Center for Nanoscience and Nanotechnology (C2N)

Jérôme Saint Martin

- **Creation in June 2016**, merging of IEF and LPN operated by
  - CNRS INSIS
  - CNRS INP
  - Paris Saclay University

- A new building (18,000 m²) in Palaiseau including **2,900 m² high class cleanroom** facilities

- **Around 400 members**:
- 200 permanent researchers, engineers, admin staff
- More than 100 PhD students and Post-docs
- 37 nationalities
- Director : Giancarlo Faini

NAME

GDR Nanomaterials for Energy Applications

ELABORATION
MEASUREMENTS & METROLOGY
SIMULATIONS & THEORY
APPLICATIONS

C2N

université PARIS-SACLAY

cnrs

C2N: 4 research departments, many topics

Nanoelectronics Department

Photonics Department

Materials Department

MicroSystems and NanoBioFluidics Department

- Nanoscale Physics
- Quantum Photonics & Electronics
- Novel computation paradigms
- Theory, modeling and simulation: from nanostructures to nanodevices
- Materials, nanostructures and hybrid integration (Silicon & III-V/Si photonics)
- Cutting-edge instrumentation and nanotechnologies
- Advanced concepts for light manipulation at any wavelength
- Advanced nanoelectronic and photonic devices
- Photovoltaics and energy harvesting
- Advanced biosensing

C2N

C2N Nanotechnology facility

2,900 m² cleanroom, including

1,200 m² : process
700 m² : epitaxy & material growth
170 m² : education & training
250 m² : hosting of startups and SME

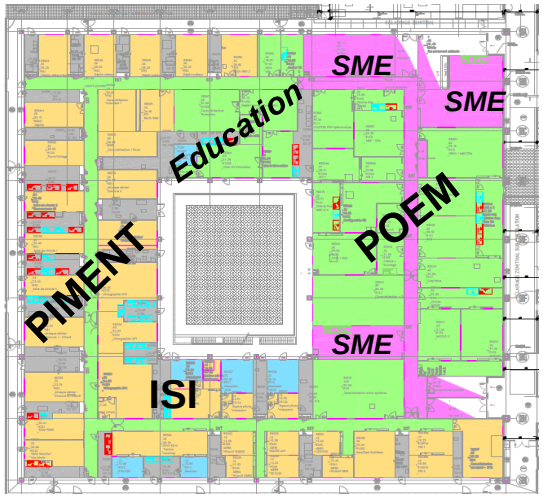
More than 600 process tools

50 M€ total equipment (including growth & analysis)

3 Platforms

Micro and Nano-Technologies Innovation Platform (PIMENT)
PlatfOrm for Elaboration of Materials (POEM)
Material Analysis Platform (PANAM)

Photo: Sergio Grazia



GDR Nanomaterials for Energy Applications

C2N in GDR NAME

- 20 people involved in the GDR

In Physics&engineering (CNRS INSIS+INP)

AXIS
Fabrication
Material/device Measurement
Simulations

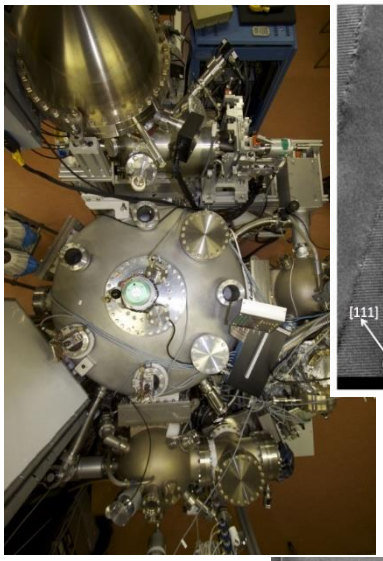
Energy carriers
Photon
Electron
Phonon

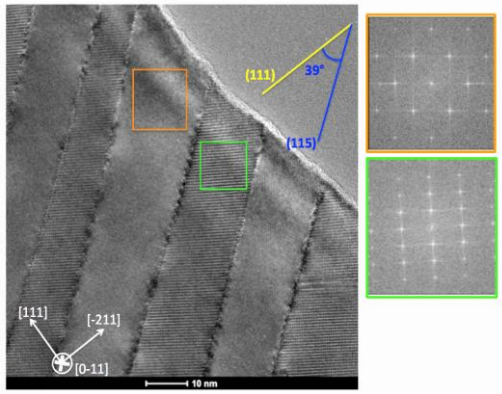
Kinds of energy conversion
Thermoelectric (µW)
Photovoltaic (kW)
Piezoelectric (mW)
Opto-mechanic (phonon/photon)

