

PHYS2M - Teaching profile

Learning outcomes

Observe and understand the physical reality of the world around him/her, understand it, explain it and model it, these are the challenges that the student enrolled in the Master [120] in Physics is preparing to meet. This programme aims to develop mastery of the fundamental laws and essential tools of today's physics, with a focus that allows entering the world of research or industry (research focus), the world of education (training focus) or the hospital environment (specialized focus on medical physics). It leads to the acquisition of skills such as the ability to analyze a physical problem, the ability of abstraction and modeling, the rigor in reasoning and expression, the autonomy and the ability to communicate, including in English.

At the end of his/her training at the Faculty of Sciences, the student will have acquired the disciplinary and cross-disciplinary knowledge, and skills needed to perform numerous professional activities. His/her modeling and in-depth understanding of phenomena, his/her liking for research and his/her scientific rigor will be sought not only in scientific professions (research, development, teaching, etc.), but also more generally in the current and future Society.

On successful completion of this programme, each student is able to :

1. Master and use in depth the specialized knowledges of physics.

1.1 Formulate the fundamental concepts of current physical theories, highlighting their main ideas, and link these theories together.

1.2 Identify and apply physical theories to solve a problem.

1.3 Know and use adequately the principles of experimental physics : measurements, their uncertainties, measuring instruments and their calibration, the processing of data by computer tools.

1.4 Explain and design a measurement method and implement it.

1.5 Model complex systems and predict their evolution using numerical methods, including computer simulations.

1.6 Retrace the historical evolution of physical concepts and recognize the role of physics in various parts of the body of knowledge and culture.

2. Demonstrate methodological, technical and practical skills useful for solving problems in physics.

2.1 Choose, knowing their limitations, a method and tools to solve a novel problem in physics.

2.2 Design and use instruments to measure or study a physical system.

2.3 Properly handle computer tools to help solve problems in physics, while knowing the limitations of these tools.

2.4 Design algorithms adapted to the problems addressed and translate them into computer programmes.

2.5 Apply adequate tools, both basic and more advanced, to model complex physical systems and solve specific problems in physics application fields.

3. Apply a scientific approach and reasoning, and identify, using an inductive or deductive approach, the unifying aspects of different situations and experiences.

3.1 Evaluate the simplicity, clarity, rigor, originality of a scientific reasoning, and identify any flaws.

3.2 Develop or adapt a physical reasoning and formalize it.

3.3 Argue the validity of a scientific result and adapt its argumentation to various audiences.

3.4 Show the analogies between different problems in physics, in order to apply known solutions to new problems.

4. Build new knowledge and research related to issues in one or more areas of current physics.

4.1 Develop an autonomous physical intuition by anticipating expected results and verifying consistency with existing results.

4.2 Analyze a research problem and select the appropriate tools to study it in a thorough and original way.

5. Learn and act autonomously to continue training in an independent way.

5.1 Search in the physical literature for sources and assess their relevance.

5.2 Read and interpret an advanced physics text and relate it to acquired knowledge.

5.3 Acquire new scientific and technical skills.

5.4 Judge autonomously the relevance of a scientific approach and the interest of a physical theory

6. Work in a team and collaborate with students and professionals in other disciplinary fields to achieve common goals and produce results.

6.1 Share knowledge and methods.

6.2 Identify individual and collective goals and responsibilities, and work in accordance with these roles.

6.3 Manage, individually and as a team, a major project in all its aspects.

6.4 Evaluate your performance as an individual and team member, and evaluate the performance of others.

6.5 Recognize and respect the views and opinions of team members.

o Formation spécialisée en physique (30 credits)

NB : Des programmes types en fonction des orientations de la recherche en sciences physiques à l'UCLouvain sont proposés sur le site

⌘ Physique atomique, moléculaire et optique

⌘ LPHYS2242

Fundamentals of quantum information

Matthieu
Génévriez (coord.)
Sorin Melinte
Bernard Piroux

EN

				Year	
				1	2
⊗ LGBIO1111	Cell biology and physiology	Charles De Smet Laurent Jacques Pascal Kienlen-Campard	DB [q2] [30h+15h] [5 Credits]	x	x
⊗ LGBIO1112	Introduction to biomedical engineering	Benoit Delhayé (compensates Philippe Lefèvre) Sophie Demoustier (compensates Philippe Lefèvre) Greet Kerckhofs (compensates Philippe Lefèvre)	DB [q2] [45h] [5 Credits]	x	x

⊗ **Optional courses :**

These credits are not counted within the 120 required credits.

