

Specialty CONDENSED MATTER AND NANOPHYSICS (MCN)

Presentation of training curriculum:

This experimental and theoretical training program by, and for research, aims to train graduate students in Physics of Condensed Matter. It is conceived to attain a specialized know-how on the elaboration and characterization of solid-state objects and polymers, particularly at the nanometric scale. This area of research is thriving at present, due to the growing importance of nano-physics. The electronic, magnetic, and optical properties, as well as their combination, constitute the core of the teaching and research contents of the program, which is strongly oriented towards the study novel phenomena at the small-size scales.

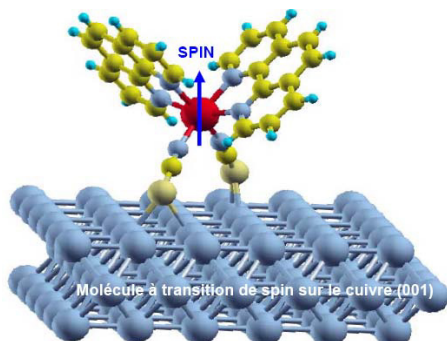


Access and recruitment:

- ♦ **Entry level:** bachelor degree or equivalent (French or foreign "licence") in physics or applied physics. The direct admission to the M2 level is possible for students with strong academic records that have the M1 level.
- ♦ **Duration of training:** 2 years.
- ♦ **Enrollment procedure:** online inscription via Aria (<https://aria.u-strasbg.fr>).

Targeted skills:

- ♦ Basic skills in the Physics of Condensed Matter, as well as in advanced techniques of instrumentation and scientific programming.
- ♦ Transverse skills : an ease to work in an English environment (the M2 lectures are conducted in English), introduction to a research activity carried out at the international level, numerical methods for data treatment and simulations.




Job opportunities:

- ♦ **Functions:** researcher, university professor, research engineer (after a PhD).
- ♦ **Relevant branches of activity:** basic or applied research, technology development and management of large technical projects in the public and private sectors; universities, CNRS, CEA, IRSN, EDF, ANDRA, AREVA, companies developing sensors, measurement systems and simulation tools.

Condensed matter and nanophysics

Subjects taught:

Master 1:  (common to all specialties, taught in French)

- Quantum mechanics and statistical physics (112 h).
- Programming and simulation (66 h).
- Experimental physics (60 h).
- 2 optional courses (28 h each): Mechanics of continuum media, Objects of the universe and their observation, Group theory, Ionizing radiation and detection methods, General relativity, Nanostructures and nanophysics, Computational applications in physics, Advanced quantum mechanics and statistical physics, Quantum many-body problems, Critical phenomena and non-equilibrium statistical physics.
- Possibility to complete the necessary basis in quantum mechanics and statistical physics for students with different backgrounds (32 h).
- Nuclear matter, elementary particles and condensed matter (112 h).
- Physics in Labs (16 days).
- Today's research topics in physics (28 h).
- 3 optional courses (28 h each): Particles and Astroparticles, Physics of stars, Physics of living matter, Atomic and molecular physics, Project supervised, Relativistic quantum mechanics, Numerical applications in Physics.

Master 2:  (taught in English)

- 4 common courses (28 h each): Electronic properties of nanostructures, Photon-matter interaction, Out-of-equilibrium statistical physics, Spectroscopy for nano-science.

- 3 optional courses (18 h each): Magnetism and magnetic nanostructures, Modeling of the electronic structure of solids, Order and disorder in the soft condensed matter, Spintronics, Dynamical processes in optics, Quantum many-body theory, Carbon in all its forms, Dynamics of complex fluids, Physics of living structures, Diffusion and diffraction of radiation in soft matter, Tutored project: computational physics project, Electron dynamics in metallic nanostructures.

Laboratory internship:

The introduction to research is a preliminary step to a PhD thesis. In semester 4, a full-time laboratory training of at least 3 months will allow the student to test his/her ability to integrate into a research team, to confront the problems of research, synthesize the results of the performed research and assess his/her degree of autonomy. The topic can be chosen among proposals from local laboratories, as well as French and international laboratories or companies performing research.

Local laboratories:

Institute of physics and chemistry of materials of Strasbourg (IPCMS), Institute Charles-Sadron (ICS), Institute of science and supramolecular engineering (ISIS), Electronic department of the solid-systems & photonics (D-ESSP), Sciences laboratory of engineering, computing and imaging (ICube), and Laboratory physical and electronic spectroscopy (LPSE, Mulhouse).

Merit scholarships:

Highly qualified students can apply for a M2 scholarship. The evaluation is based on academic performance. The financial support is provided by the laboratory of excellence NIE.

Contacts / information:

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