Master of Physics and Materials Science

Program objectives

The Master of Physics and Materials Science trains high-level experts in the fields of photonics, modeling and simulation of mechanic processes (the program includes an accelerated learning of an industrial code, functional materials and structural materials.
In these very dynamic activity sectors, players must possess both a thorough understanding of basic concepts and extensive technical skills to adapt to technological evolution. The goal of the Master of Physics and Materials Science is to make students proficient in scientific and technical aspects of technological applications by giving them a solid ground training in pure science.
The Master in Physics and Materials Science formed partnerships with the Conservatoire National des Arts et Métiers (CNAM – co-accreditation), the Université Paris Diderot-Paris 7, the Institut Supérieur de Mécanique de Paris ("SupMéca") and the Institut National de Formation et d'Enseignement professionnel du Caoutchouc (IFOCA).
The Master in Physics and Materials Science is also involved in study abroad programs (with the USA, Taiwan, Turkey...) which offer student opportunities to do an internship or to study for a semester in partnering foreign universities.
Students who graduated from the M1 (first year of the Master's program) in Physics and Material Science can also apply for admission in the M2 (second year) of the Master in Light, Matter, Interactions specializing in Optics, Matter and Plasmas for which the Université Paris 13 is also accredited. This program is run by a group of universities, engineering schools and other higher education institutions of the Île-de-France region (namely the Université Pierre et Marie Curie, the Université Paris Sud, the Ecole Polytechnique, the Institut d'Optique Graduate School, the Université Versailles Saint-Quentin, the Ecole Supérieure de Physique et Chimie Industrielle, and the Université Paris 13).

Program overview

The first semester (S1) involves a core curriculum for all students (worth 30 ECTS credits). In the second semester (S2), 14 ECTS credits form a core curriculum and students can select classes (TUs or Teaching Units) for 16 ECTS credits to prepare them for the specialization they wish to study in their second year (M2) of their Master's program.
In the second year (M2) of the program, 4 specializations are offered: Photonics and Nanotechnology, Modeling and Simulation in Mechanics, structural materials, and Functional Materials.

For more information on pursuing a second year (M2) in the Master of Light, Matter, Interactions specializing in Optics, Matter and Plasmas, go to http://master-omp.com/lumi/.

Admission requirements

• M1: admission is open to students who hold a Bachelor's degree in Physics, Physics/Chemistry, Electronics, Engineering Sciences, Mechanics or Materials from any French university or from any European Union university functioning on a bachelor-master-doctoral system. Other students are admitted upon review of their application and after an interview.

• M2: admission in each of the four specializations is granted upon application review and/or interview. Admission is granted by the university's president after recommendation from the director of the program.

Career placement

• Jobs: R&D Engineer in high-tech fields such as aeronautics, energy, photonic or electronic devices and nanotechnology. Cleanroom manager. Research engineer. Faculty research or research/teaching appointments after a PhD.

• Fields: Aerospace, Transports, Defense, Controls, Quality, Optical Instrumentation, Lasers, Optoelectronics, Telecommunications, Metrology, Sensors, Energy, Nanotechnology,...

Further education

• Graduates of the Master in Physics and Materials Science can pursue their studies with a PhD program in the fields of physics, photonics, mechanics modeling, functional materials, structural materials.

Master of Physics and Materials Science

SEMESTER 1

TU 1
• General knowledge (4 ECTS credits)

TU 2
• Harmonization (8 ECTS credits)

TU 3
• Digital Techniques (6 ECTS credits)

TU 4
• Measuring and characterization methods (6 ECTS credits)

TU 5
• Mechanical, electromagnetic and photonic properties of matter (6 ECTS credits)

SEMESTER 2

TU 1
• General knowledge (4 ECTS credits)

TU 2
• Introduction to nanotechnology and to micromechanics (4 ECTS credits)

