

Neutron and X-ray Scattering of Quantum Materials

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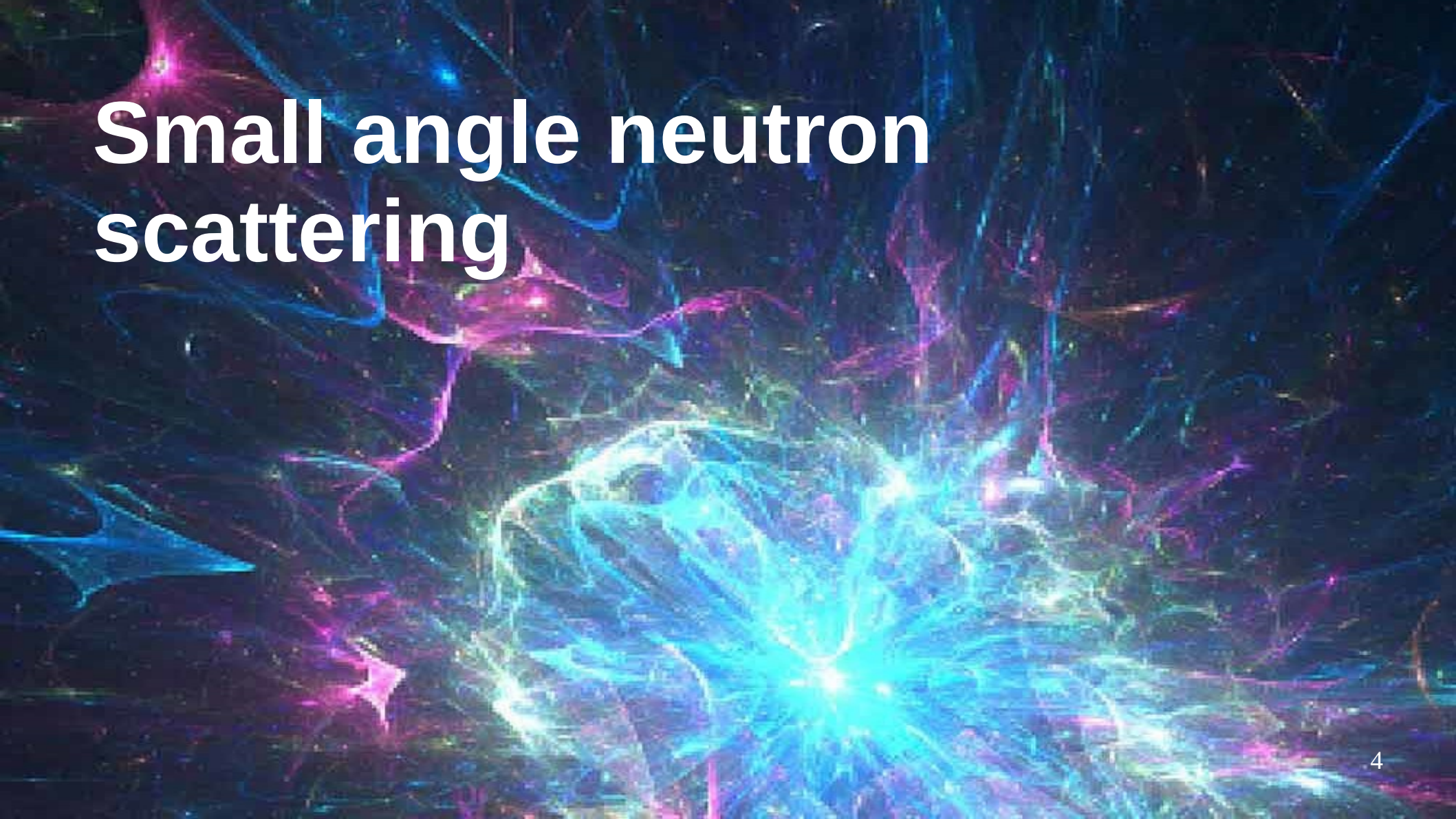
Outline for today

- Recap from last week (Chapters 3 and 10)
- Small angle neutron scattering
- Reflectometry

