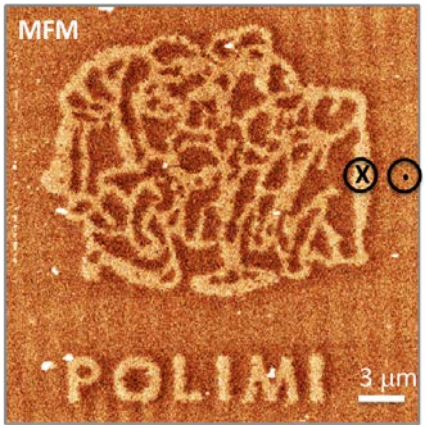
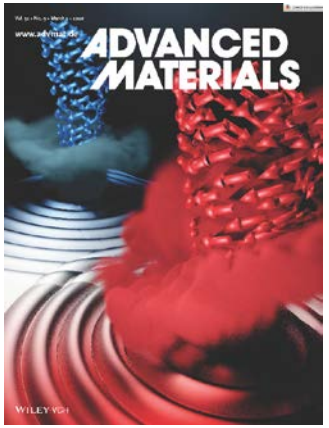
RL 4 - Epitaxial growth and nanostructure fabrication

- **Engineering Physics in Nanostructured materials and Devices**
- **Nanomagnetism for Biology and Spintronics**
- **Spin transport in semiconductor-based platforms**
- **Semiconductors nanostructures and devices**
- **2D Nanoelectronics and Nanofabrication**
- **Scanning tunneling microscopy of low-dimensional systems**
- **Photoemission spectroscopies to explore nano-assembled molecular architectures**

Engineering Physics in Nanostructured materials and Devices Group http://phynd.polimi.it

- **Nanoscal**e control of the static and dynamic **magnetic properties** of materials.
- **Spin waves and topological quasi-particles** for novel devices for beyond CMOS computing.



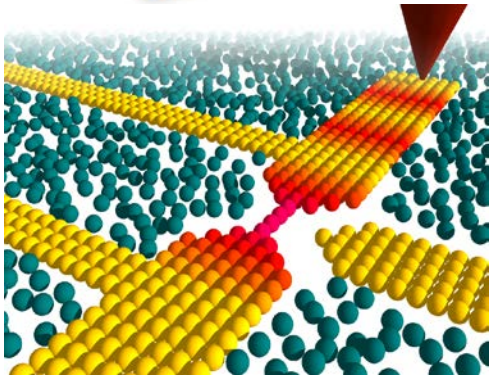


BEYOND

Beyond nanofabrication via nanoscale phase engineering of matter

erc

ERC-2020-STG



- Develop a new class of **artificial nanomaterials** with unprecedented electronic transport properties.
- Realize **novel monolithic three-dimensional nanoelectronic platforms** for beyond-CMOS computing.

polifab
POLITECNICO DI MILANO

Edoardo Albisetti, Daniela Petti
e-mail: name.surname@polimi.it

Nanomagnetism for Biology and Spintronics (*http://nabis.fisi.polimi.it/thesis*)

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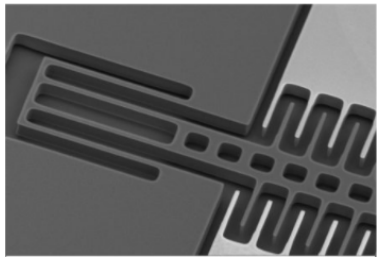
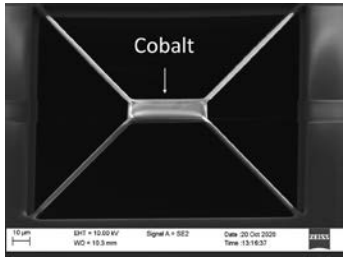
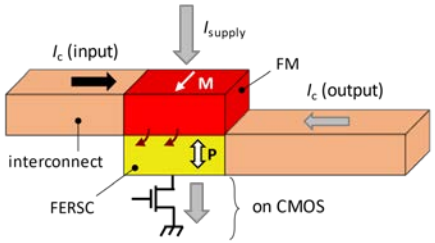
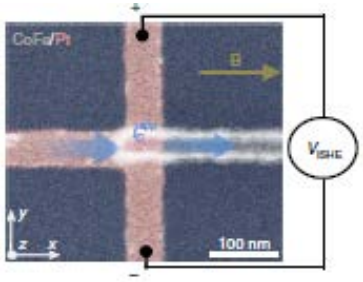
POLITECNICO DI MILANO





