Nanomagnetism for medical imaging and catalytic materials

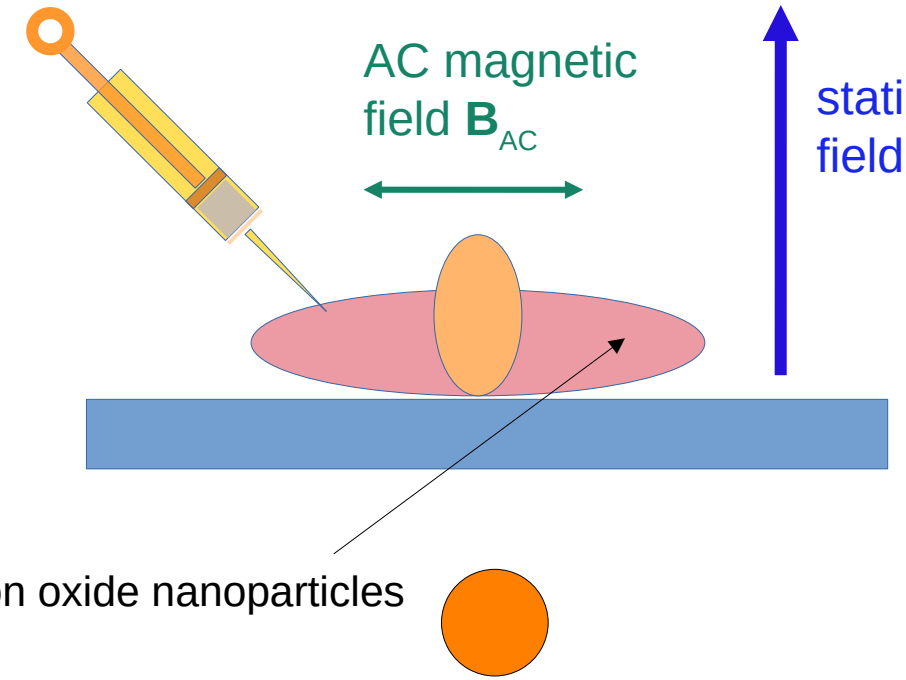
Oleg Petracic

Nanomagnetism for medical imaging

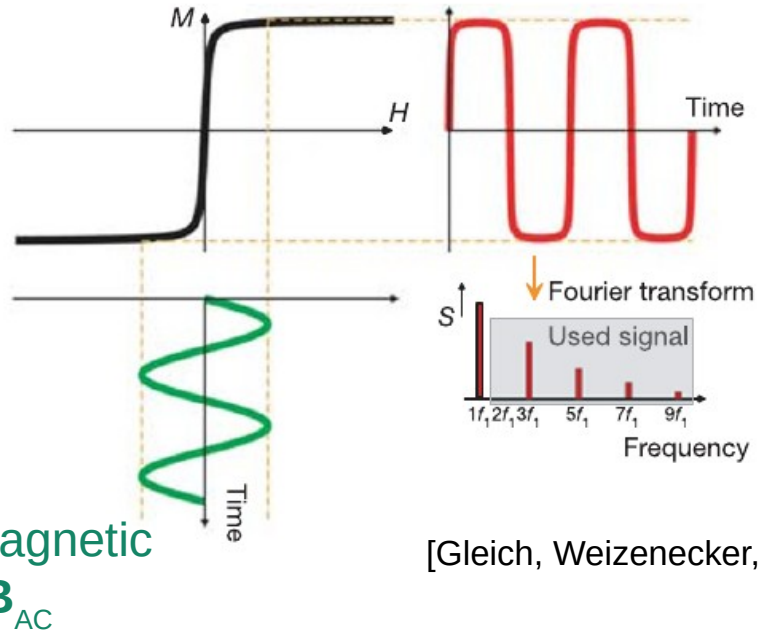
Magnetic Particle Imaging

- Novel 3D medical imaging technique which will very likely replace PET and SPECT