From last week: Magnetic diffraction



Small angle neutron scattering



Small angles for large structures

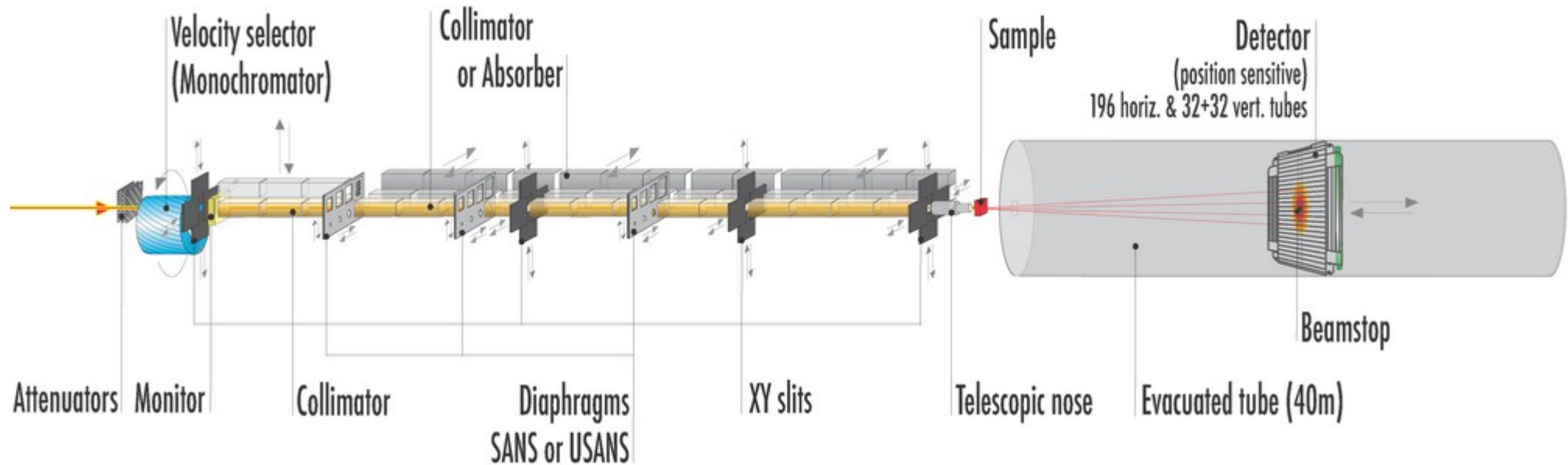
Differential scattering cross section: $\frac{d\sigma}{d\Omega} = n S(q) \left| \int_{particle} \Delta\rho(r) e^{iq \cdot r} dV \right|^2$

The structure factor for a system of nano particles: $S(q) = \left| \sum_j e^{iq \cdot R_j} \right|^2$