Applications
Energy harvesting
Sensing

Elaboration techniques in relation to the GDR issues

Cluster tool UHC-CVD and CBE Coupled to characterization chamber (XPS, AES)

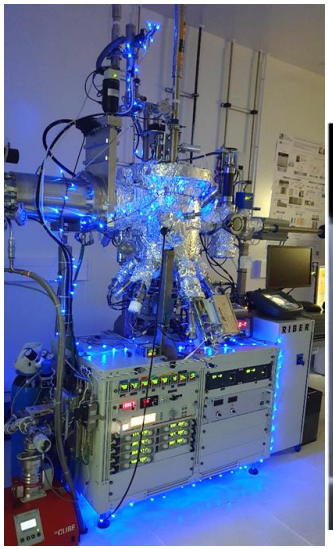


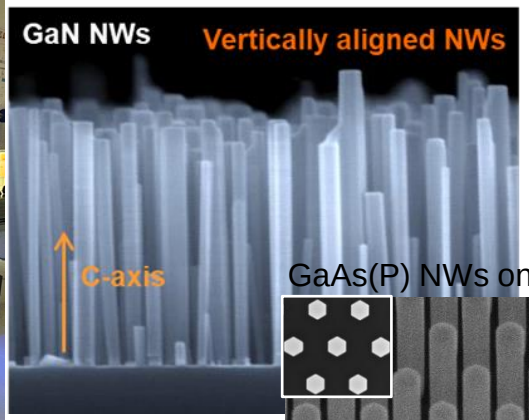


Contact:
laetitia.vincent
@c2n.upsaclay.fr

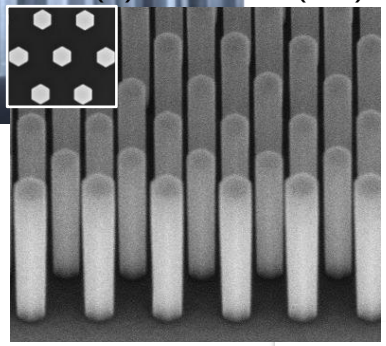
III- N (Ga(In, Al)N NWs grown by Plasma-assisted Molecular Beam Epitaxy on Si(111) substrate for nano-energy applications (LEDs, PV, Piezogenerators)

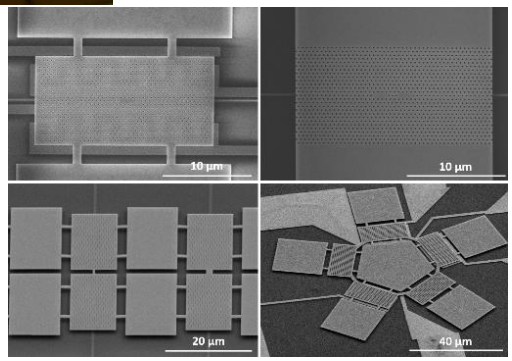
Contact: noelle.gogneau@c2n.upsaclay.fr





GaAs(P) NWs on Si(111)





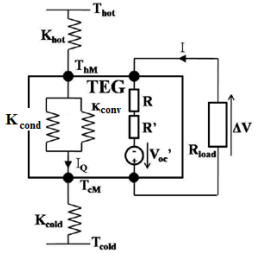
Fabrication of optomechanical and phononic nanoresonators (from MHz to THz);

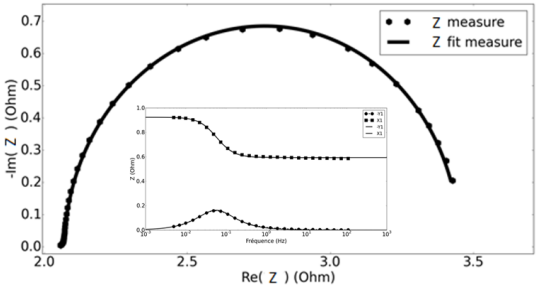
Contact: remy.braive@c2n.upsaclay.fr

GDR Nanomaterials for Energy Applications

Characterization techniques in relation to the GDR issues 1/2

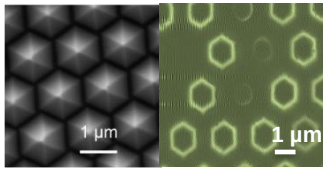
Linear and nonlinear impedance spectroscopy





