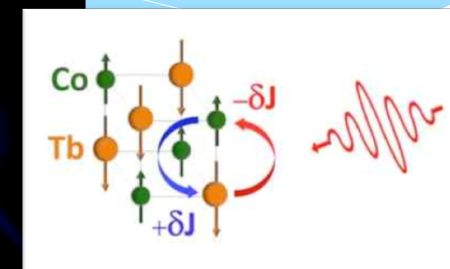
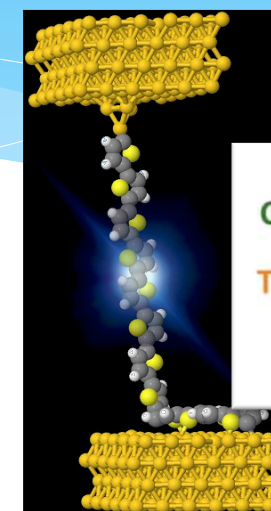
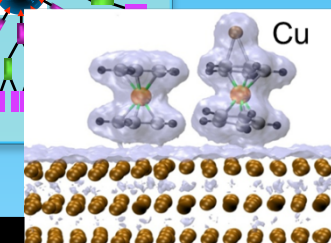
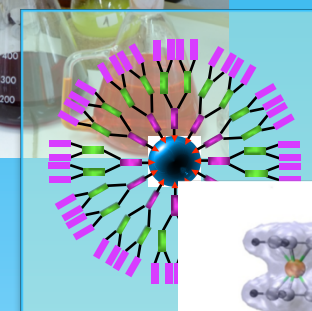


# Institut de Physique et Chimie des Matériaux de Strasbourg (IPCMS)

G. Weick

guillaume.weick@ipcms.unistra.fr

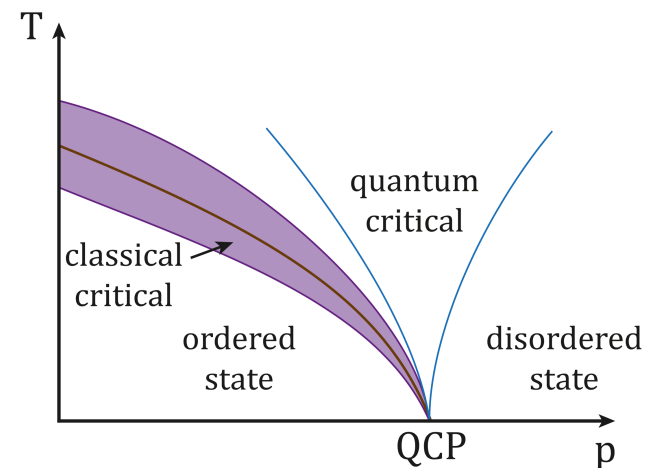


Université

de Strasbourg

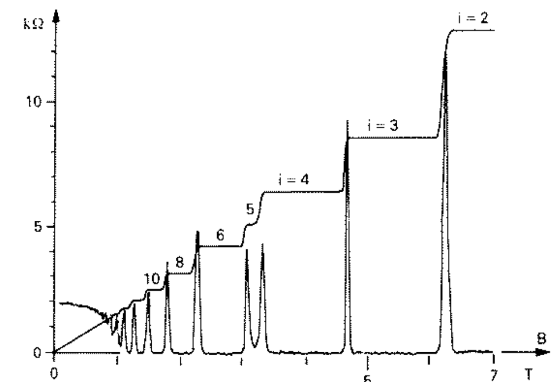
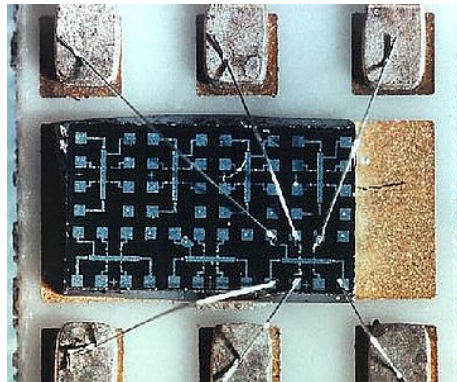
# Physique de la Matière Condensée ?