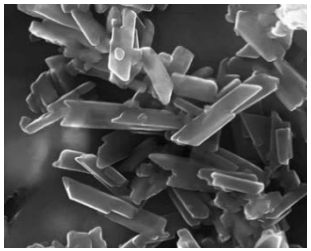
Integration of magnetic materials with MEMS for novel magnetometers and energy-harvesters





Beyond-CMOS computing in nanodevices exploiting the ferroelectric control of spin-to-charge conversion in Rashba semiconductors

Lab-on-chip diagnostic test for Malaria based on the detection of paramagnetic Hemozoin nanocrystals in blood samples.



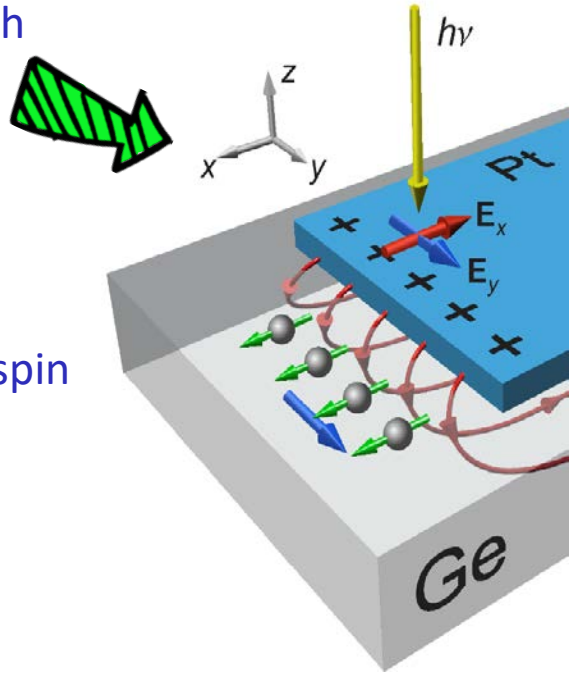
JRC with ST Microelectronics
Novel piezoelectric materials for MEMS

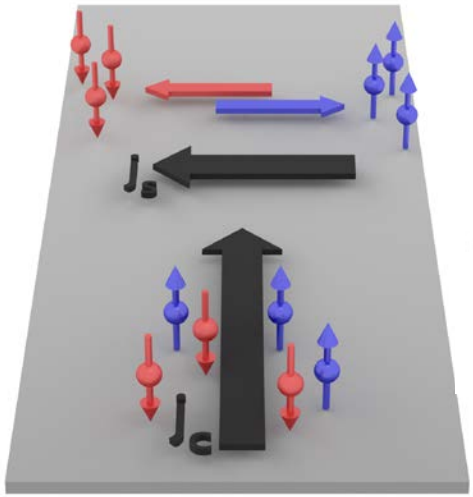
Riccardo Bertacco, Matteo Cantoni, Christian Rinaldi
Email: name.surname@polimi.it

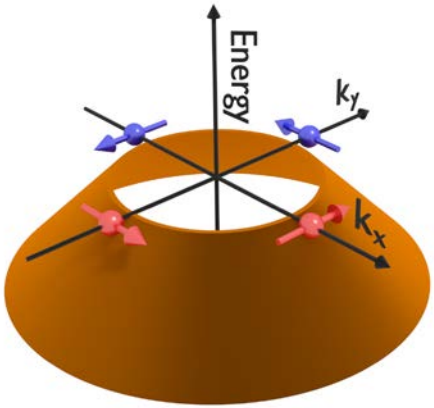
Spin transport in semiconductor-based platforms

