



Master



Sciences and technology major in physics

Subatomic and astroparticle physics | SAP

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 contact with researchers working in the major world-class projects in subatomic physics.

The Master has a partnership with the school of Quantum science and nanomaterials (QMat), which offers financial support based on academic achievements. Consult : **qmat.unistra.fr**

[More information on physique-ingenierie.unistra.fr](https://physique-ingenierie.unistra.fr)

Study at the Faculty of Physics and Engineering

Our faculty provides a comprehensive range of courses in the fields of physics and engineering sciences. These courses span a wide spectrum, covering the study of elementary particles, condensed matter, material-and nano-sciences, while also extending to applications in mechanics and electronics.

Teaching takes place across three distinct locations: the Historical Campus, the CNRS Campus in Cronenbourg, and the Technology Hall in Illkirch-Graffenstaden.

Our diverse training offers include approximately twenty degree programs, featuring alternatives such as work/study apprenticeship contracts, internships, international partnerships, and dual-qualifications with engineering schools.

What sets our program apart is its close affiliation with nationally and internationally acclaimed laboratories, as well as collaborations with the regional industrial sector.

This connection provides students with valuable opportunities for hands-on learning and professional experience and provides our faculty with significant visibility in the field of physics and engineering.

Training

 **Duration of the course: 2 years**

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 **Programme and courses**

M1 (*Taught in English*)

Semester 1 (S1)

- Quantum mechanics and statistical mechanics (112h)
- Programming and actual research (58h)
- Experimental physics (60h)
- Project

1 free UE + 2 optional courses (56h) :

- Mechanics of continuous media (in French)
- Astrophysical objects and their observations
- Group theory, Ionizing radiation and detection methods
- General relativity
- Direction of time & Advanced statistical mechanics
- Variational principles and analytical mechanics
- Elements of quantum theory of collisions
- Photonics for quantum science and technology
- Soft condensed matter

Semester 2 (S2)

- Nuclear physics and elementary particle-Solid state physics (112h)
- Computer programming and numerical simulations (22h)
- Laboratory physics (16 days)
- Project

1 free UE + 1 optional course (56h) :

- Particles and astroparticles
- Stellar physics
- Atomic and molecular physics
- Intro. to physics of living systems
- Relativistic quantum mechanics
- Numerical methods in physics
- Electronics for quantum science and technology
- Critical phenomena and non-equilibrium statistical physics

M2 (*Taught in English*)

- Subatomic physics (86h)
- Instrumental and computing treatment of a Physics project (48h)

4 optional courses (80h) :

- From nuclei to stars
- Theoretical approach of Nuclear Physics
- Standard model and beyond
- Strong interaction at hadronic colliders
- Astroparticles and observational cosmology
- General relativity and cosmology
- Elements of analytical and quantum mechanics and special relativity
- Nuclear reactors and applications of nuclear physics.

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Targeted skills and knowledge

- **Science :** understanding 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 theoretical framework inventing, designing and simulating an experiment, analyzing and interpreting data.
- **Project management :** work impact and communicate in large international collaborations.

Internship

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 abroad : for example IN2P3, CEA, CERN in France, GSI, DESY, KIT in Germany, SCK-CEN in Belgium, STFC in UK.

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, Mirion Tech., international research organisations, companies developing detectors software algorithms (Big Data) and computing simulations.

Continuation of studies possible in this Master (M2 level) from the third year at TPS, ensuring a double engineering and Master degree.

Key figures

89%

of the students obtained their Master diploma (over the last five academic years).

75%

of these chose to continue with a PhD thesis in academic or private research.

25%

of our students find an internship outside France.

Contacts

Program head

Boris Hippolyte

boris.hippolyte@unistra.fr | 03 88 10 61 54

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Head of internships

Isabelle Huber

isabelle.huber@unistra.fr | 03 68 85 49 70

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Program assistant

Rachida Azagouaghe

rachida.azagouaghe@unistra.fr | 03 68 85 49 53

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Faculté de physique et ingénierie

3 rue de l'université

67084 Strasbourg Cedex

Scolarité  | assistance-etudiant.unistra.fr

Admission and applications

Entry level

→ 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.

 **Admission : ecandidat.unistra.fr or Campus France**