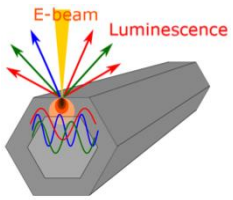
Contact: philippe.lecoeur@c2n.upsaclay.fr

EBIC (electron beam induced current)



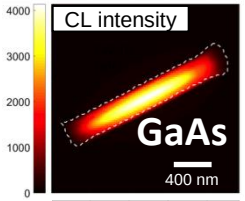
Contact: maria.tchernycheva@c2n.upsaclay.fr

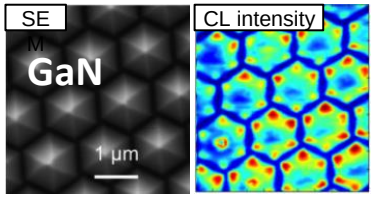
CL (cathodoluminescence)

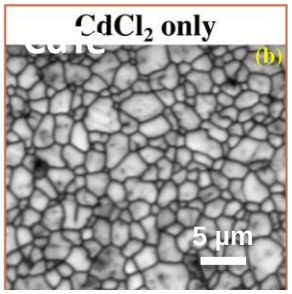


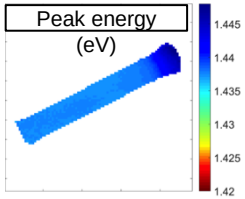
From Attolight

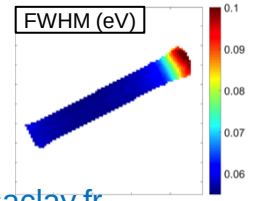
- (TR)CL, SEM, EBIC
- 250 nm - 1.7 µm
- 10K - 350K
- Temporal res. 10 ps





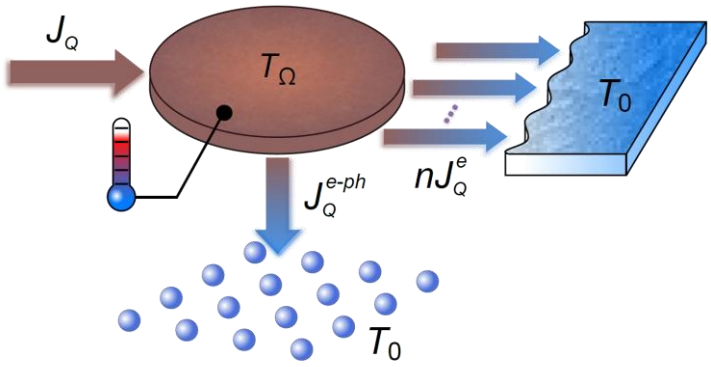






Contact: andrea.cattoni@c2n.upsaclay.fr

Experimental measurement of quantum electronic heat transport



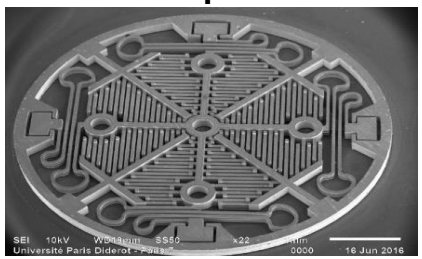
Contact: anne.anthore@c2n.upsaclay.fr

GDR Nanomaterials for Energy Applications

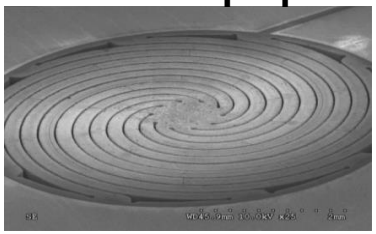
Characterization techniques in relation to the GDR issues 2/2

MEMS

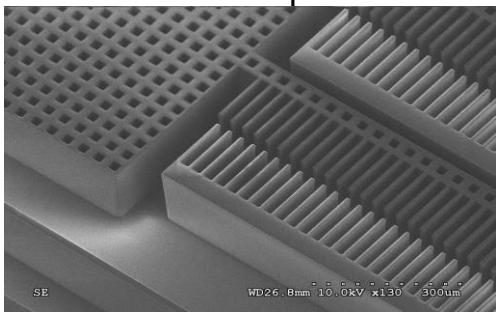
3D electroplated electrostatic µ-Harvester