- > **Propriétés** microscopiques et macroscopiques de la matière dans son état « condensé », lorsque  $N \gg 1$
- > **Outils** : mécanique quantique, physique statistique, électromagnétisme, ...
- > **Emergence** : le tout est plus que la somme de ses parties (e.g., transitions de phase)
- > **Elementaire  $\neq$  Fondamental**

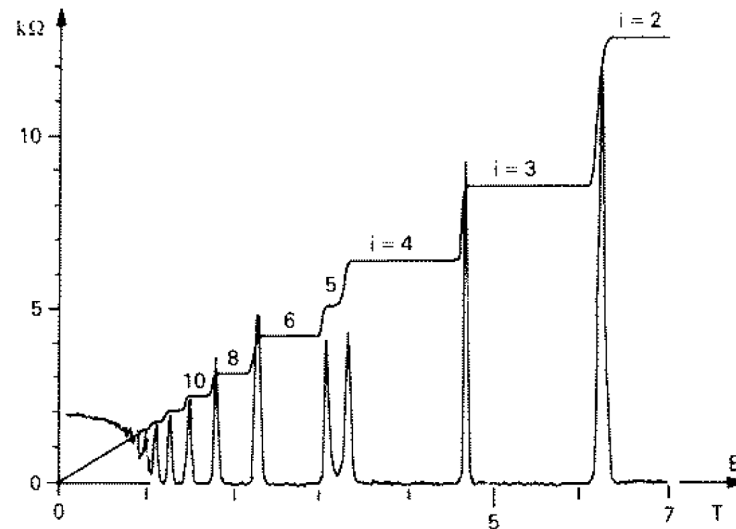
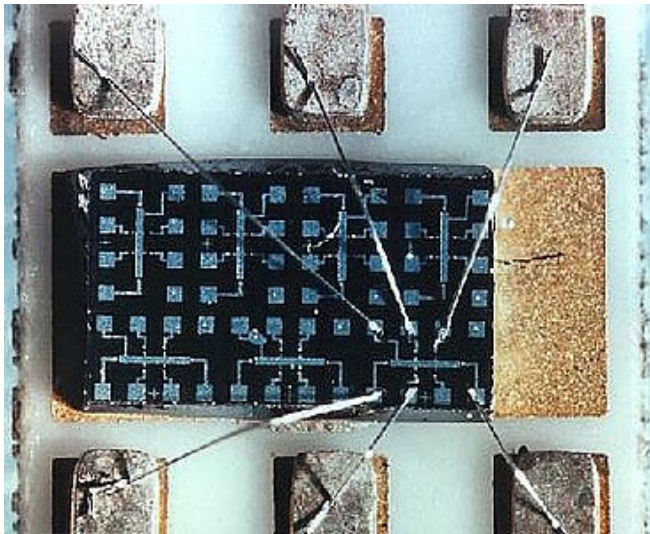


# Nanosciences et Nanotechnologies ?

- > **Propriétés** de la matière pour des tailles du nm au  $\mu\text{m}$ , ~~lorsque  $N \gg 1$~~  (e.g., nanoparticules, boîtes quantiques, etc.)
- > « There's plenty at the bottom » (Richard Feynman, 1959)
- > **Transition** quantique => classique ???
- > **Applications**  $\gg \gg \gg 1$  (ordinateur et calcul quantique, stockage de l'information, nanomédecine, nouvelles sources d'énergie, thermoélectricité, etc., etc.)



