

Institute of Light and Matter, UMR 5306



Director : Dr. P. Dugourd

<https://ilm.univ-lyon1.fr/index.php>

CNRS (INP/INC) and University Claude Bernard Lyon 1



Université Claude Bernard



Lyon 1

Speaker : Stéphane Pailhès

5 teams (T), 22 researchers and 4 engineers involved in NaMe

Fundamental nano-physics

Materials

Heat/charge
transport

Nano-
magnetism

Thermal
dynamics

Photonics

Optical
properties

Theory

Development of nano-materials

Thin films / flakes

Colloidal
synthesis

Laser
Ablation

Clusters

Nanostructured bulk crystals

HP-HT
Sintering

Eutectics



N A M e

GDR Nanomaterials for Energy Applications

μ -mechanisms of heat/charge transport

T1 “(Nano)Materials for Energy” , 4 Res. / 2 ITA involved, contact: [Valentina Giordano](#)

Skills

Elementary excitations of heat and charge transport
(Inelastic spectroscopy)

High pressure and high temperature

Nano-powders sintering (Spark Plasma Sintering)

Ranges

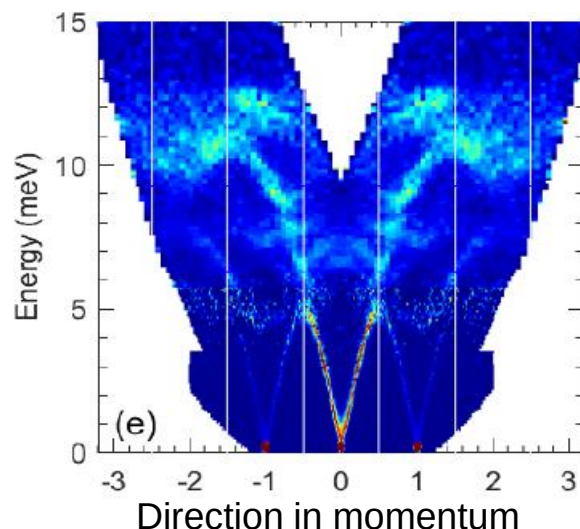
Thin films & bulk

[4 K : 2 000 K]

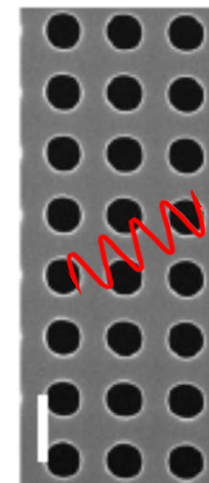
[1 GPa : 50 GPa]

Energy related research

Thermal management, Thermoelectricity, Batteries



**Phonon (q, ω)
spectrum in a
complex
material**



**Impact on the
phonon (q, ω)
spectrum by
nanostructures /
nanocomposites**

ANR [MAPS](#)



N A M e

GDR Nanomaterials for Energy Applications

Focus

Nano-Magnetism

T2 “Magnetic Nanostructures”, 3 Res. / 2 ITA involved, Contact: [Florent Tournus](#)

Skills

Cluster deposition (Nanoparticles thin films)

Pure metals

Nano-alloys

Hybrid systems

Nano-composites

Structural studies (Diffraction, HRTEM, Dichroism)

Magnetism of nano-magnet (Meas. & Modelling)

Ranges

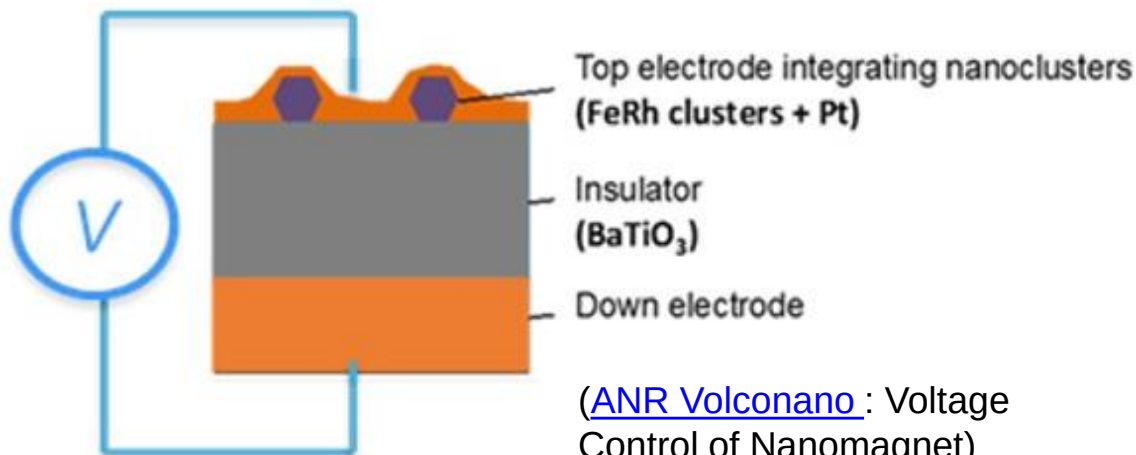
[2 K:300 K]

[-5 T: 5 T]

Energy related research

Magnetic + coupling with strain/charge/electric field

Focus



([ANR Volconano](#) : Voltage Control of Nanomagnet)



N A M e

SDR Nanomaterials for Energy Applications

Thermal dynamics at the nanoscale

T3 “*FemtoNanoOptics*”, 7 Res. Involved, Contact: [Paolo Maioli](#)

Skills

Time-resolved optical spectroscopy with fs-lasers

Measurement of thermal interface resistance,
Thermal conductivity

Cooling dynamics of nano-objects
(single and ensemble)

