

# International Doctoral Program in Science Position

## Advanced spectroscopies of 2D materials and hybrid interfaces for applications in the field of photocatalysis and photovoltaics

### Background and motivation

The project will tackle two novel aspects in the field of 2D materials and related applications. The first focuses on the capability to track the electronic properties of a set of 2D materials both pristine and functionalized when exposed to selected molecules or vapors that may introduce relevant changes of electronic structure, such as doping or band gap opening. The starting material to be considered is graphene, prepared with novel routes to achieve the desired level of doping or functionalization. Additional 2D materials will be selected along the project to match the specific properties required for applications. In fact all these materials will be used to prepare interfaces suitable for photocatalysis and photovoltaics applications. Consequently, the second novel aspect of the proposed work will be to conduct detailed spectroscopic studies of the interface electronic properties, aimed to gain a control (e.g. chemical gating) on the buried interface by gas adsorption at the surface. Photophysics effects will then be explored by state-of-the-art spectroscopies, including time-resolved spectroscopies in the ultra-fast regime aimed to track charge transfer dynamics at the interfaces.

The main goals of the project are:

- Accessing the change of the electronic properties of 2D materials and hybrid interfaces upon absorption of selected molecules
- Tracking the dynamics of charge transfer processes induced by combined surface adsorption and photon irradiation, being these processes at the heart of future applications and device development.

### Profile

- Diploma: Master's degree or comparable qualification in Physics, Materials Science, Chemistry or adjacent fields. The title must be obtained before OCTOBER 31ST 2019.
- A solid background in physics, materials science or materials chemistry is required.
- Experience in optical and electronic spectroscopies and surface science will be considered as an advantage.
- A strong interest for multidisciplinary research is required.
- Good knowledge of the English language, both spoken and written, is essential.
- Strong commitment, and eagerness for international mobility is desired.

### Opportunities

- Participating to an international collaboration between Università Cattolica del Sacro Cuore and University of Notre Dame (USA)
- Double degree opportunity.
- This position is supported by a fellowship of 15.343 (gross income) per year. The monthly allowance is increased by 50% when students are abroad. The fellowship covers also the annual Ph.D. taxes.

### Supervisors

- Prof. Luigi Sangaletti, UCSC [luigi.sangaletti@unicatt.it](mailto:luigi.sangaletti@unicatt.it)
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