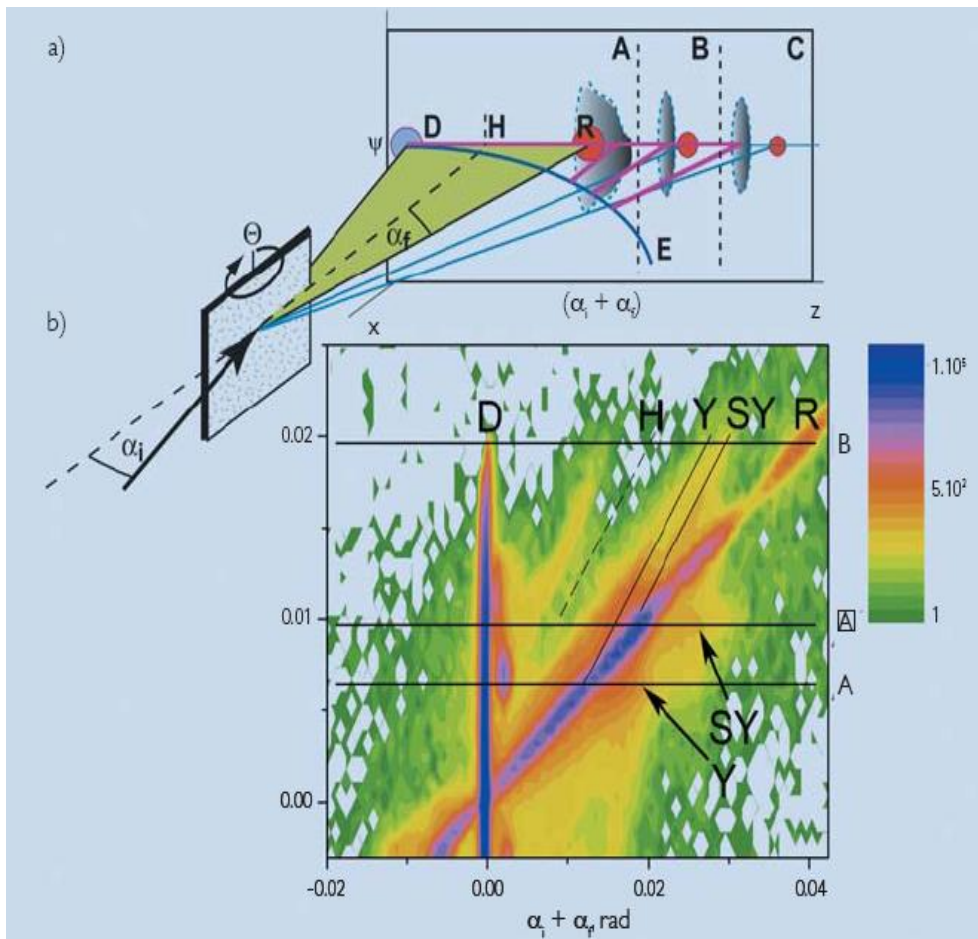
Distance from substrate (nm)

# GISANS & OSS from self assembling nano-composite multilayers of di-block co-polymer and Fe<sub>3</sub>O<sub>4</sub> (D22, ILL Highlights 2005)

V. Lauter-Pasyuk (TU Munich)

B. Toperverg (PNPI St. Petersburg and ILL)

M. Jernenkov and H. Lauter (ILL)



***Thank you!***