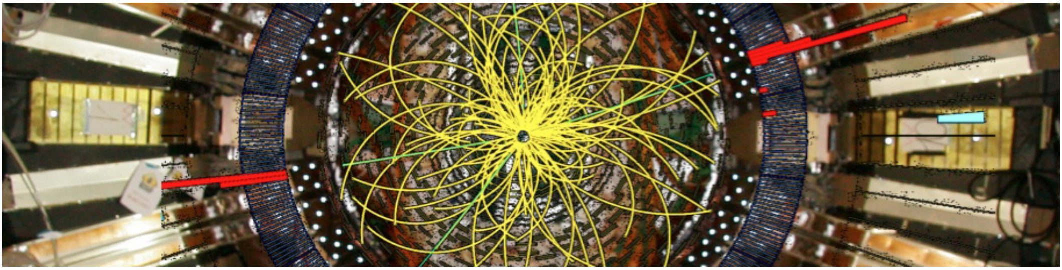
MASTER sciences and technology

Major in PHYSICS

Specialty SUBATOMIC AND ASTROPARTICLE PHYSICS



Programme goals:

This Master programme focuses on fundamental and applied research conducted at the large centres in particle physics (LHC at CERN, Geneva, Switzerland) or in nuclear physics (SPIRAL at GANIL, Caen, France) and on the strong connections with modern cosmology and astrophysics. The two-year Master programme includes advanced lectures on theoretical methods and experimental techniques and requires active participation of the students in research projects to get them ready for an international career in science.

The second year is hosted by Institut Pluridisciplinaire Hubert-Curien, where students are in close contacts with researchers working in the major world-class projects in subatomic physics.

Admission and applications:

- **First year admission**: European Licence or Bachelor’s degree in physics.
- **Second year admission**: European M1 level (4 university years completed), with prerequisites in Electrodynamics, Quantum Physics, and Special Relativity.
- **Applications site**: see www.physique-ingenierie.unistra.fr

Targeted skills and knowledge:

- **Science**: concepts and phenomena in subatomic and astroparticle physics, in particle detection and instrumentation, in computing and big data analysis.
- **Research**: modeling a physical problem within a given theory, inventing designing and simulating an experiment, analyzing and interpreting data.
- **Project management**: work impact and communicate in large international collaborations.

Career opportunities:

Our students pursue their career both in the public or private sector, either after a successful PhD-thesis or directly after having completed the Master Diploma.

The career possibilities cover a large range of domains, both in fundamental and in applied research: Universities, CNRS, CEA, IRSN, EDF, ANDRA, AREVA, international research organisations, companies developing detectors software algorithms (Big Data) and computing simulations.

Subatomic and astroparticle physics

Syllabus 1st year: *(M1, lectures in French)*

Semester 1

- Quantum mechanics and statistical physics basis at the beginning of the semester for students with different backgrounds (32 h).
- Quantum mechanics and statistical physics (112 h).
- Programming and current research (58 h).
- Experimental physics (60 h).
- 3 courses (84 h) among: Mechanics of continuum media, Objects of the universe and their observation, Group theory, Ionizing radiation and detection methods, General relativity, nanostructures and nanophysics, Elements of the theory of quantum scattering, Critical phenomena and non-equilibrium statistical physics, Supervised projects…

Semester 2

- Nuclear matter, elementary particles and condensed matter (112 h).
- Programming and numerical simulation (22 h).
- Physics in research labotories (16 days).
- 2 courses (56 h) among: Particles and astroparticles, Physics of stars, Atomic and molecular physics, Introduction to biophysics, Soft-matter physics, Relativistic quantum mechanics, Optics and photonics, Numerical applications in physics, Supervised projects…

Syllabus 2nd year: *(M2, lectures in English)*

- Subatomic physics (86 h): Quantum field theory, Inroduction to particle and nuclear physics.
- Instrumentation and modelisation (48 h).
- 5 optional lectures (200 h) among: From nuclei to star, Theoretical aspects of nuclear physics, Standard model and beyond, particle physics theory, Strong interaction at hadronic colliders, Astroparticles and observational cosmology, General relativity and cosmology, Nuclear reactors and applications of nuclear physics.

Master thesis:

A Master Thesis concludes the programme with a minimum of three months research project in a laboratory.

This internship allows to develop professional skills required by scientific work: problem analysis, autonomy, team work and results presentation. Students can pick any research subjects among the many ones proposed by IPHC or other international laboratories in France or aboard: for example IN2P3, CEA, CERN in France, GSI, DESY, KIT in Germany, SCK-CEN in Belgium, STFC in UK. About 25 % of our students find an internship outside France.

Success rate and PhD thesis:

Averaged over the last five academic years, our statistics shows that well over 85 % of the students obtained their Master diploma, about 60 % of these chose to continue with a PhD thesis in academic or private research.

Grants:

Academic grants are offered to students with the highest academic achievements and require a specific application.

Partnership:

In association with the Ecole Universitaire de Recherche «Quantum Nanomaterials and Nanoscience».

Contacts / information:

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