Piezoelectric µ-spiral

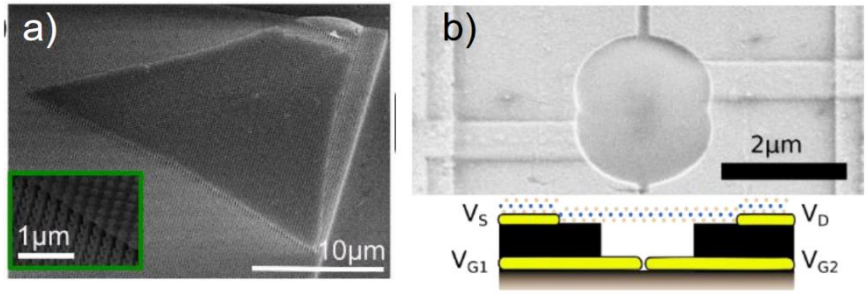


Silicon-on-Glass electrostatic µ-Harvester



Contact : elie.lefeuvre@c2n.upsaclay.fr

2D materials

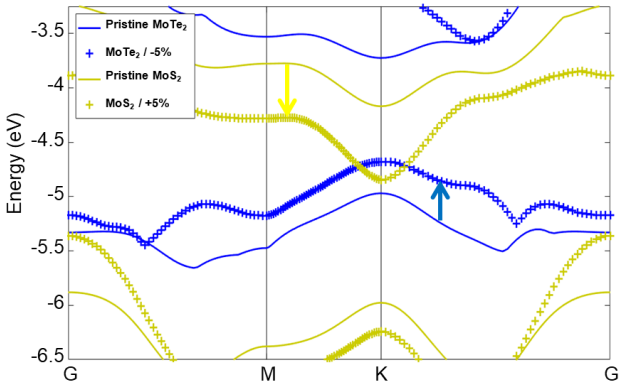


Contact : julien.chaste@c2n.upsaclay.fr

Numerical tools in relation to the GDR issues

Materials properties :

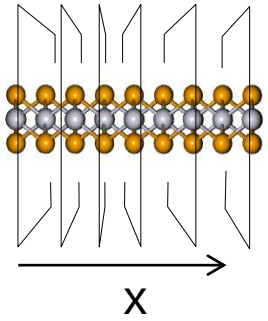
semi-empirical + ab-initio approaches

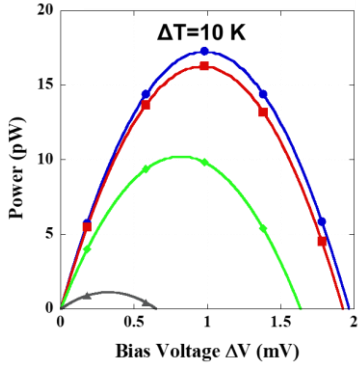


Charge and heat transport modeling

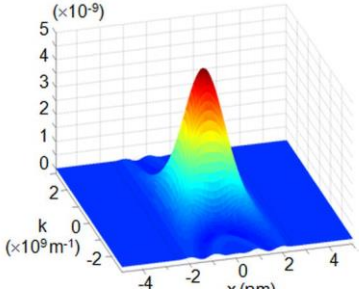
- Semi-classical formalism

Boltzmann by using particle Monte Carlo

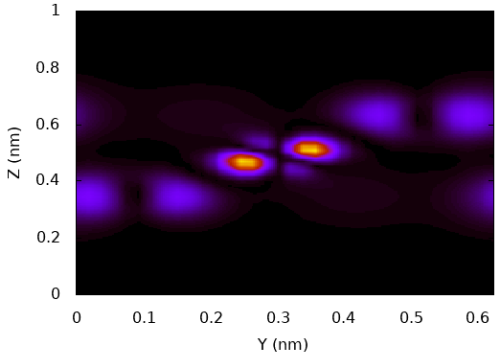


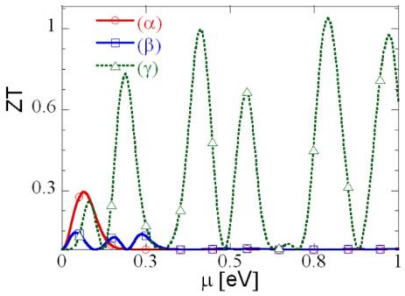


- Quantum transport formalisms



Wigner / NEGF





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THANK YOU YOUR FOR ATTENTION !