⊗ LSST1001	IngénieursSud	Stéphanie Merle Jean-Pierre Raskin	DB [q1+q2] [15h+45h] [5 Credits]	x	x
⊗ LSST1002M	Information and critical thinking - MOOC	Anne Bauwens (compensates Jean- François Rees) Myriam De Kesel	DB [q2] [30h+15h] [3 Credits]	x	x

Course prerequisites

There are no prerequisites between course units (CUs) for this programme, i.e. the programme activity (course unit, CU) whose learning outcomes are to be certified and the corresponding credits awarded by the jury before registration in another CU.

The programme's courses and learning outcomes

For each UCLouvain training programme, a [reference framework of learning outcomes](#) specifies the the skills expected of every graduate on completion of the programme. Course unit descriptions specify targeted learning outcomes, as well as the unit's contribution to reference framework of learning outcomes.

authorisation from the faculty/
school.

Others Bachelors of the French speaking Community of Belgium

	Direct access
Bachelier en sciences de l'ingénieur, orientation ingénieur civil	Access based on application

Bachelors of the Dutch speaking Community of Belgium

Direct access

Foreign Bachelors

[Access based on application](#)

Non university Bachelors

> Find out more about [links](#) to the university

Holders of a 2nd cycle University degree

Diploma	Special Requirements	Access	Remarks
"Licenciés"		Direct access	
Masters		Direct access	

Holders of a non-University 2nd cycle degree

Access based on validation of professional experience

> It is possible, under certain conditions, to use one's personal and professional experience to enter a university course without having the required qualifications. However, validation of prior experience does not automatically apply to all courses. Find out more about [Validation of priori experience](#).

Access based on application

Access based on application : access may be granted either directly or on the condition of completing additional courses of a maximum of 60 ECTS credits, or refused.

The first step in the procedure is to submit a file online (see <https://uclouvain.be/en/study/inscriptions/futurs-etudiants.html>).

Students who wish to be admitted on the basis of a dossier are invited to consult the [criteria for the evaluation of application](#).

Admission and Enrolment Procedures for general registration

Specific professional rules

Successful completion of the master's course with **teaching focus** leads to the award of the master's degree with teaching focus and the title of secondary school education specialist.

The [Réforme des Titres et Fonctions](#) ("Titles and Functions Reform"), in force since 1 September 2016, is intended to harmonise the titles, functions and pay scales of basic and secondary education professionals in French Community of Belgium networks.

It also aims to guarantee the priority of preferred titles over minimum titles and to establish a regime for titles in short supply.

AESS holders can learn which functions they can carry out and the pay scales from which they can benefit by [clicking here](#).

The university cannot be held responsible for any problems that students may encounter at a later date with a view to a teaching appointment in the French Community of Belgium.

Teaching method

Most teaching units are given by default in English.

Various teaching methods are used : lectures, flipped classroom, project-based learning, etc. Exercise and practical lab sessions are organized for certain teaching units. Individual or group projects are planned for most of the teaching units. These projects play a significant role (around 20%) in the final grade.

Almost all teaching units have a website on the MoodleUCL platform. Useful information is provided, as well as syllabi and other documents essential to student's work.