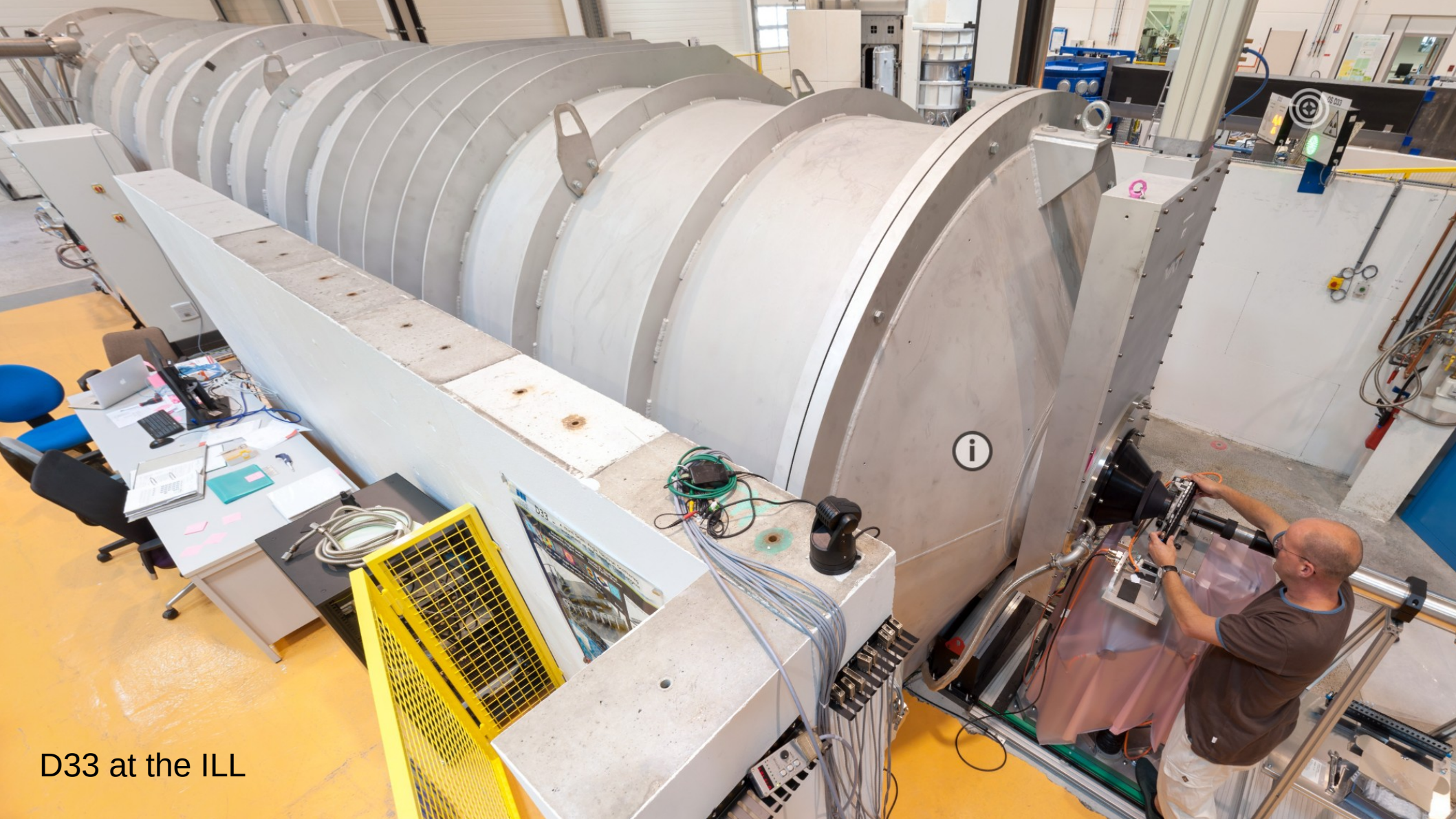
The small angle approximation: $qa \ll 2\pi$

Scattering length density and density contrast: $\rho_b = \frac{1}{V_0} \sum_{j \in V_0} b_j$ $\Delta\rho(r) = \rho_b(r) - \rho_s$