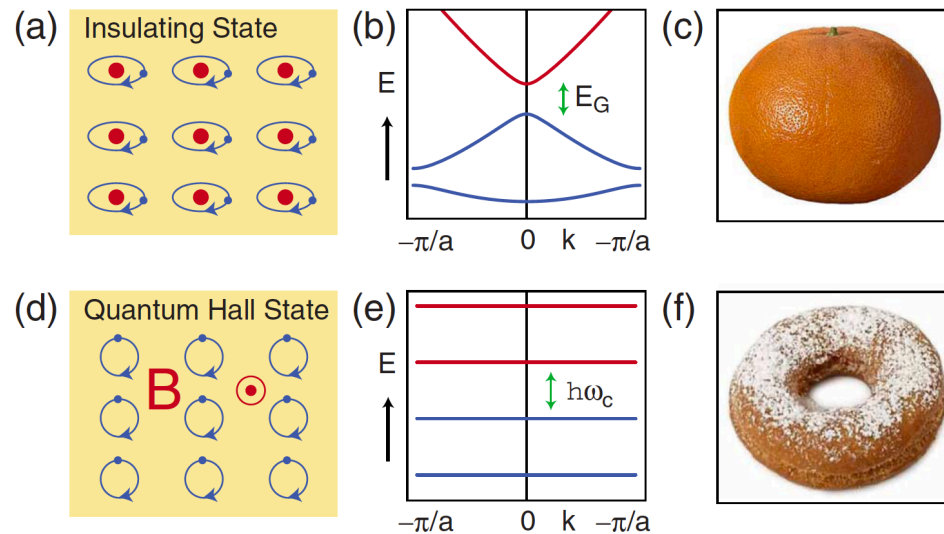
# Effet Hall quantique



Klaus von Klitzing  
(Prix Nobel 1985)

$$R^{-1} = i \times \frac{e^2}{h}, \quad i = 1, 2, \dots$$

# Topologie et matière condensée



[Hasan & Kane, Rev. Mod. Phys. 2010]

- isolants topologiques
- fermions de Dirac / Weyl
- fermions de Majorana

# Institut de Physique et Chimie des Matériaux de Strasbourg



## UMR7504



From the design of **advanced materials and nanostructures** to the study of the **associated physical properties**, with a pronounced effort on **magnetism, electronics and optics and their applications.**

### Physics

- Surfaces & Interfaces
- Magnetism of Nanostructures
- Ultrafast Optics & Nanophotonics

### Chemistry

- Inorganic Materials
- Organic Materials

**230 people :**

80 Research & University staff

60 Engineers and technicians

90 PhD &-post-doc

**11000 m<sup>2</sup>**

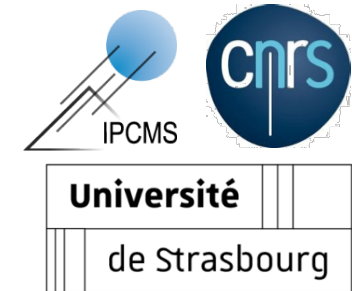
Bureau de direction

Conseil de Laboratoire  
Conseil scientifique

Responsable Qualité  
H. Majjad

# Institut de Physique et Chimie des Matériaux de Strasbourg UMR 7504

Directeur : P. Rabu  
Directeur adjoint : R. Jalabert  
Administratrice: J. Lacava



## PLATEFORMES

**Nanofabrication**  
B. Doudin - H. Majjad

**Microscopie MET**  
O. Ersen - C. Bouillet

**Microscopie MEB**  
G. Pourroy - J. Faerber  
(commune avec l'ICPEES)

**Diffraction des RX**  
C. Lefevre - M. Lenertz

**Calcul**  
R. Hertel - F. Muller

## DEPARTEMENTS DE RECHERCHE

**DMONS**  
Magnétisme des Objets NanoStructurés  
Y. Henry

**DON**  
Optique ultra rapide & Nanophotonique  
P. Hebraud

**DSI**  
Surfaces & Interfaces  
H. Bulou

**DMO**  
Matériaux Organiques  
L. Douce

**DCMI**  
Chimie des Matériaux Inorganiques  
N. Viart

## SERVICES GENERAUX

J. Lacava

**Services d'appui à la Recherche**  
J. Lacava

**Atelier Mécanique**  
A. Boulard

**Bureau d'Etude**  
N. Beyer

**Service Informatique**  
F. Muller

# INTERDISCIPLINARY SCIENCE – FUNDAMENTAL RESEARCH ON NANOMATERIALS

## Physics

Magnetism

Optics

Nano / quantum  
transport

Ultrafast processes

Theor. physics

TEM & near-field  
microscopy

Instrumentation

## Chemistry

Modeling &  
Comput. Sc.

