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## Thesis subject

Name of the laboratory: CINaM UMR 7325

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### Subject's title:

**Graphene superlattice induced by supramolecular networks**

### Subject description:

Van der Waals heterostructures, composed of vertically stacked inorganic two-dimensional (2D) materials, represent an ideal platform to demonstrate novel device architectures and to study emergent phenomena in these materials such as superconducting and magnetic state or anisotropic transport. The PhD project aims at the development of hybrid organic/inorganic van der Waals heterostructures based on supramolecular networks deposited on graphene. This will allow us to efficiently pattern the potential landscape of these 2D materials, in a deterministic manner, with molecular precision at large scales. The nanometric periodic modulation of the electrostatic potential, namely nanosuperlattice, resulting from the nanometric mesh of the supramolecular network, cannot be reached by conventional fabrication processes, and constitutes an ultimate way to control the electronic transport in the 2D materials. It will thus pave the way for a new generation of electronic devices. During the PhD project, the hybrid van der Waals heterostructures will be synthesized in ultra-high vacuum (UHV) set-ups and characterized by scanning tunneling microscopy (STM) working at low temperature. The candidate will work in the group 2D ASAP (Bidimensional Architectures Self Assembled and Properties) composed of physicists, in close collaboration with chemists of the Laboratory.

CINaM (Centre Interdisciplinaire de Nanoscience de Marseille) is a mixed research Institute (Aix-Marseille University and CNRS). The laboratory is carried out by **160** researchers, teaching researchers, engineers, technicians, administrators, doctoral students and students. The activities are divided between experiment and theory and organized in five departments. The focus is both on fundamental aspects and applications in various fields (biomineralogy, structural and functional materials, nanomedicine, ...). The CINaM teams are therefore strongly involved in the major societal challenges affected by nanotechnology, energy, health and the environment.

The 2D ASAP team synthesizes under UHV environment and studies 2D systems adsorbed on surfaces in order to establish the relationship between nanostructuring on large scales and the resulting physical properties. Experimental studies of the 2D materials are mainly conducted by scanning probe microscopy (atomic scale structure, electronic properties).

<http://www.cinam.univ-mrs.fr/cinam/en/team/nanomateriaux/2dasap/>

Candidates should hold a Master Degree with honours in physics with a preferential background in Solid Physics, Quantum mechanics and strong inclination for experimental physics. Knowledge in organic chemistry will be strongly appreciated.

**Applications** (CV+ Letter of motivation + Letter of reference) should be emailed to **before May, 20th**: [laurence.masson@univ-amu.fr](mailto:laurence.masson@univ-amu.fr) and [thomas.leoni@univ-amu.fr](mailto:thomas.leoni@univ-amu.fr)