

At Louvain-la-Neuve - 120 credits - 2 years - Day schedule - In English

Dissertation/Graduation Project : **YES** - Internship : **NO**

Activities in English: **YES** - Activities in other languages : **NO**

Activities on other sites : **optional**

Main study domain : **Sciences**

Organized by: **Faculty of Science (SC)**

Programme acronym: **PHYS2M** - Francophone Certification Framework: 7

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Introduction		
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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 Web de l'école de physique. L'étudiant-e choisit 30 crédits parmi les UE ci-dessous (les UE LPHYS2143 et LPHYS2102 sont vivement conseillées pour les étudiant-e-s inscrit-e-s à la finalité spécialisée) :

⌘ Physique statistique et mathématique

⌘ LPHYS2112	Mathematical physics	Christophe Ringeval	EN [q1] [30h] [5 Credits]  > French-friendly	X
⌘ LPHYS2113	Critical phenomena	Philippe Ruelle1 G	0 d 2 w 0 0 m 85.0e3.043999 m 353.3	

LIST OF FOCUSES

- > **Research Focus** [en-prog-2023-phys2m-lphys200a]
- > **Teaching Focus** [en-prog-2023-phys2m-lphys200d]
- > **Professional Focus : Medical Physics** [en-prog-2023-phys2m-lphys200s]

RESEARCH FOCUS [30.0]

- Mandatory
- ⊗ Optional
- △ Not offered in 2023-2024
- ⊖ Not offered in 2023-2024 but offered the following year
- ⊕ Offered in 2023-2024 but not the following year
- △ ⊕ Not offered in 2023-2024 or the following year
- Activity with requisites
- 🌐 Open to incoming exchange students
- 🚫 Not open to incoming exchange students
- (FR) Teaching language (FR, EN, ES, NL, DE, ...)

Click on the course title to see detailed informations (objectives, methods, evaluation...)

Year

1 2

o **Content:**

⊗ **Physique statistique et mathématique**

⊗ LPHYS2211	Group theory	Philippe Ruelle	EN [q2] [22.5h+22.5h] [5 Credits] 🌐 > French-friendly	X	
⊗ LPHYS2215	Statistical field theory		EN [q2] [30h] [5 Credits] ⊖ 🌐 > French-friendly	X	X

⊗ **Gravitation, cosmologie et astroparticules**

⊗ LPHYS2221	Astrophysics and astroparticles	Gwenhaël de Wasseige	EN [q2] [30h] [5 Credits] 🌐 > French-friendly	X	
⊗ LPHYS2223	utrino physics and dark matter	Marco Drewes	EN [q2] [30h] [5 Credits] 🌐 > French-friendly	X	
⊗ LPHYS2224	Advanced cosmology and general relativity	Christophe Ringeval	EN [q2] [30h] [5 Credits] 🌐 > French-friendly	X	

⊗ **Physique des particules**

LPHYS2233A, LPHYS2233B and LPHYS2233C cannot be taken if the full course LPHYS2233 is selected .

⊗ LPHYS2233	Experimental methods in fundamental physics	Agni Bethani (compensates)			
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TEACHING FOCUS [30.0]

IMPORTANT NOTE: In accordance with article 138 para. 4 of the decree of 7 November 2013 concerning higher education and the academic organisation of studies, teaching practice placements will not be assessed in the September session. Students are required to make every effort to

				Year	
				1	2
○ LAGRE2400	See specifications in french	Mathias El Berhoumi (compensates) Xavier Delgrange Hervé Pourtois (coord.) Pierre-Etienne Vandamme	PK [q2] [20h] [2 Credits]	x	x

o Module animer un groupe et travailler en équipe

o Comprendre l'adolescent en situation scolaire, gérer la relation interpersonnelle et animer le groupe classe (4 credits)

Choisir 1 des activités suivantes.

⊗ LAGRE2020P	Comprendre l'adolescent en situation scolaire, Gérer la relation interpersonnelle et animer le groupe classe.	Baptiste Barbot Véronique Leroy Nathalie Roland	PK [q2] [22.5h+22.5h] [4 Credits]		x
⊗					

PROFESSIONAL FOCUS : MEDICAL PHYSICS [30.0]

Les étudiants ayant choisi cette finalité doivent obligatoirement avoir choisi les cours PHY 2130, PHY 2236 et PHY 2340 parmi les cours de base et les cours au choix. Ils suivront aussi tous les cours repris ci-dessous.

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[Click on the course title to see detailed informations \(objectives, methods, evaluation...\)](#)

Year

1 2

○ Alternatives (below)

○ This goal is only available through the special program in medical physics organized in co-graduation with the KU Leuven

⊗ LGEO1343

				Year	
⌘ LGBIO1112	Introduction to biomedical engineering	Philippe Lefèvre	PK [q2] [45h] [5 Credits]	1	2
				x	x

⌘ Optional courses :

These credits are not counted within the 120 required credits.