NP growth &  
organization

Molecular  
synthesis

Thin film growth

Synthesis of hybrid  
materials

## Material Science

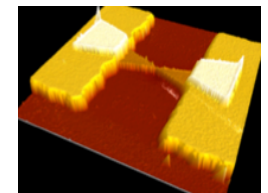
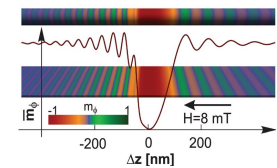
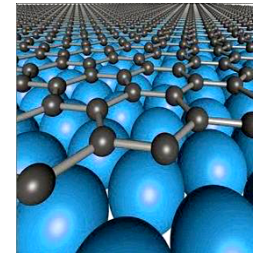
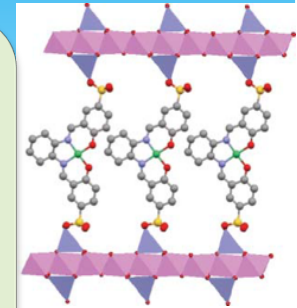
Ferromagnet –  
organic interfaces

Multiferroic  
nanosystems

Graphene &  
2D materials

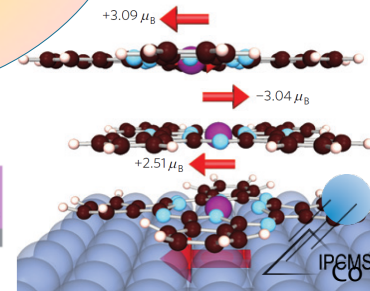
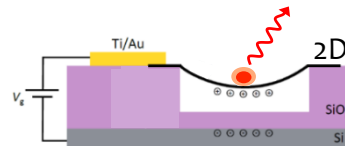