SANS instrument layout

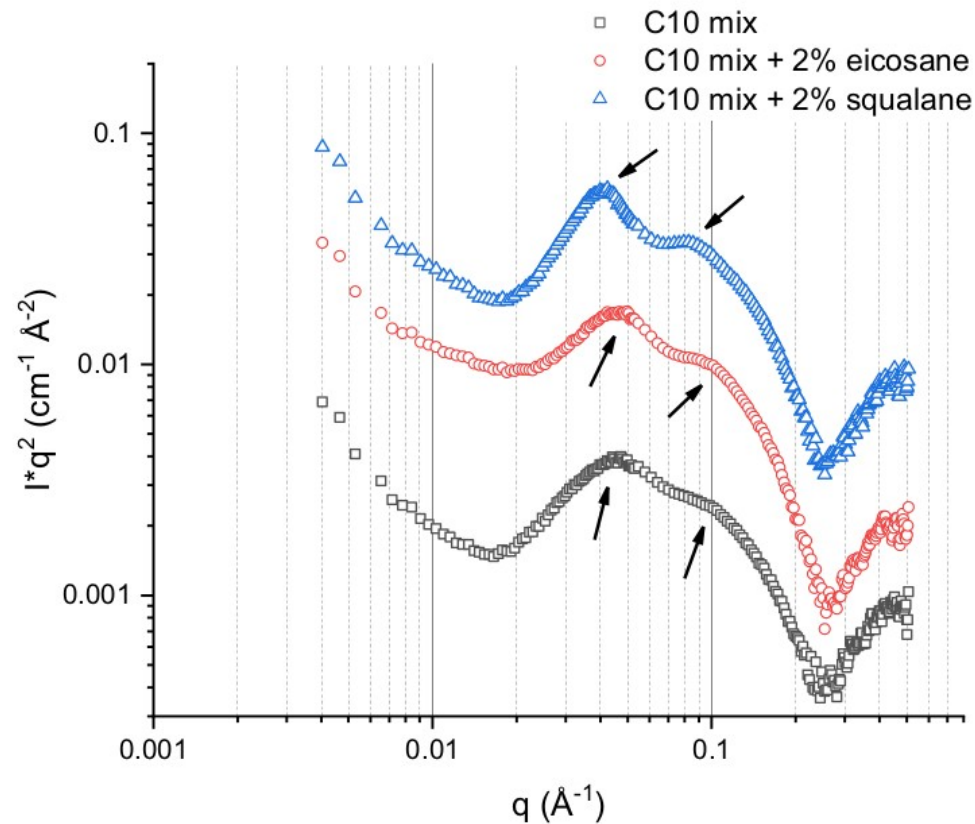
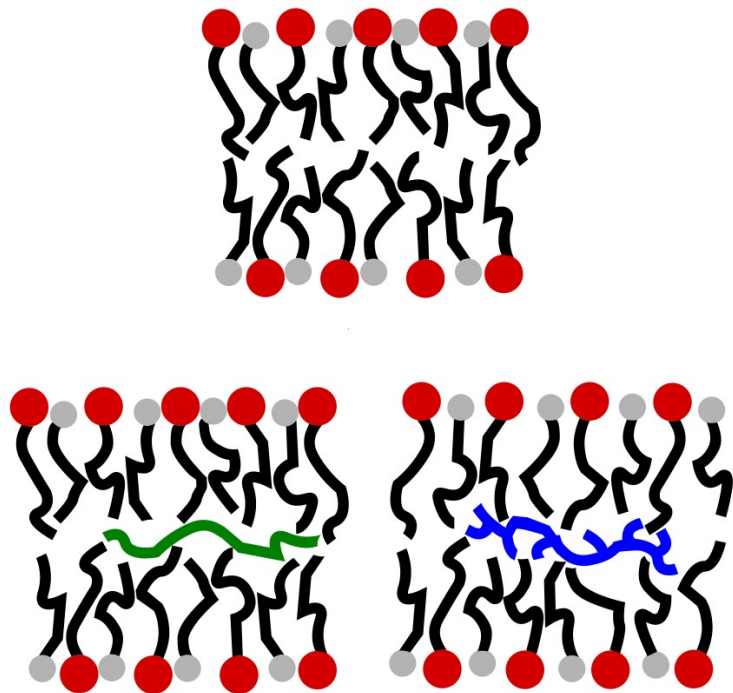