⌘ LSST1001	IngénieursSud
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Alternatives

> [Master \[120\] in Physics \[professional focus of Medical Physics : UCLouvain-KULeuven\]](https://uclouvain.be/en-prog-2023-phys2m-programme) [<https://uclouvain.be/en-prog-2023-phys2m-programme>]

MASTER [120] IN PHYSICS [PROFESSIONAL FOCUS OF MEDICAL PHYSICS : UCLouvain-KULEUVEN]

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Year

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o Physics, Mathematics and Chemistry (16 credits)

● EPHMD2398	Introductory Nuclear Physics			EN [q1] [18h] [3 Credits] 🌐	X	
● LPHYS2102	Ionizing Radiation Detection and Nuclear Instrumentation	Eduardo Cortina Gil		EN [q1+q2] [26h+26h] [6 Credits] 🌐	X	
● LPHMD2357	Computational and Numerical Methods for Medical Physics	John Lee Edmond Sterpin		EN [q1] [24h+10h] [] Credits 🌐	X	

o Nuclear and Radiochemistry (3 credits)

Choose a course from

⌘ LPHYS2504	Use, management and control of radioelements	Pascal Froment		EN [q2] [22.5h] [3 Credits] 🌐		X
⌘ EPHMD2393	Nuclear and Radiochemistry					

Medical Information Systems (3 credits)

Choose a course from

⌘ EPHMD2376	Medical Information Systems		
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○ Philosophy, Sustainability and Ethics (6 credits)

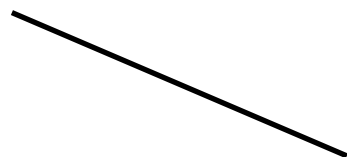
Choose between the UCLouvain module and the KU Leuven module

⌘ Philosophy, Sustainability and Ethics (KU Leuven) (6 credits)

○ EPHMD2354	Science and Sustainability: a socio-ecological approach		EN [q1] [24h] [3 Credits]			X
○ EPHMD2379	Ethics and Law in Biomedical Research		EN [q2] [20h] [3 Credits]			X

⌘ Philosophy, Sustainability and Ethics (UCLouvain) (6 credits)

○ WMDS2135	Enjeux sociaux et éthique de la santé et de la médecine 1		FR [q2] [24h] [2 Credits]			X
○ WMDS2235	Enjeux sociaux et éthiques de la santé et de la médecine 2	Isabelle Aujoulat Anne Berquin Jean-Philippe Cobbaut Dominique Lamy Alain Loute (coord.) Isabelle Scheers	FR [q2] [18h] [2 Credits]			X



These additional teaching units (maximum 60 credits) will be selected in the programme of the second and third annual units of the Bachelor's degree in physics, in consultation with the Study advisor, depending on the previous teaching units followed by the student and his/her training project, and will be submitted to the approval of the School of Physics.

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o Enseignements supplémentaires

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.

PHYS2M - Information

Access Requirements

Master course admission requirements are defined by the French Community of Belgium Decree of 7 November 2013 defining the higher education landscape and the academic organisation of courses.

General and specific admission requirements for this programme must be satisfied at the time of enrolling at the university.

Unless explicitly mentioned, the bachelor's, master's and licentiate degrees listed in this table or on this page are to be understood as those issued by an institution of the French, Flemish or German-speaking Community, or by the Royal Military Academy.

In the event of the divergence between the different linguistic versions of the present conditions, the French version shall prevail.

SUMMARY

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- > [Holders of a 2nd cycle University degree](#)
- > [Holders of a non-University 2nd cycle degree](#)
- > [Access based on validation of professional experience](#)
- > [Access based on application](#)
- > [Admission and Enrolment Procedures for general registration](#)

Specific access requirements

Since this program is taught in English, no prior proof of French language proficiency is required, except for students wishing to access the didactic program who must provide proof of a CEFR level C1 proficiency.

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

Concerning the specific program in medical physics in co-graduation UCLouvain - KU Leuven, [specific information](#) is applicable. Apply at <https://www.kuleuven.be/english/application/instructions>

University Bachelors

Diploma	Special Requirements	Access	Remarks
UCLouvain Bachelors			
Bachelor in Physics		Direct access	
Bachelor in Mathematics	Si l'étudiant a suivi la Titre inconnu:Iminphys	Access based on application	In some cases, the UCLouvain Enrolment Office, after reviewing their online enrolment or re-enrolment application, will ask the students concerned to provide an enrolment authorisation from the faculty/ school.
Bachelor in Engineering	Si l'étudiant a suivi la Titre inconnu:Iminphys	Access based on application	In some cases, the UCLouvain Enrolment Office, after reviewing their online enrolment or re-enrolment application, will ask the students concerned to provide an enrolment authorisation from the faculty/ school.
Bachelor in Geography : General	Crédits de la Minor in Physics acquis	Access based on application	In some cases, the UCLouvain Enrolment Office, after reviewing their online enrolment or re-enrolment application, will ask the students concerned to provide an enrolment

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