Au & Ag nanospheres

Carbon nanotubes

Nanorods

Ranges

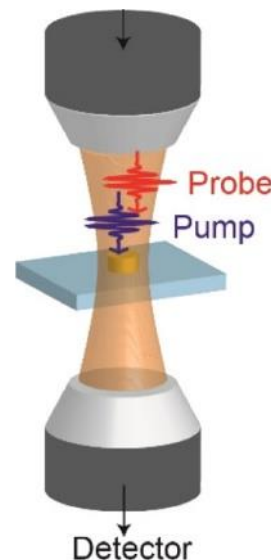
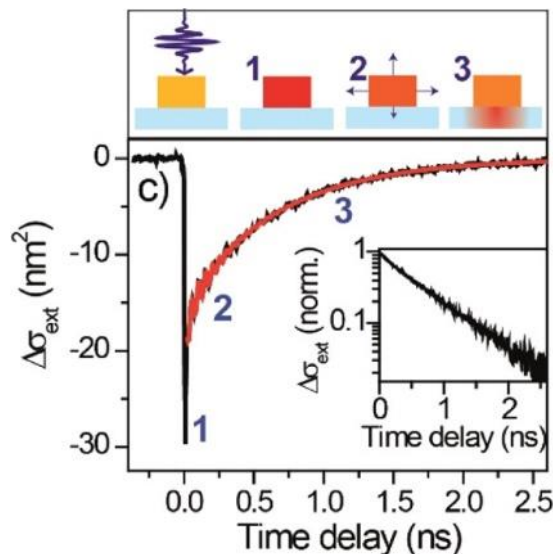
Cooling time
fs to ns

Object size
1-100 nm

Energy related research

Photoexcitation

Focus



Rouxel *et al.*, JPCC 2020
“Ultrafast Thermo-Optical
Dynamics of a Single Metal Nano-
Object”
DOI: 10.1021/acs.jpcc.0c04709

Luminescence of nano-structures

T4 “*Luminescence*”, 5 Res. Involved, Contact: [Christophe Dujardin](#)

Skills

Colloidal synthesis of nanostructures
(Cd based QDs, 2Ds WS₂, halide perovskite)
Pulsed Laser Ablation in Liquid
Confocal microscopy at the single particle level
Optical spectroscopy (Brillouin)

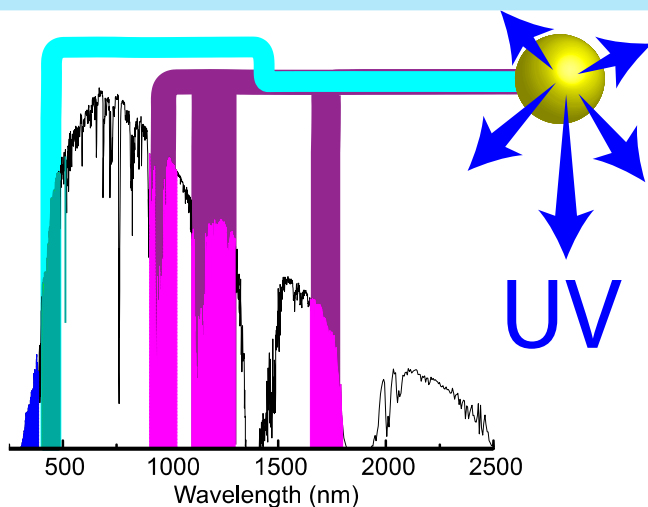
Ranges

IR->UV

100 ps -> s

Energy related research

Water splitting, Optical conversion (up-conversion), photocatalysis



LiYF₄:Yb³⁺,Tm³⁺ Nanocrystals

[ANR UPHocat](#)

(Upconversion for photocatalysis)

Purohit et al. ACS Photonics 2019
[10.1021/acsp Photonics.9b01151](https://doi.org/10.1021/acsp Photonics.9b01151)



GDR Nanomaterials for Energy Applications

N A M e

Theory of charge and heat transfers

T5 “Modelling Condensed Matter and Interfaces”, 3 Res. Involved, Contact: [Samy Merabia](#)

Skills

Atomistic simulations
MD., Ab initio DFT, DFTB, Phase field
Thermal and electronic conductivities
Interface thermal resistance

Nanostructured
interfaces
Nanoparticles
Nanofluidics

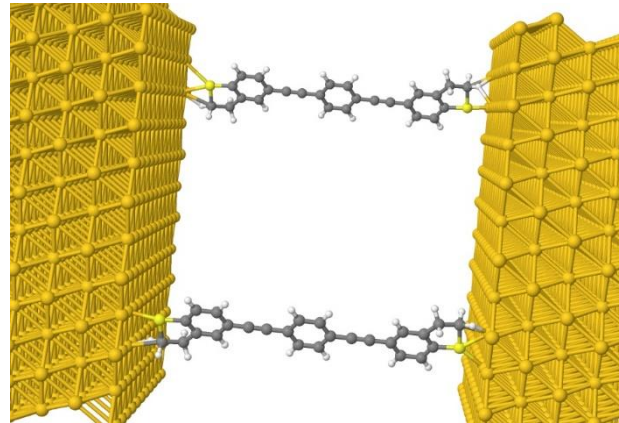
Ranges

A few tens of nanometers

Energy related research

Thermoelectricity, Thermoplasmonics

Focus



[EFINED](#) (FETOPEN H2020)

Thanks for your attention

And don't hesitate to visit us



<https://ilm.univ-lyon1.fr/index.php>