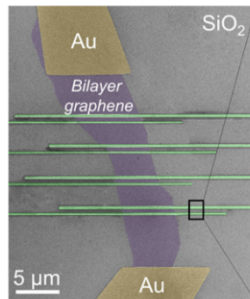
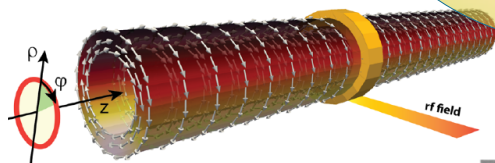
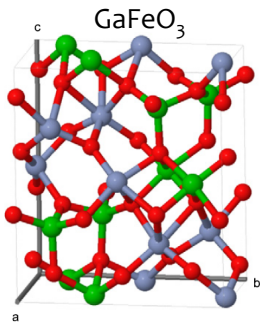
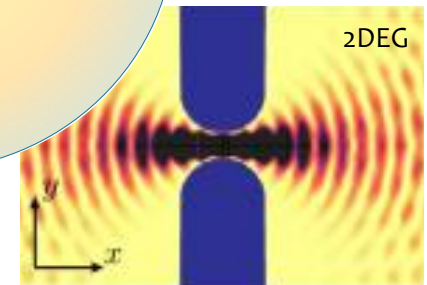
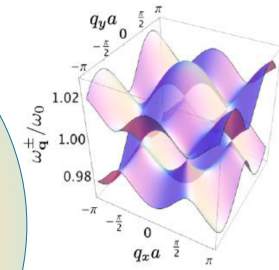
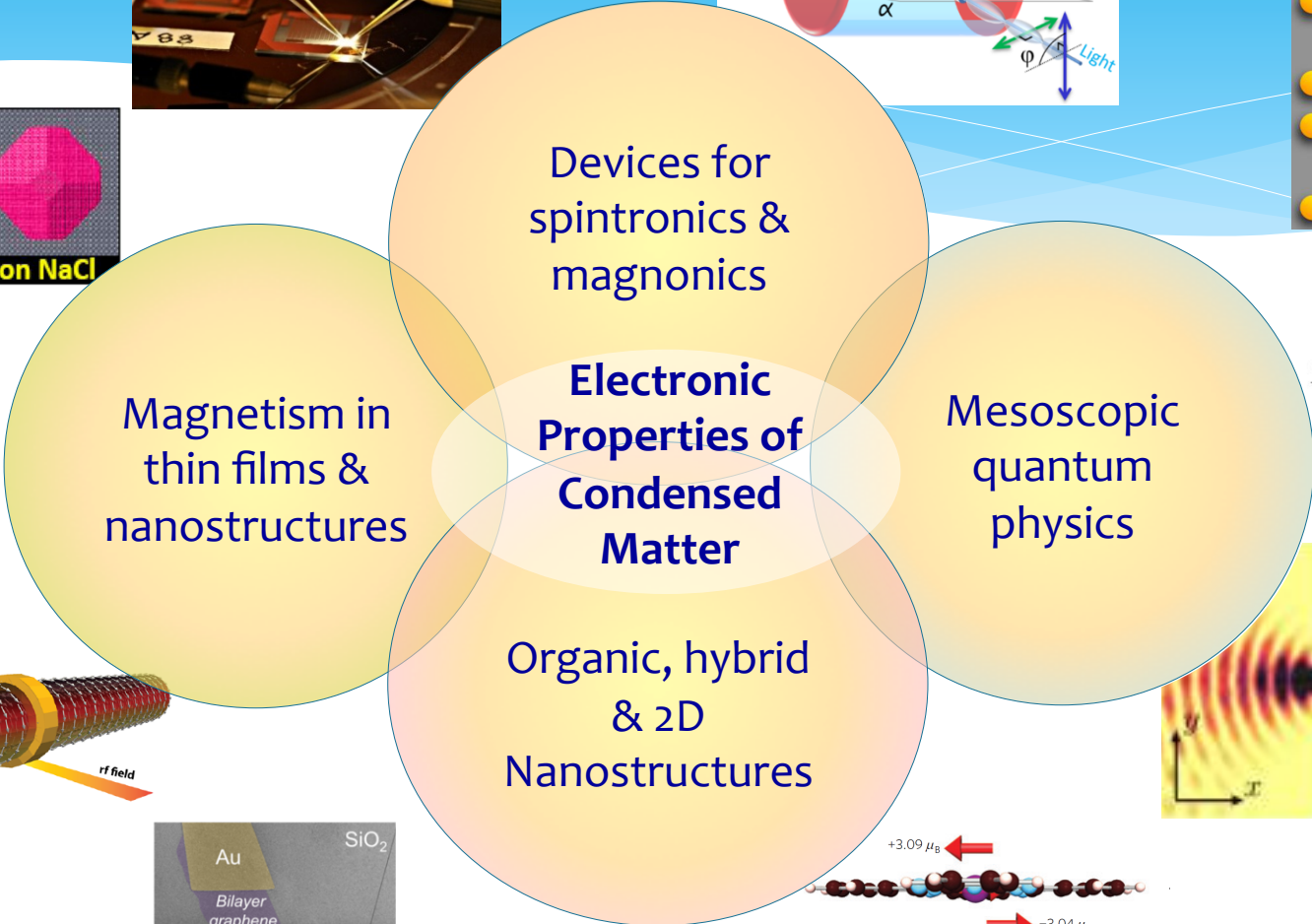
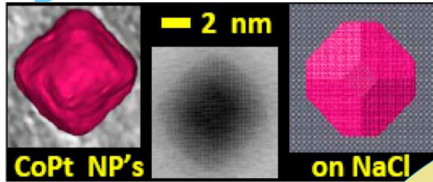
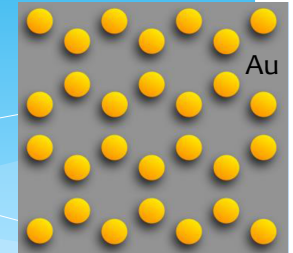
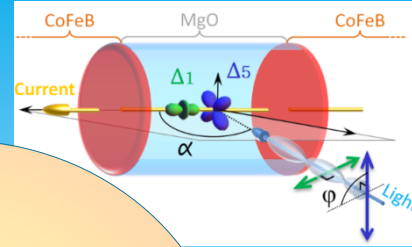
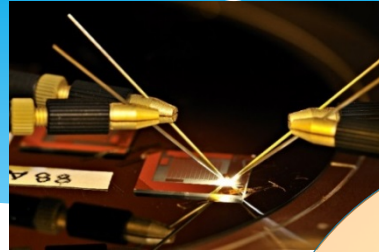
Biomaterials

Comp. Mat. Sci.





