

**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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## 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	

				Year	
				1	2
⊗ LSC2001	Introduction to contemporary philosophy	Peter Verdée Peter Verdée (compensates Charles Pence)	EN [q2] [30h] [2 Credits]	x	x
⊗ LSC2220	Philosophy of science	Alexandre Guay	EN [q2] [30h] [2 Credits]	x	x
⊗ LFILO2003E	Ethics in the Sciences and technics (sem)	Alexandre Guay (compensates Charles Pence) Hervé Jeanmart René Rezsóhazy	EN [q2] [15h+15h] [2 Credits]	x	x
⊗ LTHEO2840	Science and Christian faith	Benoît Bourguine Paulo Jorge Dos Santos Rodrigues	EN [q1] [15h] [2 Credits]	x	x

### ⊗ Formation facultative

These credits are not counted within the 120 required credits.

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







## ***TEACHING FOCUS [30.0]***

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**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 Berhomi (compensates) Xavier Delgrange Hervé Pourtois (coord.) Pierre-Etienne Vandamme	PR [q2] [20h] [2 Credits]	x	x

o 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.	Baptiste Barbot Véronique Leroy Nathalie Roland	PR [q2] [22.5h+22.5h] [4 Credits]		x
⊗ LAGRE2020Q	Comprendre l'adolescent en situation scolaire, Gérer la relation interpersonnelle et animer le groupe classe.	Baptiste Barbot Véronique Leroy Nathalie Roland	PR [q2] [22.5h+22.5h] [4 Credits]		x





⊗ LGEO1343

⌘ LGBIO1112 Introduction to biomedical engineering


## Alternatives

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> [Master \[120\] in Physics \[professional focus of Medical Physics : UCLouvain-KULeuven\]](https://uclouvain.be/190991_0.51S_Q_0.2745_0.n-KULeu) [ [https://uclouvain.be/190991\\_0.51S\\_Q\\_0.2745\\_0.n-KULeu](https://uclouvain.be/190991_0.51S_Q_0.2745_0.n-KULeu) ]

**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)**

<input type="radio"/>	EPHMD2354	Science and Sustainability: a socio-ecological approach		EN [q1] [24h] [3 Credits]			X
<input type="radio"/>	EPHMD2379	Ethics and Law in Biomedical Research		EN [q2] [20h] [3 Credits]			X

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

<input type="radio"/>	WMDS2135	Enjeux sociaux et éthique de la santé et de la médecine 1		FR [q2] [24h] [2 Credits]		X	
<input type="radio"/>	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





## 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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### 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



## Specific professional rules

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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

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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

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***The evaluation methods comply with the regulations concerning studies and exams (<https://uclouvain.be/fr/decouvrir/rgee.html>). 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 bibliographical references, writing of monographs and reports, presentation of seminars, dissertation, etc.). When the training requires it, the student is also evaluated regarding his/her ability to assimilate the masterly taught subject. The evaluation of the Master's thesis is based on the work performed during the year and its written and oral presentation.

To obtain the average, the marks obtained for the different teaching units are weighted by their respective credits.

If a student enrolled in an exam at the January session has not been able to present the examination for reasons of force majeure which are duly justified, he/she may ask the President of the Jury for permission to present the examination at the June session. The President of the Jury judges the relevance of the application and, if the course owner agrees, may authorize the student to present the examination at the June session.

## Mobility and/or Internationalisation outlook

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Most teaching units are given by default in English.

Students who have chosen the research focus are encouraged to study abroad outside the Wallonia-Brussels Federation within the framework of a Socrates/Erasmus agreement or equivalent (Mercator, Erasmus Belgica), preferably during the second semester of the first annual unit or the first semester of the second annual unit. This study stay will consist of following several teaching units proposed by the host university, for a maximum of 30 credits, and/or preparing the Master's thesis. For a list of Belgian and foreign universities

## Possible trainings at the end of the programme

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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.