The thesis work is focused on

- **Generation** of spin-polarized carriers in semiconductors with optical techniques
- **Detection** of spin-polarized carriers exploiting spin-charge interconversion phenomena (e.g., inverse spin-Hall, inverse Rashba-Edelstein)
- Investigation of spin-transport with the aim of **modulating** spin accumulation in non-local geometries







Selected literature:

Bottegoni et al., *Nature Mater.*, **13**, 790 (2014)

Bottegoni et al., *Phys. Rev. Lett.* **118**, 167402 (2017)

Zucchetti et al., *Phys. Rev. B* **98**, 184418 (2018)

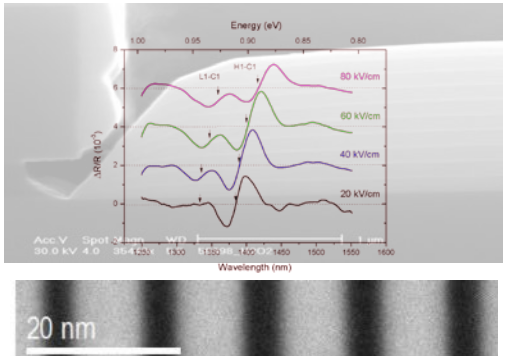
Marchionni et al., *Appl. Phys. Lett.* **118**, 212402 (2021)

Semiconductors nanostructures and devices: Strain engineering and quantum effects SiGe heterostructures

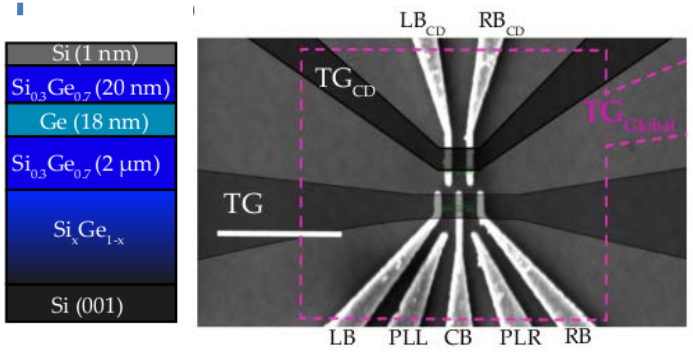
L-NESS

Como Campus

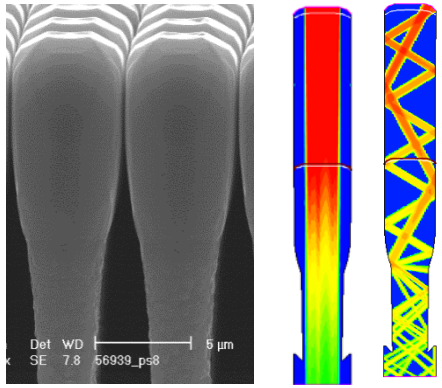
Mid-infrared non-linear effects in Ge QWs



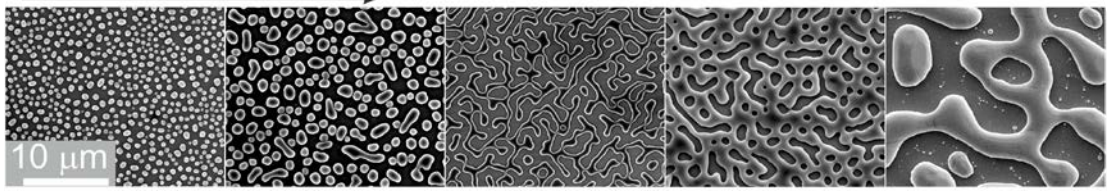
2D Hole gas in Ge QWs for qubit implementation



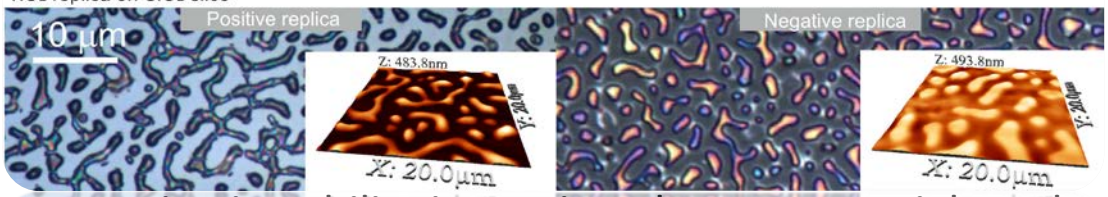
Photodetectors based on Ge microcrystals



