Master

Material sciences and nano-objects-nanomat

OVERVIEW

SMNO-nanomat offers a complete high-level theoretical and experimental training on materials and their applications. Concerned systems are nanostructured materials, 2D materials, thin films, materials for energy, materials under extreme conditions, glasses, minerals and cultural heritage materials, with a systematic focus on the microscopic phenomena at the origin of their macroscopic properties. Student following the program will get the basic background allowing them to pursue in PhD in many different fields, either in an industrial or an academic environment.

Language of instruction: English
ECTS: 60
Oriented: academic research or industrial sector
Duration: 1 year
Courses Location: Sorbonne Université, Paris

EDUCATIONAL OBJECTIVES

The objective is two-fold: (i) to acquire the theoretical bases allowing a thorough understanding of the materials properties, (ii) to be trained in advanced experimental and numerical investigation methods. The program includes numerous tutorials, laboratories and numerical projects in relation with current scientific topics that can answer to societal challenges (renewable energies, ecology, health, heritage, ...). The addressed topics concern optics, electronics, spintronics, superconductivity, correlated systems, physical chemistry of solids and high-density liquids, exploration of planetary interiors, interaction with the environment, etc.
PROGRAM STRUCTURE

COURSE PROGRAM (from September to January, semester M2S3)

The lectures are entirely in English; they are organized in teaching units, called UE for Unité d'Enseignement in French, credited by 3 or 6 ECTS. A standard pedagogical contract (30 ECTS) includes:

- 2 “basic” UE of 3 ECTS to be chosen among 4:
  - Condensed matter physics level 1: basics *PCmat*
  - Condensed matter physics level 2: magnetism and semiconductors physics
  - Condensed matter physics level 3: correlated material physics
  - Condensed matter chemistry

- 1 common core of 2 UE of 6 ECTS:
  - Fundamental aspects and applications of different experimental and numerical methods of materials
    - Diffraction, microscopy, local and non-local spectroscopies
    - Functional theory of density, molecular dynamics, meta dynamics
  - Practical works including laboratories and numerical projects, applying the fundamental concepts dealt with in the core and basic UE, in relation with the "materials" themes addressed in the optional UE.
2 optional UE of 6 ECTS, to be chosen among 12 (including 5 of the Master of Chemistry, taught in French):

- Surfaces, interfaces and nanostructures *PCmat*
- Nanoelectronics and devices with molecules and nanoparticles *PCmat*
- Nanostructures for optoelectronics and spintronics
- Advanced condensed matter physics
- Physics of macroscopic interfaces *PCmat*
- Non-crystalline solids and nanomineralogy *PCmat*
- Physics of materials under extreme conditions *PCmat*
- Matériaux pour un monde durable *PCmat*
- Biomatériaux et matériaux pour le vivant *PCmat*
- Revêtements et nanomatériaux supportés *PCmat*
- Modélisation des propriétés électroniques - Chimie quantique *PCmat*
- Modélisation multi-échelle des systèmes moléculaires complexes *PCmat*

RESEARCH INTERNSHIP (from February, semestre M2S4)

The second semester of the M2 consists of a 5-6 months compulsory internship (30 ECTS), full time in a research unit of the public or industrial sector, focused on materials and nanosciences, in France or abroad.

Each year, about 200 internship proposals in more than 30 host laboratories are offered to the SMNO-nanomat students.

TUITION FEES

CONTACT

Thierry Gacoin (X)

thierry.gacoin@polytechnique.edu