

## Research Topics for Doctorate in Science and Technology of Chemistry and Materials, curriculum in Nanochemistry

### Research Topics

1. Superlattices and quantum confinement in 2D materials via substrate effects ..... 1
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#### 1. Superlattices and quantum confinement in 2D materials via substrate effects

##### Tutor

Michele Tamagnone

##### Research Line

[Nanophotonic Devices](#), IIT, Genova

##### Description

This research activity will be focused on creating new nanophotonic devices based on 2D materials including (but not limited to) graphene, boron nitride and transition metal dichalcogenides. The goal is to control the band structure and excitons of these materials using substrate effects (also known as meta-gate). This will be achieved using a new nanofabrication technique to create a patterned substrate with features of less than five nanometers and then transferring 2D materials on top of this substrate. The candidate will be working on the theory and optionally on the fabrication of these new devices in the cleanroom facilities at the Italian Institute of Technology and on their characterization with multiple techniques including optical and electrical measurements, electron microscopy and atomic force microscopy. The research activity will be interdisciplinary and include the numerical modelling of the observed phenomena. In addition to significantly advancing the state of the art of nanophotonics, this project will offer to the candidate an excellent opportunity to learn advanced solid-state physics, cleanroom nanofabrication skills and materials characterization techniques and acquire cutting-edge knowledge in multiple technical disciplines. She/he is expected to work independently but in strong collaborations with other researchers.

##### Requirements

The successful candidate should have a degree in materials science, engineering, or physics, with a strong interest in solid state physics, nanomaterials, experimental optics and

optoelectronics. Work experience within a micro/nano-fabrication facility will be positively considered. A working knowledge of Matlab or Python programming is desirable.

**Contact**

[michele.tamagnone@iit.it](mailto:michele.tamagnone@iit.it)

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