SiGe heigth, Ge content



TiO2 replica on SiO2 slice



Visible Infrared dual band detectors

Dewetting instability in semiconductors materials and their applications by nanolitoghraphy

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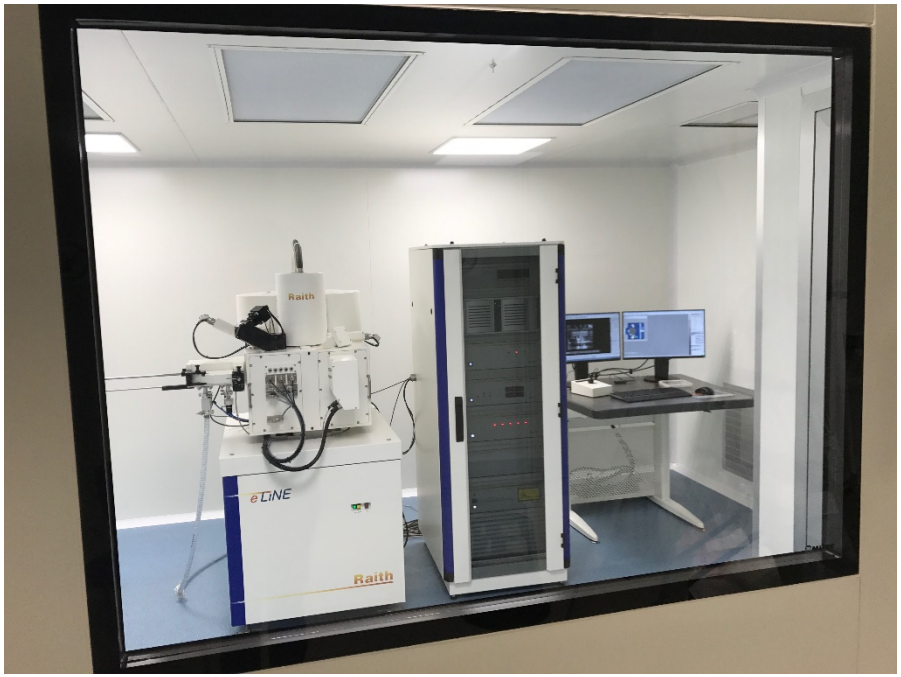
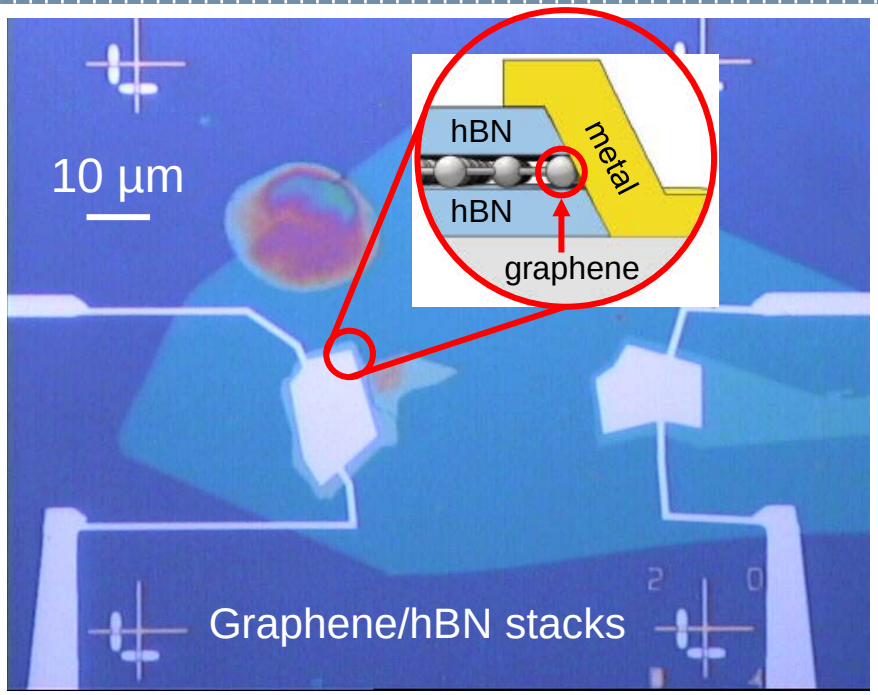
Daniel Chrastina – daniel.chrastina@polimi.it Jacopo Frigerio – Jacopo.frigerio@polimi.it