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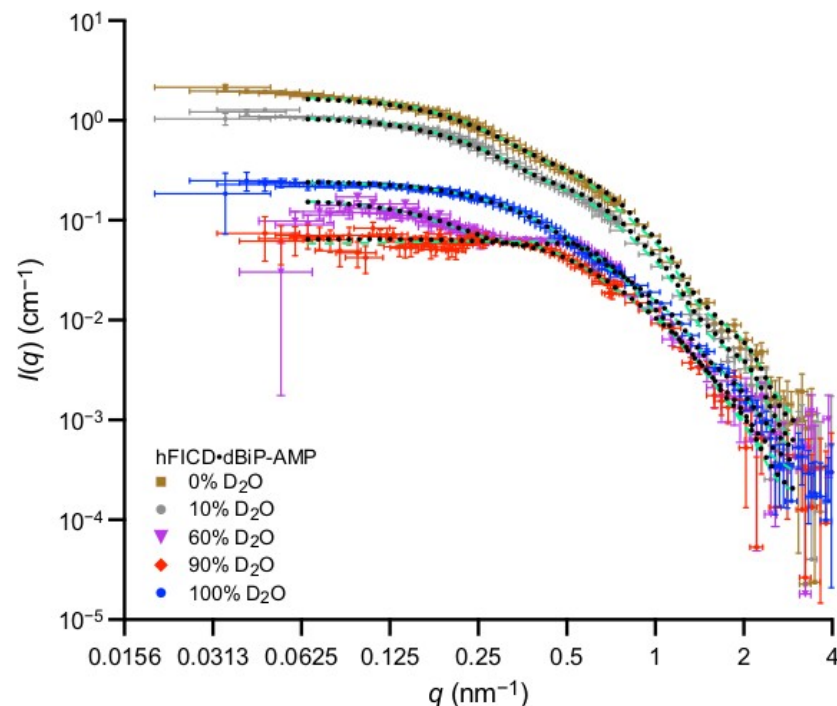
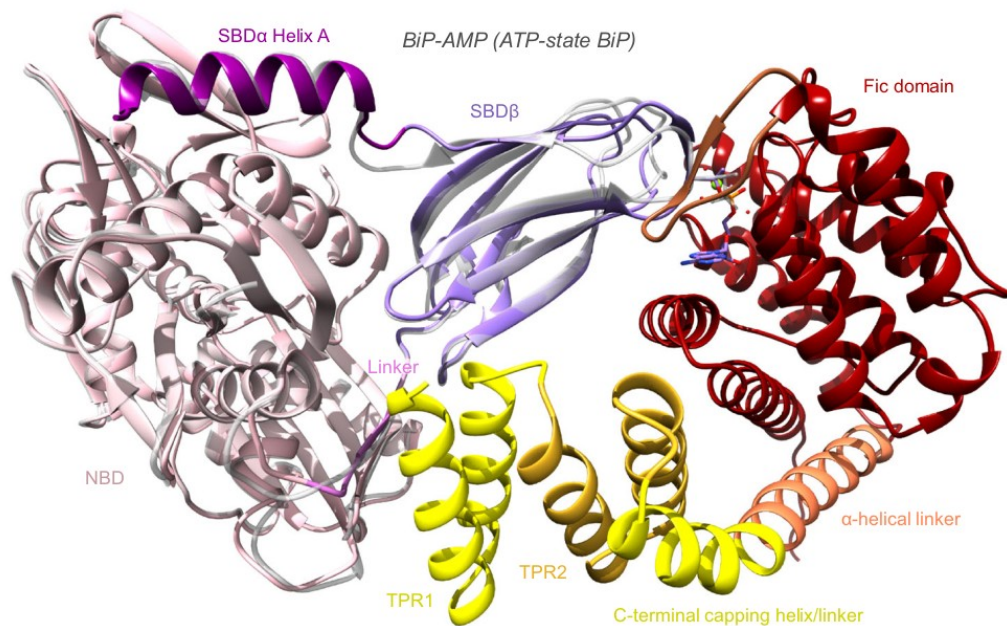
D33 at the ILL