Application of magnetic nanoparticles



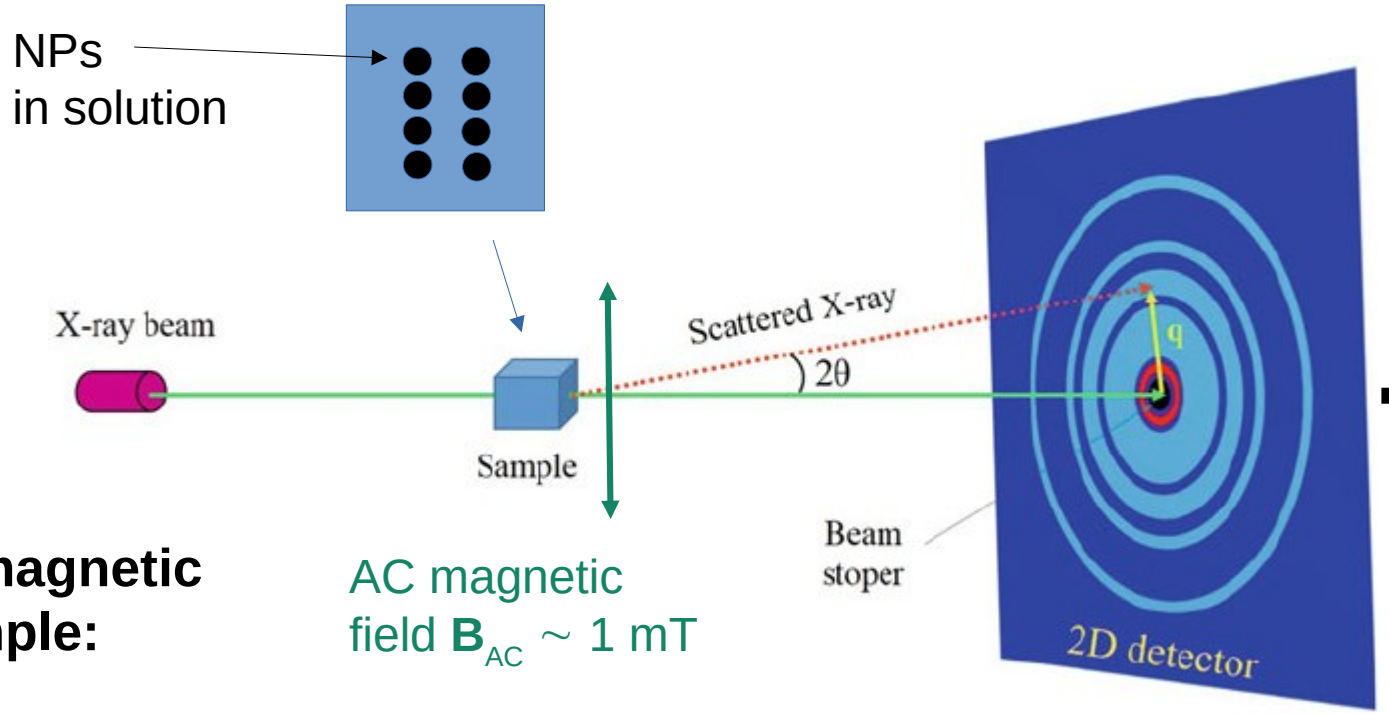
Magnetic response from nanoparticles



[Gleich, Weizenecker, Nature 2005]

1: Magneto-mechanical AC suscpetibility

- To probe the **structural** AC response of (periodic) aggregates of magnetic NPs in solution



Measure **smearing out of I(q)**:
real-part, χ'
and
imag. part, χ''

- **Apply AC magnetic field at sample:**

AC magnetic field $\mathbf{B}_{AC} \sim 1$ mT

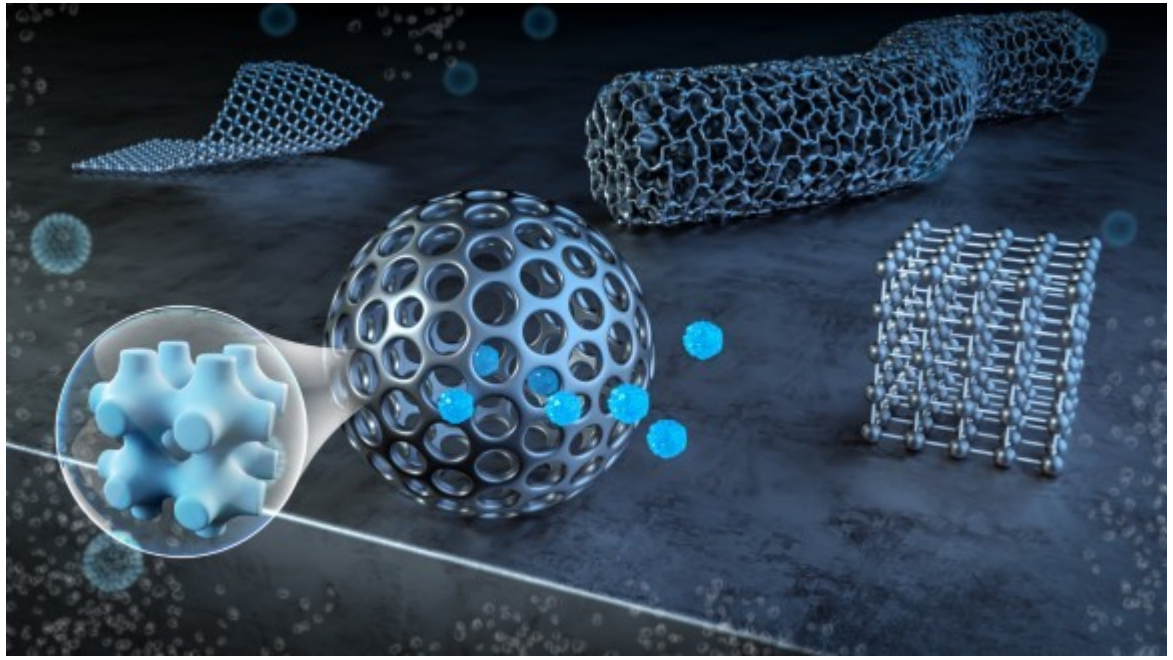
[O. Moscoso Londoño, 2018]