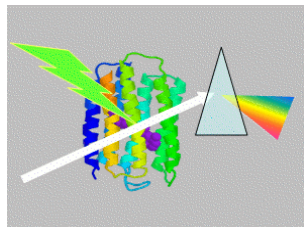
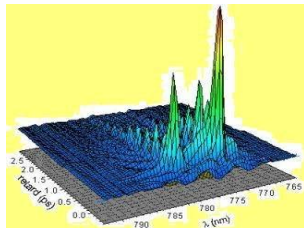
# Department of Magnetism and Nano-Structured Objects



# Department Ultrafast optics and Nanophotonics

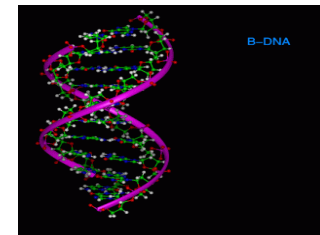
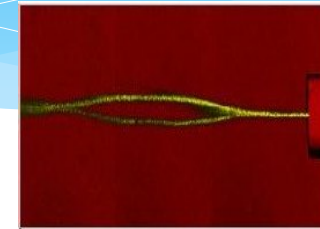
## Ultrafast processes in functional nanostructures

Metals, semiconductors, polymers, biomolecules, hybrid organic/inorganics



## Nanophotonics

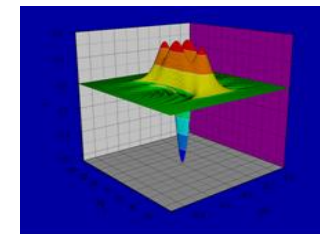
Single biomolecules, organic materials and self-written waveguides, laser nanostructuring, cellular biophysics



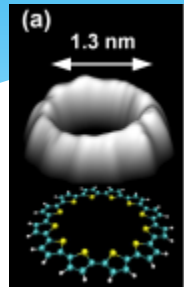
## Femto - & Attoseconds

Sub-diffraction limit < 100 nm

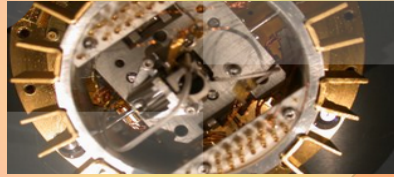
Biophysics and soft matter



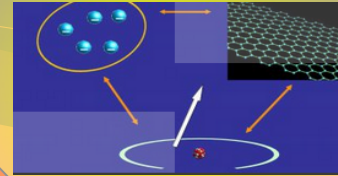
# Department Surfaces – Interfaces



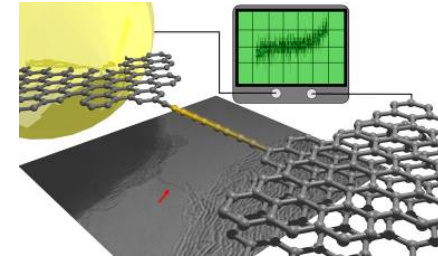
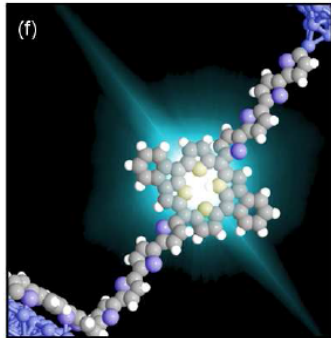
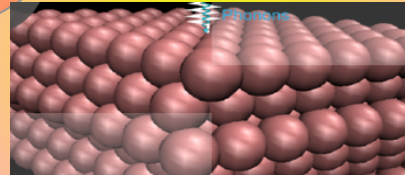
**STM**