The Master's thesis is a formative activity that must lead students to demonstrate their ability to (1) deal in depth with a physical problem in all its real complexity, by conducting a personal research, under the direction of a promoter, and (2) write a summary of his/her work and defend it in public in a rigorous and educational way, while being able to answer relatively specific questions. The various stages are : constitution of a relevant bibliography on the subject, reading and understanding of the selected articles, implementation and execution of the project, analysis and interpretation of the results obtained, writing of a synthesis manuscript and oral presentation of the latter. To carry out this project, the student is embedded in a research group with which he/she can interact.

A "thesis tutorial" introduces the student to scientific communication and, in particular, to the oral presentation of a scientific subject in English.

The physics seminar is composed of three series of presentations to which students must attend : lectures of general interest, more specific seminars dealing with physics research carried out in UCLouvain research institutes and testimonials from former students on their professional background.

Evaluation

The evaluation methods comply with the [regulations concerning studies and exams](#). More detailed explanation of the modalities specific to each learning unit are available on their description sheets under the heading "Learning outcomes evaluation method".

The evaluation methods are in accordance with the regulations for studies and examinations. More details on the terms and conditions specific to each teaching unit are available in their fact sheet under the heading "Assessment of student achievement".

The student is evaluated on the basis of the personal work that he/she will have accomplished (readings, consultation of databases and

Possible trainings at the end of the programme

Whatever the focus chosen, the Master's [120] degree gives direct access to the PhD in Science.

In addition, there are two particularly adapted programmes that allow for further study and obtaining specific diplomas :

1) An additional year of study at Mol, after the Master's [120] degree, allows to follow the English-speaking interuniversity programme giving the title of "Master in Nuclear Engineering" managed by BNEN (Belgian Nuclear Higher Education Network) (intensive courses are given in English by professors from different Belgian universities at the Mol Nuclear Research Center).

2) For students who have completed and passed a Master's [120] degree with specialized focus on medical physics, an expert's license in radiotherapy, medical radiophysics or radiology may be obtained by carrying out a 1-yr internship after the Master [120]. This internship also includes some additional teaching units required by the Federal Agency for Nuclear Control. These teaching units provide additional training in the following areas :

- principles, techniques and quality control in medical imaging ;
- special radiological protection issues and supplements ;
- radiochemistry, radiotoxicology and radiopharmacy ;
- assessment of the risks of radioactive releases into the environment in normal and accidental situations, and emergency plan for nuclear risks.

In addition, UCLouvain Masters (usually 60) are widely available to UCLouvain Masters' graduates. For example :

- the Master [120] in Science and Environmental Management and the Master [60] in Science and Environmental Management (direct access with possible supplements) ;
- the different Masters [60] in management science (direct access through examination of the file) : see the list ;
- Master [60] in Information and Communication in Louvain-la-Neuve or Master [60] in Information and Communication in Mons.

Certificates

The teaching units listed in the specialized focus on medical physics may be followed for obtaining certificates of complementary studies in radiation protection and application of ionizing radiation for persons wishing to obtain accreditation for the surveillance and protection of workers and population against the danger of ionizing radiation.

Accessibility : doctors, pharmacists, veterinarians, science graduates, civil engineers, agronomists, industrial engineers.

These students will, among other things, have to follow advanced teaching units in nuclear physics and nuclear techniques :

LPHYS2102 Detectors and sensors

LPHY2360 Atomic, nuclear and radiation Physics

LPHYS2504 Production, use, management and control of radioelements.

Contacts

Curriculum Management

Entity

Structure entity

Denomination

Faculty

Sector

Acronym

Postal address

SST/SC/PHYS

(PHYS)

Faculty of Science (SC)

Sciences and Technology (SST)

PHYS

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<https://uclouvain.be/fr/facultes/sc/phys>

Website

Academic supervisor: [Vincent Lemaitre](#)

Jury

- President: [Christophe Ringeval](#)
- Secretary: [Christophe Delaere](#)
- Study advisor: [François Massonnet](#)
- Study advisor: [Gauthier Durieux](#)

Useful Contact(s)

- Administrative manager for the student's annual program: [Catherine De Roy](#)

