

Semiconductor Nanostructure Systems and Devices:


This research line has a strong interdisciplinary character. It aims at exploiting the motion and arrangement of ions to control nanoelectronic devices, by using the field effect enabled by Electric Double Layers (EDL) that build up at the interface between nanostructures and ionic environments.

- Design and fabrication of hybrid nanoelectronic devices, combining individual semiconductor nanostructures and soft-matter electrolyte gating media e.g. polymers, gels or ionic liquids.
  - **Nanostructures:** Nanowires (in collaboration with Prof. Lucia Sorba); 2D materials (graphene, 2TMDs in collaboration with Camilla Coletti); Black-phosphorus (in collaboration with Prof. Stefan Heun).
  - **Electrolytes:** Polymers and gels (in collaboration with Prof. Dario Pisignano); Ionic liquids (in collaboration with Prof. Lorenzo Guazzelli).

- Transport experiments with electrolyte-gated semiconductor nanostructure-based field effect transistors, also at low temperature, also in magnetic field.

Main topics of investigation include, but are not limited to:

1) Thermal/electrical transport in hybrid polymer-semiconductor systems: towards the nanoscale thermal transistor.
2) Thermal gating of semiconductor nanodevices using polymers enriched with mobile ions.
3) Calorimetric/dielectric techniques applied to the study of electrolytes used in EDL nanodevices.
4) Hybrid polymer-semiconductor metamaterials: photonic platforms for machine learning.
5) Surface acoustic wave-driven nanowire EDL transistors. (Collaboration: Prof. Marco Cecchini)
6) Quantum transport in EDL nanodevices.
7) Magnetic functionalization and electrostatic control in electronic nanodevices.
8) Nanoscale sensors and transductors enabled by EDLs.
9) Impact of electrode geometry in EDL transistors controlled by electrolytes.
10) Printable polymeric gates to control nanoscale EDL transistors.

CONTACT

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