2D Nanoelectronics and Nanofabrication





The most advanced fully integrated 100 mm **e-beam lithography** system in Lombardy. It is placed in a clean room and features:

- Resolution down to 6 nm.
- Schottky field emission gun operated at 30 keV
- 100 mm laser interferometer stage (position error < 20 nm)
- Alignment error < 20 nm
- Automated laser height sensing (autofocus)

2D Materials in Nanoelectronics

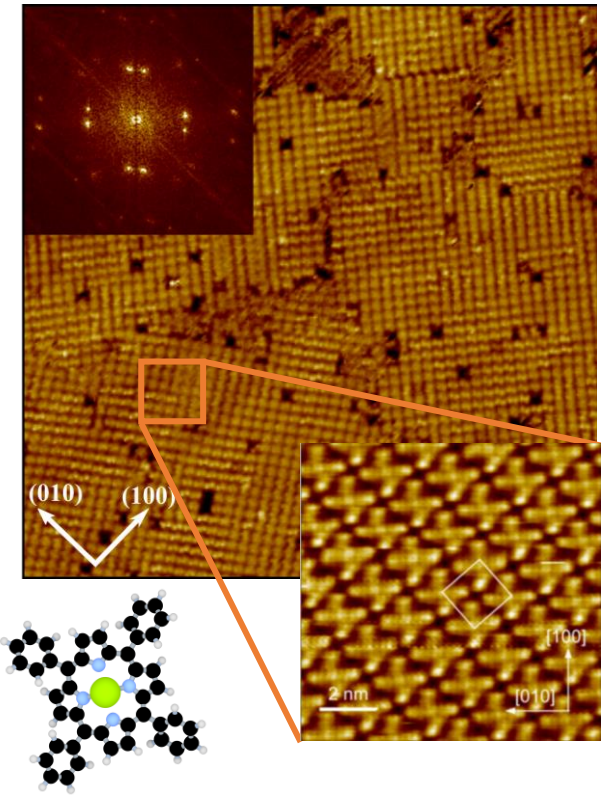
2D nanoelectronic devices and circuits are realized by stacking 2D layers of:

- Graphene (semimetal)
- MoS_2 and WSe_2 (semiconductors)
- hBN (insulator)

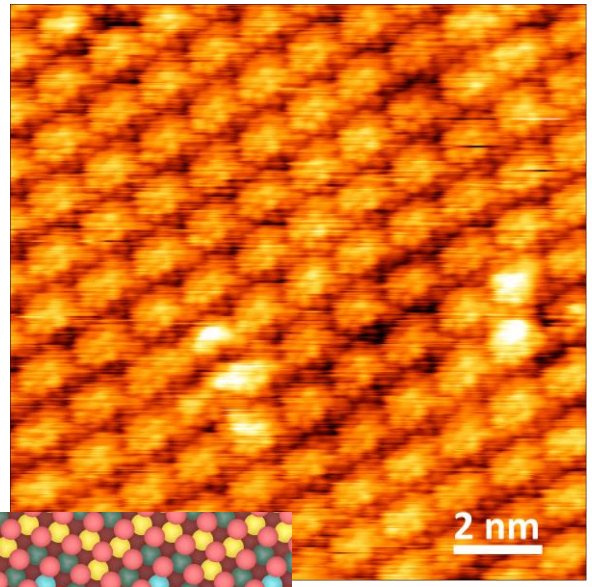
Riferimento Prof. Roman Sordan
Roman.Sordan@polimi.it

