PHYS2M - Introduction

Introduction

Introduction

The physicist possesses great capacities of reasoning and abstraction. He.she continually asks questions about the physical world around him.her in order to understand how it works. He.she observes, makes assumptions, formalizes concepts, and writes and solves the equations governing them in order to confront them with observations and experience. Thanks to his.her advanced and versatile scientific training, he.she contributes to the great challenges of the Society of today and tomorrow. He.she is involved in cutting-edge research and the resolution of important questions related to the genesis and evolution of the Universe, fundamental interactions between elementary particles, quantum optics, statistical physics, origins of the Earth, global climate change, sustainable development, energy choices, etc.

The skills developed by the physicist as part of his.her training, including his.her ability to model and characterize large data sets, can be valued in many professions specific to the realms of today’s physics, such as superconductivity, instrumentation and metrology, laser physics, nuclear physics, nonlintween elementd0obi9c3995 Tmo theec3995nombi9planettd0obi9ge5 Tmo thee aneod metrology, choisat etTm [(ch

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 enroled 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 (reasearch 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.

7.4 Adapt the presentation to the level of expertise of the interlocutors.

7.5 Use a variety of media and computer tools to communicate (explain, write, publish) concepts and physical results.

7.6 Discuss with colleagues from other disciplines.

8. If he.she chooses the research training, actively address a research theme.

8.1 Achieve a level of expertise in a chosen field of contemporary physics.

8.2 Deepen a subject beyond current knowledge.

9. If he.she chooses the specialized focus on medical physics, practice the profession of physicist in the hospital environment.

9.1 Identify and apply the imaging and treatment techniques specific to physicists in the hospital environment.

9.2 Intervene in a clinical setting.

9.3 Undertake basic and clinical research.

10. If he.she chooses the teaching focus, mobilize the necessary skills to effectively start the profession of teacher in physics in high schools, and be able to evolve positively there.

10.1. Intervene in school context, in partnership with different actors.

10.2. Teach in authentic and varied situations.

10.3. Exercise a reflexive glance and to project him.her.self in a logic of continuous development.

Programme structure

The programme leading to the Master's [120] degree in physics includes a core curriculum, which consists of :

- 30 credits of specialized training in physics, to be chosen from a list of teaching units organized into subject blocks and to be followed during the first semester of the first annual unit,
- 5 credits of physics seminar, to be followed during the second annual unit,
- 2 credits of training in human sciences, to be chosen from a list of teaching units and to be followed during the first or second annual unit,
- 28 credits of activities related to the Master's thesis, which include the Master's thesis itself (26 credits) and the thesis tutorial (2 credits), to be carried out during the second annual unit.

The programme also includes 30 credits of teaching units specific to the chosen focus, to be followed during the first or second annual unit, as well as 25 credits of elective teaching units, to be selected from a list of teaching units organized into subject blocks and to be followed mainly during the second annual unit.

PHYS2M Programme

Detailed programme by subject

CORE COURSES [65.0]

Mandatory
Optional
Not offered in 2024-2025
Not offered in 2024-2025 but offered the following year
Offered in 2024-2025 but not the following year
Not offered in 2024-2025 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 [redacted]

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 Ruelle	EN [q1] [22.5h+7.5h] [5 Credits] > *French-friendly*	x	
LPHYS2114	Nonlinear dynamics	Michel Crucifix	EN [q1] [22.5h+22.5h] [5 Credits] > *French-friendly*	x	

Gravitation, cosmologie et astroparticules

LPHYS2122	Cosmology	Christophe Ringeval	EN [q2] [30h] [5 Credits] > *French-friendly*	x	

Physique des particules

LPHYS2131	Fundamental interactions and elementary particles	Agni Bethani (compensates Christophe Delaere) Céline Degrande Christophe Delaere Vincent Lemaitre	EN [q1] [52.5h+7.5h] [10 Credits] > *French-friendly*	x	
LPHYS2132	Quantum field theory 1	Céline Degrande Marco Drewes	EN [q1] [52.5h+7.5h] [10 Credits] > *French-friendly*	x	

Physique atomique, moléculaire et optique

LPHYS2141	Introduction to quantum optics	Matthieu Génévriez Xavier Urbain	EN [q1] [22.5h+7.5h] [5 Credits] > *French-friendly*	x	
LPHYS2143	Optics and lasers	Clément Lauzin	EN [q1] [22.5h+22.5h] [5 Credits] > *French-friendly*	x	

Physique de la Terre, des planètes et du climat

LPHYS2161	Internal geophysics of the Earth and planets		EN [q1] [22.5h+7.5h] [5 Credits] △ > *French-friendly*	x	
LPHYS2162	Introduction to the physics of the climate system and its modelling	Hugues Goosse Francesco Ragone	EN		

LIST OF FOCUSES

> Research Focus

Year
1 2

Year
1 2

Module animer un groupe et travailler en équipe

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.	Nathalie Roland Morgane Senden (compensates Baptiste Barbot)	FR [q2] [22.5h+22.5h] [4 Credits]		x
⊠ LAGRE2020Q	Comprendre l'adolescent en situation scolaire, Gérer la relation interpersonnelle et animer le groupe classe.	Nathalie Roland Morgane Senden (compensates Baptiste Barbot)	FR [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.

- Mandatory
- Optional
- Not offered in 2024-2025
- Not offered in 2024-2025 but offered the following year
- Offered in 2024-2025 but not the following year
- Not offered in 2024-2025 or the following year
- Activity with requisites
- Open to incoming exchange students
- Not open to incoming exchange students

[FR]

UE au choix [25.0]

Year

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

⊠ Optional courses :

These credits are not counted within the 120 required credits.

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

Alternatives

> Master [120] in Physics [professional focus of Medical Physics : UCLouvain-KULeuven] *[https://uclouvain.be/en-prog-2024-phys2m-programme]*

MASTER [120] IN PHYSICS [PROFESSIONAL FOCUS OF MEDICAL

				Year 1	2
EPHMD2354	Science and Sustainabilty: 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)					
WFSP2108	Bioethics	Jean-Philippe Cobbaut Alain Loute (coord.)	FR [q2] [30h] [4 Credits]		x
Select (2 credits)					
LSC2001	Introduction to contemporary philosophy	Peter Verdée Peter Verdée (compensates Charles Pence)	FR [q2] [30h] [2 Credits]		x
LSC2220	Philosophy of science	Alexandre Guay	EN [q2] [30h] [2 Credits]		x
LFILO2003E	Ethics in the Sciences and technics (sem)	Alexandre Guay (compensates Charles Pence) Hervé Jeanmart René Rezsohazy	FR [q2] [15h+15h] [2 Credits]		x

Internships and Master's thesis (11 credits)

This internship will be completed by a second one which is part of the professional focus.

The Thesis Tutorial supports the thesis which is part of the professional focus.

These additional teaching units (maximum 60 credits) will be selected in the programme of the second and third annual units of the

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

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.

			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 mri access mr 0 4 gdTm [(Access based on application)] TJ 0 g /F1 8 Tf 1 0 0 -1 0 438.713-1 2 e 1 0 0 -15 n4472 1

Specific professional rules

Successful completion of the master's course with

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.