PHYS2M1 - 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 [60] in Physics is preparing to meet. This programme aims to develop mastery of the fundamental laws and essential tools of today's 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.

7. Communicate effectively in French and English (C1 CEFR level) and in a way that is appropriate for the intended audience

7.1 Write scientific texts in accordance with the conventions and specific rules of the discipline.

7.2 Structure an oral presentation and bring out the key elements of the subject.

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

8.2 Deepen a subject beyond current knowledge.

Programme structure

The programme leading to the Master's [60] degree in physics includes :

- 30 credits of specialized training in physics, to be chosen from a list of teaching units organized into subject blocks,
- 2 credits of training in human sciences, to be chosen from a list of teaching units,
- 18 credits of activities related to the Master's thesis,
- 10 credits of elective teaching units, to be selected from a list of teaching units organized into subject blocks.

Typical programmes, according to the different orientations of the research in physics carried out at UCLouvain, are proposed on the website of the School of Physics in the "Education and Training" section. There are nine of them. They relate to :

- statistical physics and mathematical physics,
- formal aspects of fundamental interactions,
- theory and phenomenology of fundamental interactions,
- experimentation in physics of fundamental interactions,
- instrumentation in physics of fundamental interactions,
- atomic, molecular physics and optics from the theoretical point of view,
- atomic, molecular physics and optics from the experimental point of view,
- physical climatology,
- physics of the Earth and planets.

PHYS2M1 Programme

Detailed programme by subject

CORE COURSES [50.0]

- 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

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⛒ LPHYS2122	Cosmology	Christophe Ringeval	EN [q1] [30h] [5 Credits] > *French-friendly*

⛒ 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*
⛒ LPHYS2132	Quantum field theory 1	Céline Degrande Marco Drewes	EN [q1] [52.5h+7.5h] [10 Credits] > *French-friendly*

⛒ Physique atomique, moléculaire et optique

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

⛒ Physique de la Terre, des planètes et du climat

⛒ LPHYS2161	Internal geophysics of the Earth and planets	Véronique Dehant (coord.) Jérémy Rekier	EN [q1] [22.5h+7.5h] [5 Credits] > *French-friendly*
⛒ LPHYS2162	Introduction to the physics of the climate system and its modelling	Hugues Goosse Francesco Ragone	EN [q1] [22.5h+22.5h] [5 Credits] > *French-friendly*
⛒ LPHYS2163	Atmosphere and ocean : physics and dynamics		

UE au choix [10.0]

UE AU CHOIX [10.0]

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- 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...)

Content:

Physique statistique et mathématique

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

Gravitation, cosmologie et astroparticules

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

⊠ Physique de la Terre, des planètes et du climat

⊠ LPHYS2260	Geodesy and GNSS (Global Navigation Satellite System)	Véronique Dehant (coord.) Sébastien Le Maistre Jérémy Rekier	EN [q2] [30h] [5 Credits] ⊕ > *French-friendly*
⊠ LPHYS2264	Oscillations and instabilities in the climate system	Michel Crucifix	EN [q2] [30h] [5 Credits] ⊕ > *French-friendly*
⊠ LPHYS2265	Sea ice-ocean-atmosphere interactions in polar regions		EN [q2] [30h] [5 Credits] ⊘ > *French-friendly*
⊠ LPHYS2266	Physics of the upper atmosphere and space	Viviane Pierrard	EN [q2] [22.5h+7.5h] [5 Credits] > *French-friendly*
⊠ LPHYS2267	Paleoclimate dynamics and modelling	Qiuzhen Yin	EN [q2] [22.5h+7.5h] [5 Credits] > *French-friendly*
⊠ LPHYS2268	Forecast, prediction and projection in climate science	François Massonnet	EN [q2] [22.5h+7.5h] [5 Credits] > *French-friendly*
⊠ LPHYS2269	Remote sensing of climate change	Emmanuel Dekemper	EN [q2] [30h] [5 Credits] ⊘ > *French-friendly*

⊠ Compléments de mathématique

⊠ LMAT2130	Partial differential equations	Heiner Olbermann	EN [q1] [30h+15h] [5 Credits]
⊠ LMAT2160	Training seminar for mathematical researchers	Pierre-Emmanuel Caprace Jean Van Schaftingen	EN [q1] [15h] [5 Credits] > *English-friendly*
⊠ LMAT2250	Calculus of variations		FR [q2] [30h+15h] [5 Credits] ⊘ > *English-friendly*
⊠ LMAT2420	Complex analysis	Tom Claeys	EN [q2] [30h+15h] [5 Credits] > *French-friendly*
⊠ LMAT2470	Processus stochastiques (statistique)	Donatien Hainaut	FR [q2] [30h] [5 Credits] > *English-friendly*

Supplementary classes

To access this Master, students must have a good command of certain subjects. If this is not the case, students must take supplementary classes chosen by the faculty to satisfy course prerequisites.

Rem : 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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- Activity with requisites
- Open to incoming exchange students
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- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

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

Enseignements supplémentaires

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.

PHYS2M1 - Information

Access Requirements

Master course admission requirements are defined by the French Community of Belgium Decree of 7 November 2013 defining the hiher 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

Students who wish to be admitted on the basis of a dossier (s1 1 0 0 02r on 662 [(Tf 1 0 03333 g /F3 11.2 Tf 1 0 0 -1 0 o6l -1 0 3sy1 0 0 02r on8Tm .iel

- President: Eduardo Cortina Gil (https://uclouvain.be/repertoires/eduardo.cortinagil)
- Secretary: Christophe Delaere (https://uclouvain.be/repertoires/christophe.delaere)
- Study advisor: François Massonnet (https://uclouvain.be/repertoires/francois.massonnet)
- Study advisor: Céline Degrande (https://uclouvain.be/repertoires/celine.degrande)

Useful Contact(s)

- Administrative manager for the student's annual program and Secretary of the School of physics: Catherine De Roy (https://uclouvain.be/repertoires/catherine.deroy)