Early life membranes

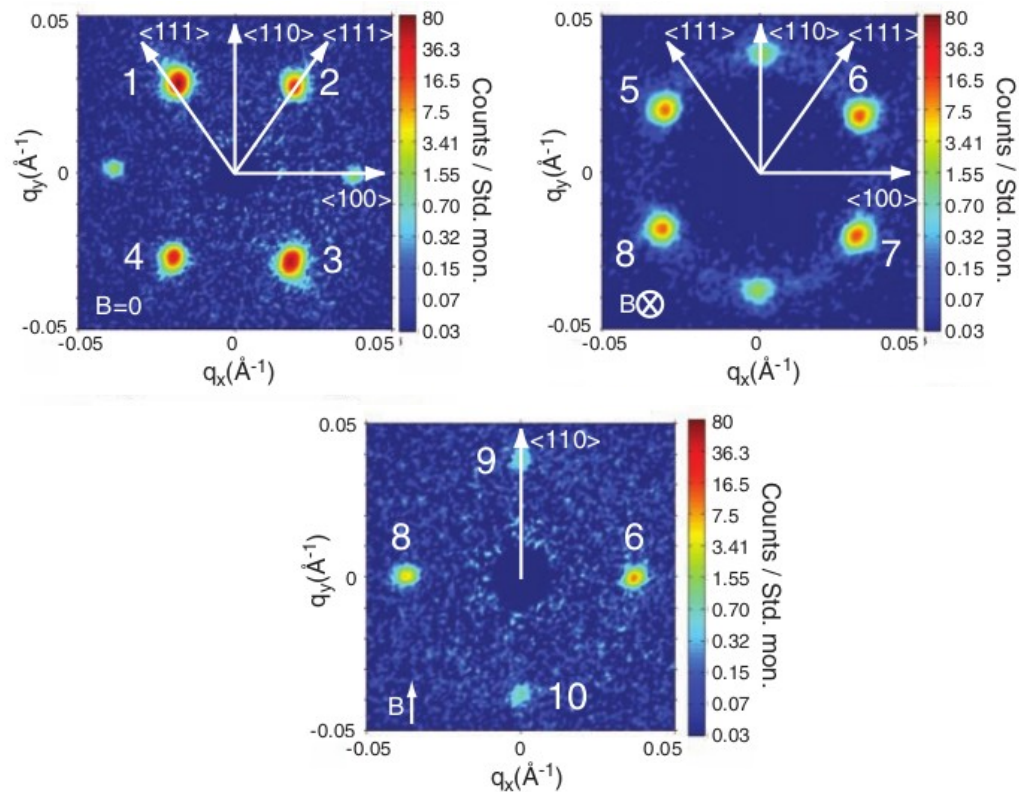
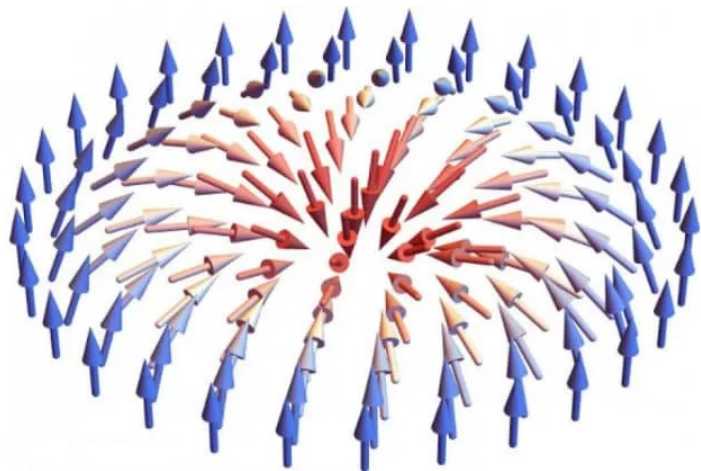


The structure of a biological complex

<https://www.ill.eu/news-press-events/news/scientific-news/exploring-the-protein-folding-chaperones-at-the-heart-of-our-cells>