TU 3
• Modelization and experimentation (6 ECTS credits)
• Elective classes: the student will choose 4 TU (4 ECTS credits per TU) relating to the M2 specialization he or she wants to pursue among the following choices:
- Optics and lasers
- Components physics
- Quantum mechanics
- Signal processing
- Digital multiphysics modeling
- Material behavior
- Elastic structure modeling and simulation
- Non-elastic structure modeling and simulation
- Tribology and thermodynamic treatments
- Selecting materials for structural materials
- Advanced characterization of materials
- Condensed matter

SEMESTER 3

> SPECIALIZATION IN PHOTONICS AND NANOTECHNOLOGIES (CO-ACCREDITED WITH THE CNAM)

TU 1
• General knowledge (4 ECTS credits)

TU 2
• Mass/radiation interaction (8 ECTS credits)

TU 3
• Lasers and advanced photonics (8 ECTS credits)

TU 4
• Experimental techniques (8 ECTS credits)

TU 5
• Project (2 ECTS credits)

> SPECIALIZATION IN MODELING AND SIMULATION IN MECHANICS

Core curriculum

TU 1
• General knowledge (4 ECTS credits)

TU 2
• Advanced mechanics (4 ECTS credits)

TU 3
• Finite elements and advanced simulation (4 ECTS credits)

TU 4
• Introduction to Abaqus (4 ECTS credits)

Mechanics emphasis

TU 5
• Multi-scale properties (4 ECTS credits)

TU 6
• Creep and stress rupture (4 ECTS credits)

TU 7
• Intermediary Abaqus (4 ECTS credits)

TU 8
• Project/advanced use of Abaqus (2 ECTS credits)

Note: students have the possibility of taking the TU in Abaqus offered by the PhD School (Python automatization and FORTRAN user procedures)

Elastomer science and technology emphasis*

TU 9
• Elastomer materials (3 ECTS credits)

TU 10
• Elastomer properties (2 ECTS credits)

TU 11
• Making of an industrial component (3 ECTS credits)

TU 12
• Elastomer transformability and applications (4 ECTS credits)

** This emphasis is conducted at the IFOCA*

> SPECIALIZATION IN STRUCTURAL MATERIALS

TU 1
• General knowledge (4 ECTS credits)

TU 2
• Multi-scale properties (4 ECTS credits)

TU 3
• Nanotechnology simulation, modeling and applications (4 ECTS credits)

TU 4
• Advanced Materials – Transports/Public works/Energy (3 ECTS credits)*

TU 5
• Materials behavior and durability (4 ECTS credits)

TU 6
• Innovation in structural materials (3 ECTS credits)*

TU 7
• Advanced materials and processes and their applications (4 ECTS credits)*

TU 8
• Tribology and surfaces (4 ECTS credits)*

** TU taught by SupMéca*

> SPECIALIZATION IN FUNCTIONAL MATERIALS

TU 1
• General knowledge (4 ECTS credits)

TU 2
• Multi-scale properties (4 ECTS credits)

TU 3
• Nanotechnology simulation, modeling and applications (4 ECTS credits)

TU 4
• Spintronics and nanophotonics (3 ECTS credits)

TU 5
• Nanomagnetism, Imaging of nano-objects (3 ECTS credits)**

TU 6
• Nanomaterials for nanomedicine (2 ECTS credits)**

TU 7
• Materials and nano-objects magnetism (6 ECTS credits)

TU 8
• Advanced materials and processes and their applications (4 ECTS credits)

***TU taught by the Université Paris-Diderot*

SEMESTER 4

• Internship (30 ECTS credits)

For more information

> Program director(s): Frédéric DU-BUCK and Alix GICQUEL – M1 Director: Paolo PEDRI
> M2 Photonics and Nanotechnology director: Gabriel DUTIER – M2 Modeling and simulation in mechanics director: Jia LI – M2 Structural materials director: Damien FAURE – M2 Functional materials director: Mourad CHERIF – M2 LUMI director: Anne AMY-KLEIN
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