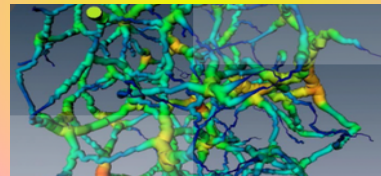
**Dynamic Processes**



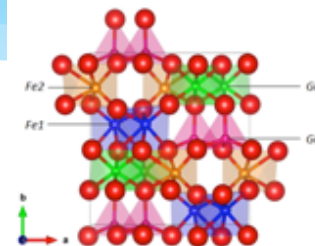
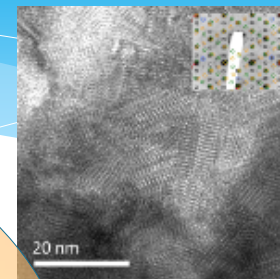
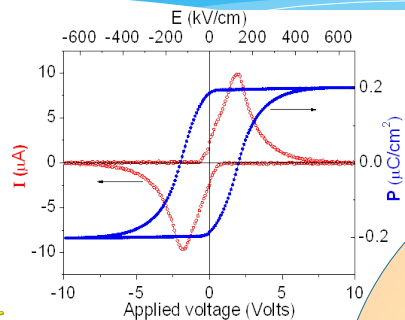
**Modelling**



**Nanomaterials  
Electron Microscopy**



# Department of Chemistry of Inorganic Materials



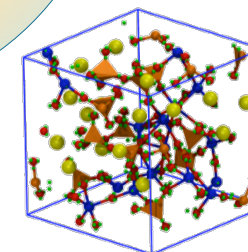
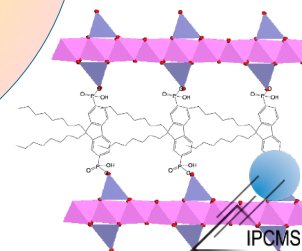
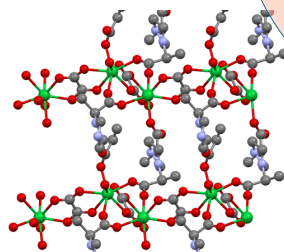
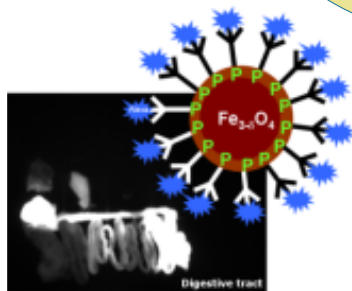
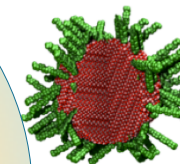
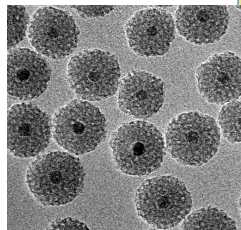
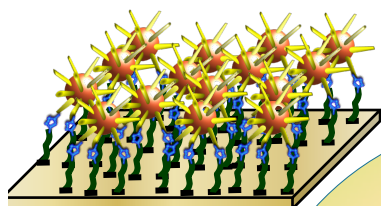
**Thin Films & Oxides  
(PLD – Sputtering)**  
Spintronics &  
photovoltaics

**Functionalized  
Nanoparticles (Self  
assembling,  
functionalization)**  
Sensors, Bio-  
imaging,  
Theranostic


**Synthesis, structure, modeling,  
properties of multifunctional /  
multiscale materials**

**Computational  
material science  
(DFT, QMMM)**  
Molecules,  
surfaces, biological  
functions, glasses

**Organic-Inorganic  
Hybrids**  
magnetic &  
multifunctional  
materials

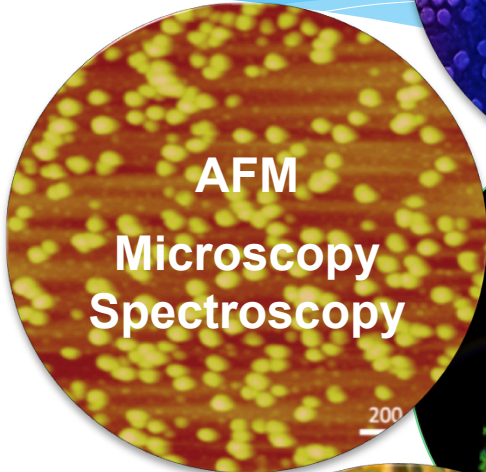


# DMO – Organic Materials



Materials  
for  
Health

A circular graphic with a dark blue background. It features a central green sphere with a network of yellow and red branching structures extending outwards, resembling a biological or molecular structure. The text 'Materials for Health' is overlaid in white.