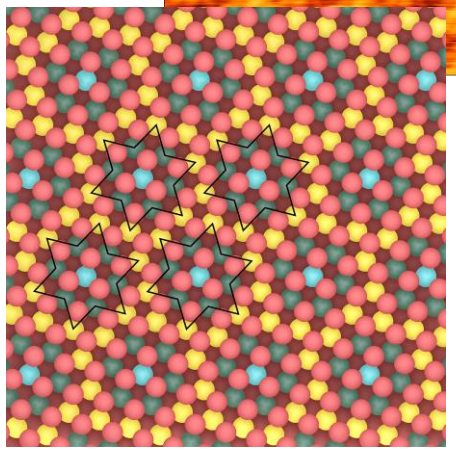
STM LAB

Co-TPP self assembly

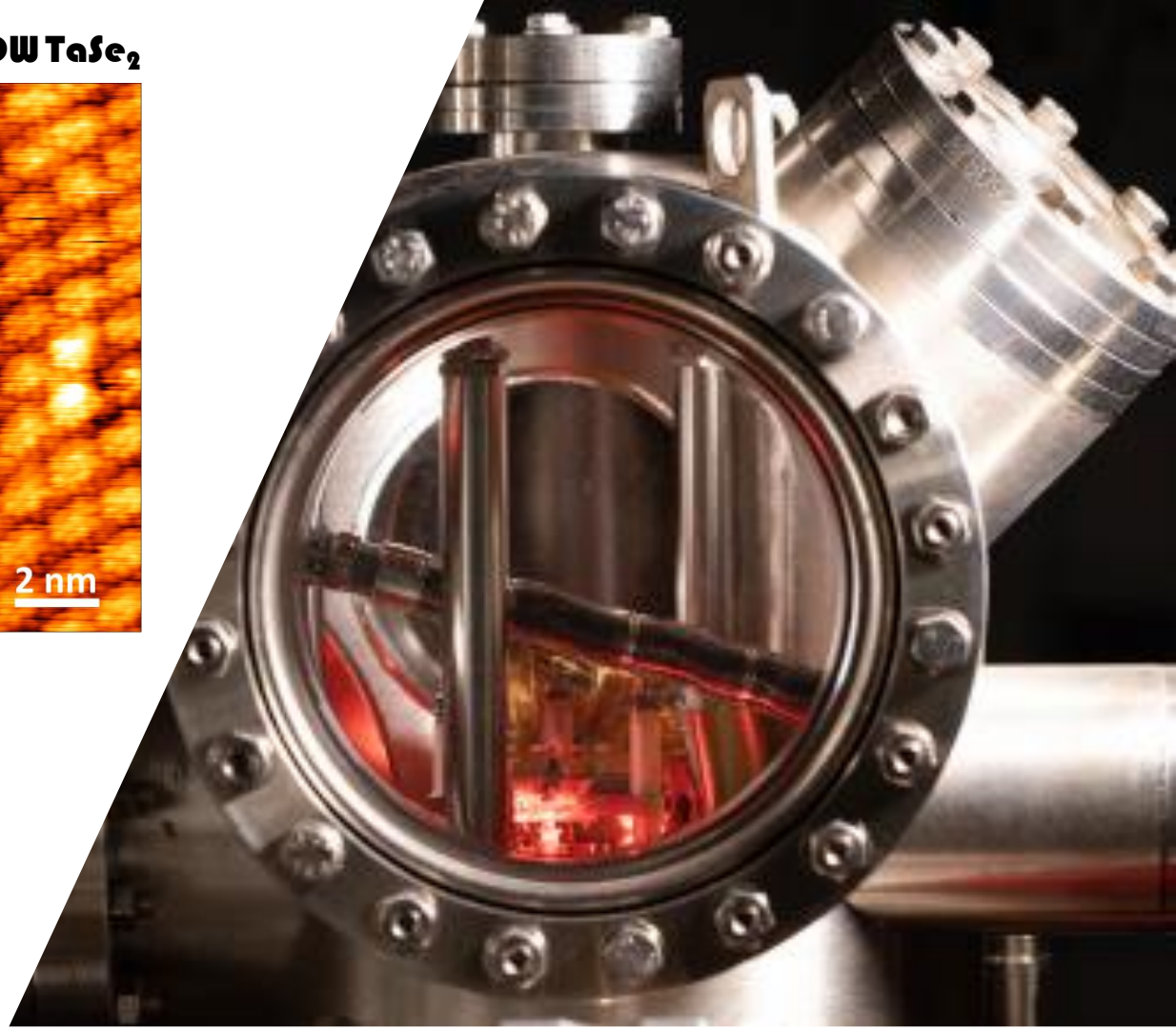


Atomically resolved CDW $TaSe_2$





Sketch model



Research fields

- Molecular Spintronics
- low dimensional systems
- Epitaxial Growth

we contribute to...

SINFONIA

EU FET Open H2020 project

Contact us