2: Nanoarchitectonics for magnetically tuned ion channels

- Novel hype topic:
  "Nanoarchitectonics"

- Fabrication and characterization of hierachrically structured materials or systems

- Hierarchically structured:
  A system which is structured on **at least two** very different **length scales**



[Cover picture: NPG asia materials, 2023]

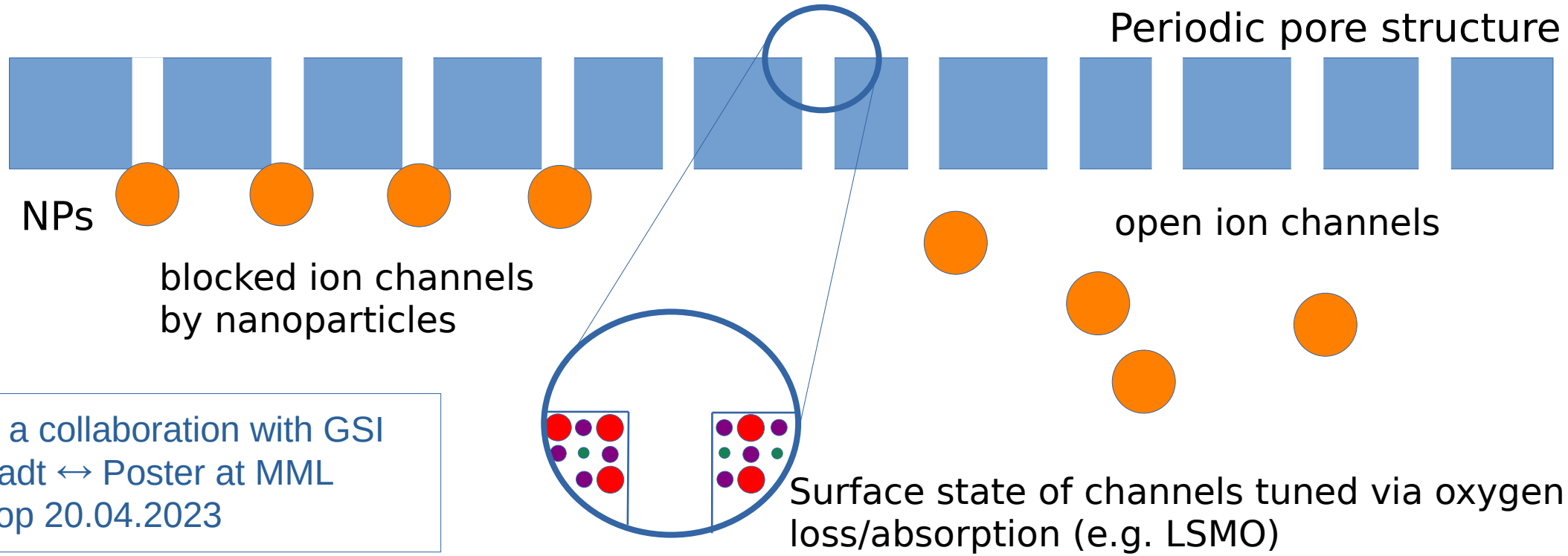
→ Ideal for scattering methods

2: Nanoarchitectonics for magnetically tuned ion channels

Fabricate a hierarchical system composed of:

1st length scale: atomic, crystalline ⟷ Complex oxide (e.g. LSMO)

2nd length scale: nano-range ⟷ Pores & magnetic nanoparticles



May be a collaboration with GSI Darmstadt ↔ Poster at MML workshop 20.04.2023