AFM  
Microscopy  
Spectroscopy

A circular graphic with a red and orange color scheme. It shows a dense field of small, bright yellow and orange spots, representing atomic force microscopy (AFM) data. The text 'AFM Microscopy Spectroscopy' is overlaid in white.



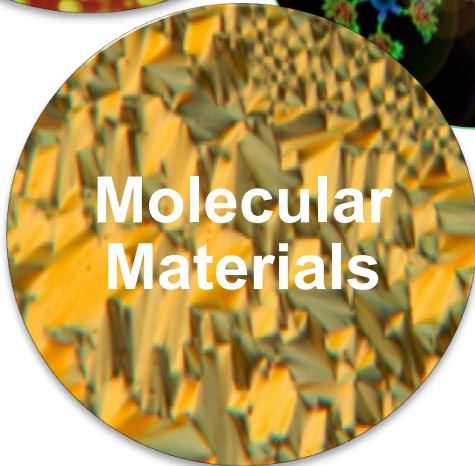
Chemistry

A circular graphic with a dark background. It features a complex, colorful molecular structure with various atoms and bonds represented in different colors (green, blue, red, yellow). The text 'Chemistry' is overlaid in white.



Nano-  
Materials

A circular graphic with a dark grey background. It shows a dense field of small, dark grey, irregular shapes, representing nano-materials. The text 'Nano-Materials' is overlaid in white.



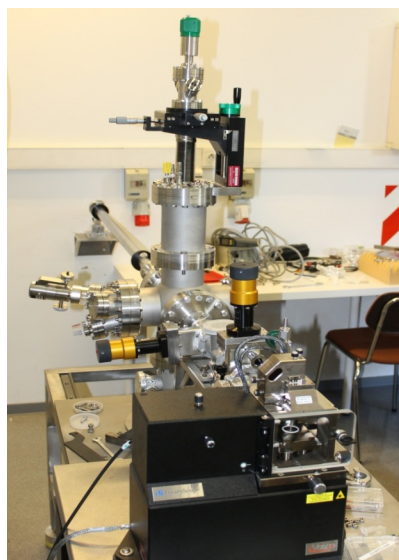
Molecular  
Materials

A circular graphic with a yellow and orange color scheme. It shows a dense field of small, yellow and orange, irregular shapes, representing molecular materials. The text 'Molecular Materials' is overlaid in white.



Catalysis

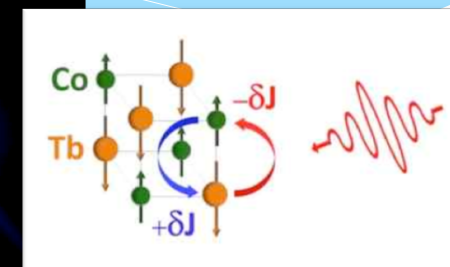
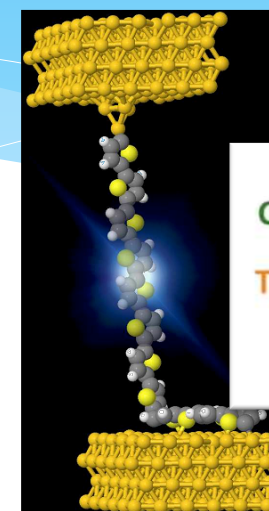
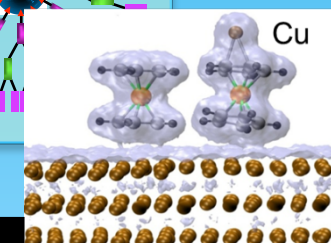
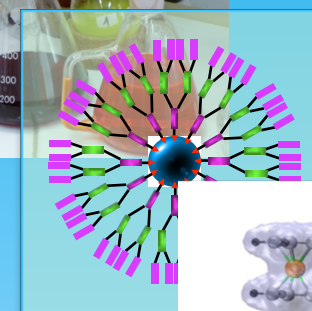
A circular graphic with a dark background. It features a network of glowing blue and orange spheres, representing catalytic processes. The text 'Catalysis' is overlaid in white.



# Institut de Physique et Chimie des Matériaux de Strasbourg (IPCMS)

G. Weick

guillaume.weick@ipcms.unistra.fr



Université  
de Strasbourg