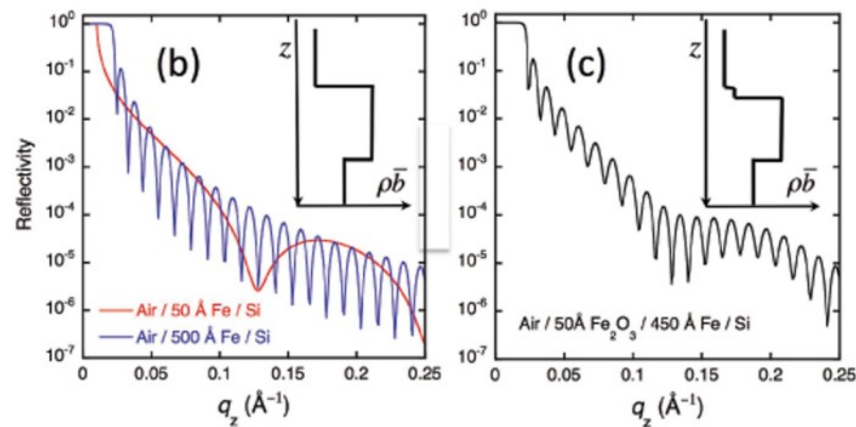
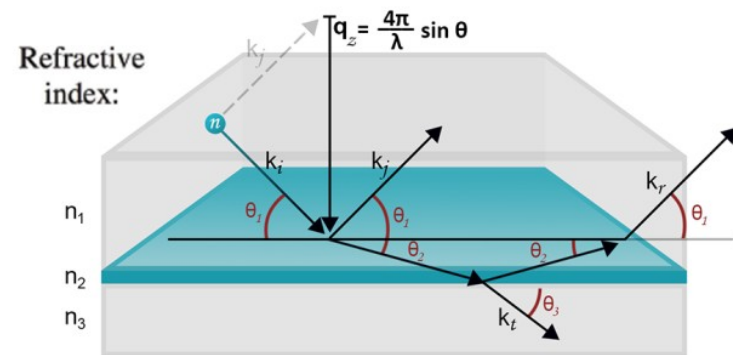
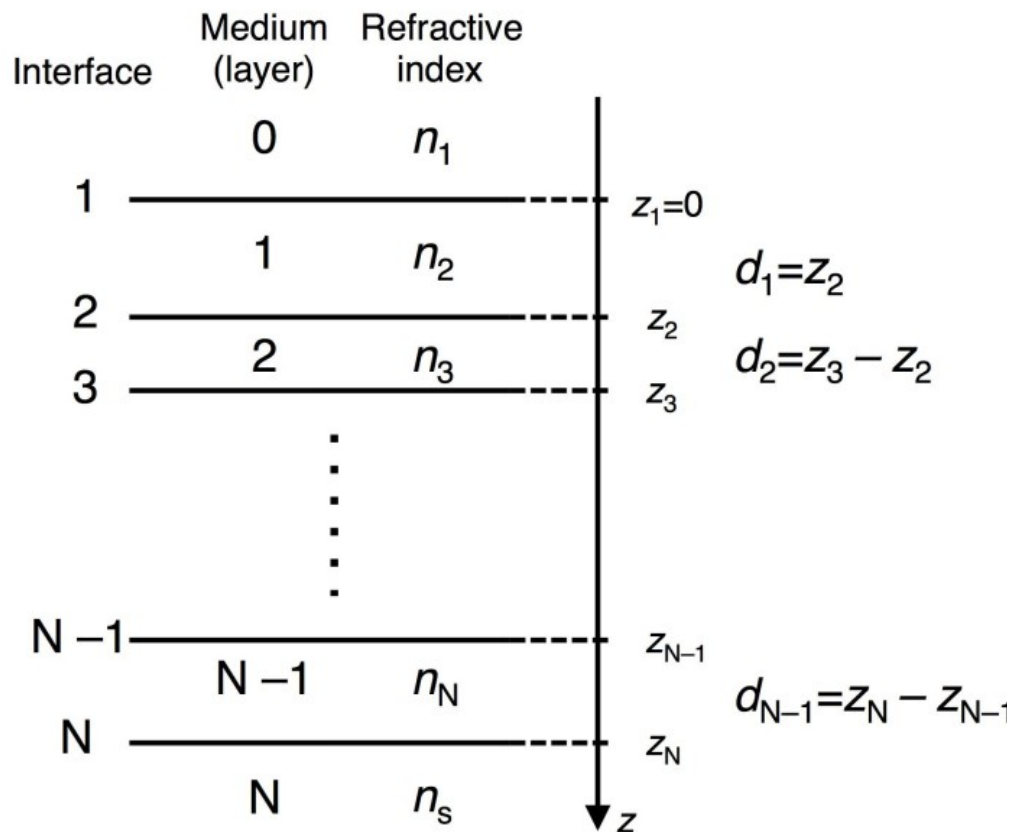


