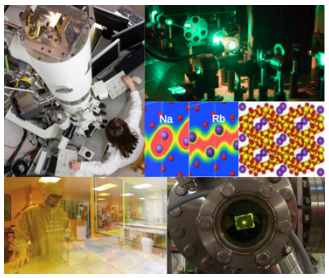
SCIENCES SORBONNE UNIVERSITÉ

MASTER
Physique fondamentale et applications

SMNO nanomat master

M2 – SMNO-nanomat – LabS

Title:	**Practical works: laboratories and simulations (LabS)**	
	Apogée code: MU5PYM06 **Number of credits:** 6 **Teaching hours:** 2 options (A) and (B) A) Experimental: laboratories (~40h) + numerical tutorials (~12h) B) Numerical: laboratories (~24h) + numerical tutorials (~12h) + numerical project (20h)	

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Objectives	This teaching unit aims at understanding through hands-on sessions the main experimental and theoretical methods that are currently used in modern materials science. It is intended as a follow up to the MIM course, which provides the appropriate physical background to the practical works (experimental and numerical). Students can choose among several projects those that are related to their master plan or may extend their knowledge on specific topics. The goals of LabS are the following: ○ to carry out several laboratories using research experimental platforms. ○ to be initiated to numerical simulations. ○ to achieve a 20h-numerical project using advanced simulations codes, currently used in computational materials science. ○ to present the results as posters/oral communications in a dedicated workshop (in January).
Content	The unit consists of tutorials (experimental and simulation) that are common to both (A) and (B) options. Option (A) allows the student to acquire a know-how of advanced experimental techniques. Students will have the opportunity to investigate the physical properties of matter by using research equipments. The choice of the laboratories will be guided by the optional lectures followed by the student in the SMNO master. A list of laboratories together with the associated lectures is given below. While the student who choose the (B) option will carry out a numerical project. The goal is to encourage students beyond the strict "school" framework, to conduct a real research effort partly autonomous, on problems that have been chosen among actual research topics (see below the list of project keywords) and using concepts that they have learned during more specialized courses or will learn on the job. The numerical projects will be carried out by groups of twins, thus introducing students to collaborative research, sharing their respective know-how and encouraging informal discussions. *List of laboratories: X-ray diffraction (MIM), Transmission Electron Microscopy (MIM), low temperature magnetometry (CMP2), Raman and Infrared spectroscopy (MIM), Scanning Tunneling Microscopy (MIM), High pressure Raman spectroscopy (PMX), Magneto Kerr effect (OptoSpin), Photoluminescence (OptoSpin), Optical lithography process (none), X-ray Photoemission spectroscopy (Surf), elasticity of biopolymer gel (PIMs)* *Project keywords: ferroelectric transitions, graphene, nano-crystal shape, Jahn-Teller distortion, magnetic alloys, thermal expansion, metadynamics, crystals under high pressures, growth of quantum dots, fractal/compact growth, glassy systems, vibrations in minerals, active matter*
Pre-requisites	Geometrical crystallography: lattice points and motif, lattice systems, Bravais lattices, conventional crystal cells, crystallographic point groups and space groups, crystal direction, lattice plane, reciprocal space, Brillouin zone, etc. For ***some*** practical works, the contents of specific elective courses.
Exam	Final evaluation as posters/oral communications in a dedicated workshop in January. Partial evaluation according to the type of practical works.