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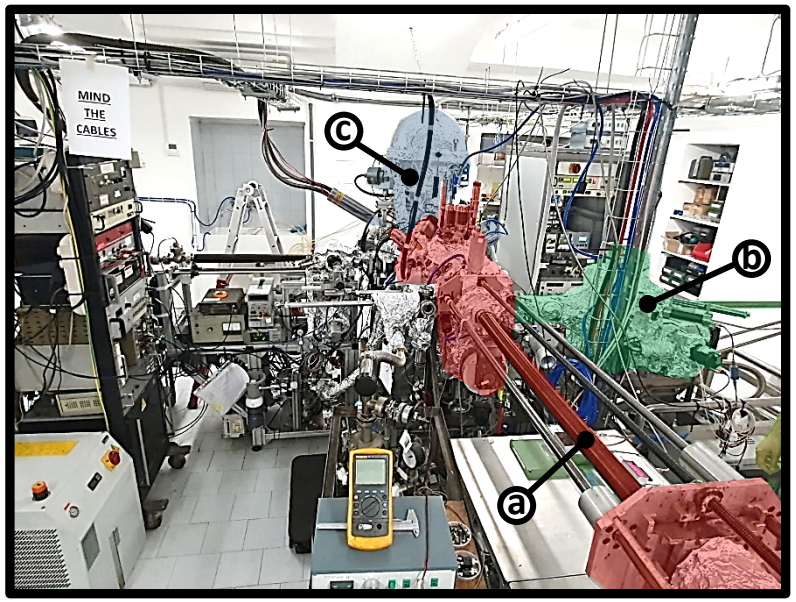
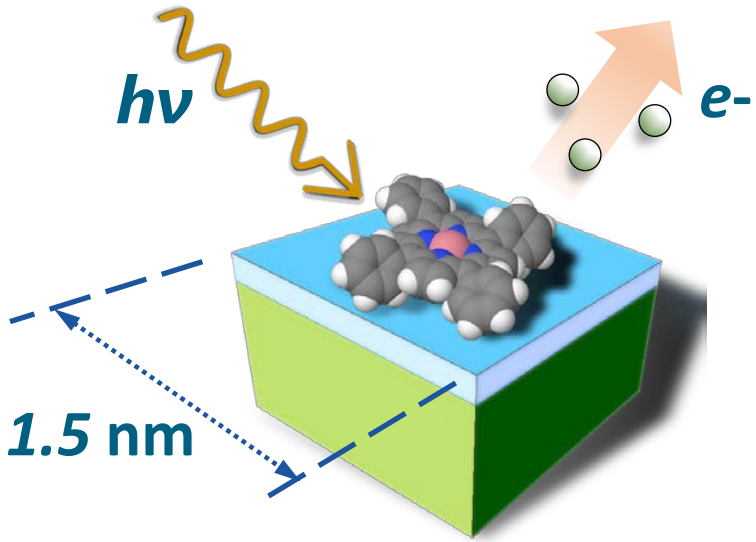
michele.capra@polimi.it

Photoemission spectroscopies to explore nano-assembled molecular architectures



VESI laboratory: (a) sample preparation chamber, (b) OMBE chamber, (c) measurement chamber



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