Skyrmions form very large structures

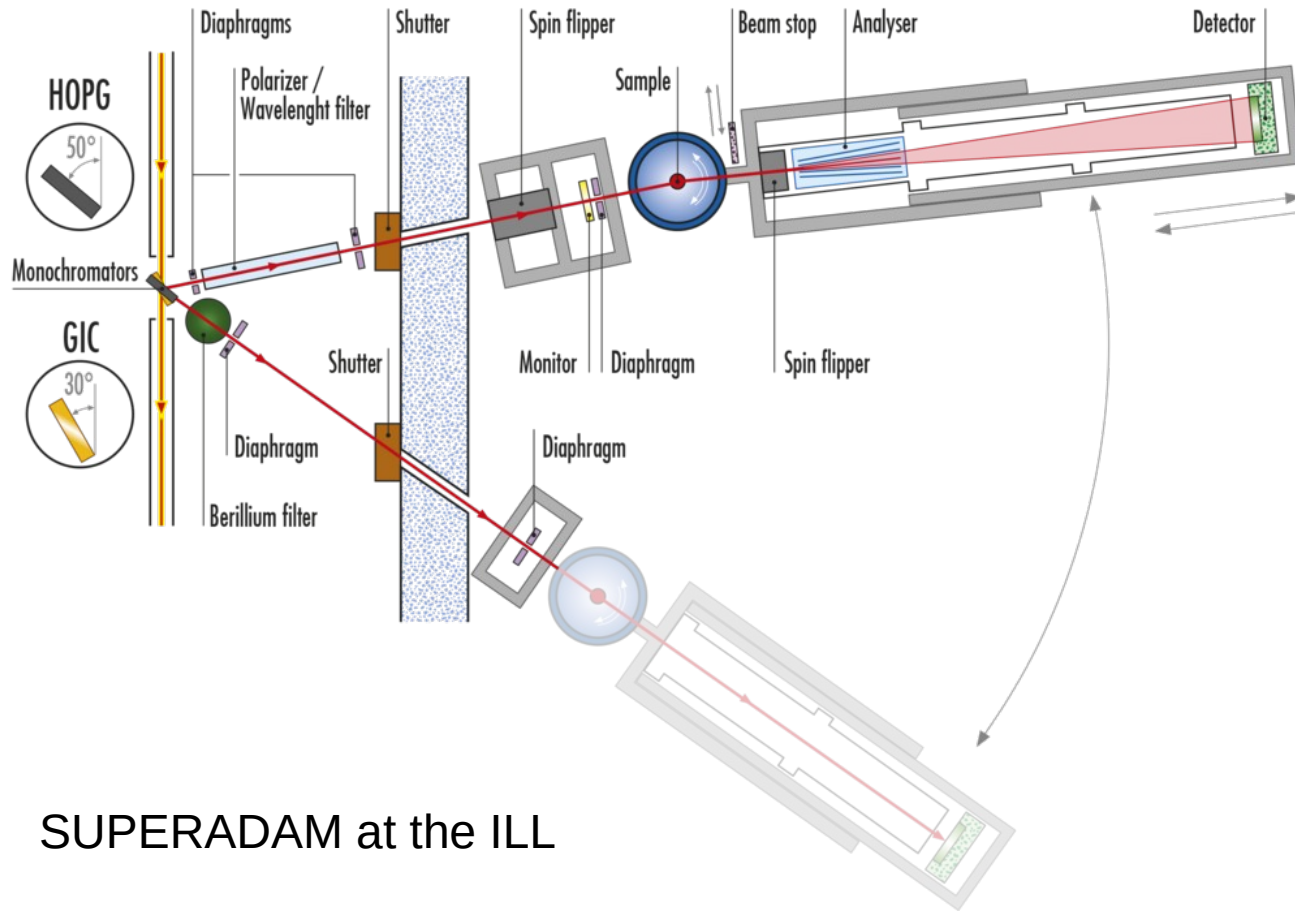


Neutron reflectometry

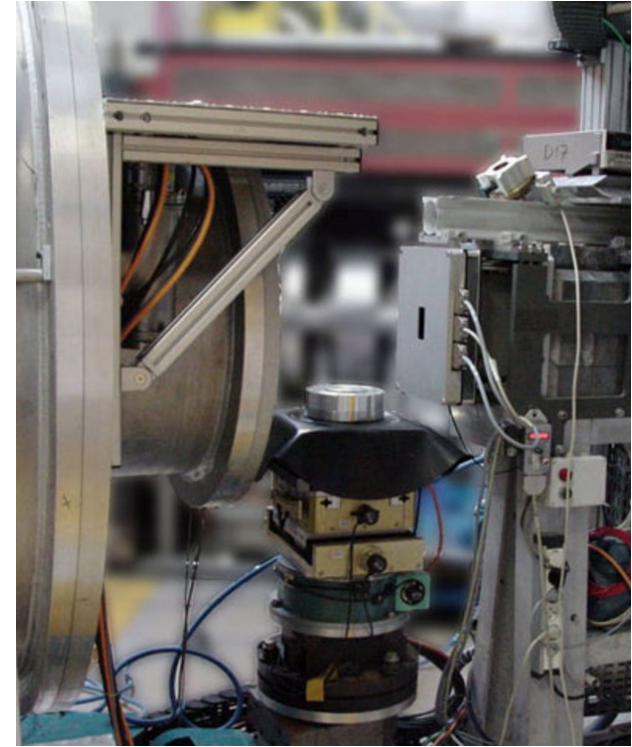
Scattering from layered structures



Reflectometer



SUPERADAM at the ILL



D17 at the ILL

Humidity-induced structural changes of a substrate

Polymers for fuel cell technology

