PHYS1BA Baccalauréat en sciences physiques (Bachelor of Physical Sciences)

Study objectives

The programme aims at the acquisition of :

- Mastery of the basic concepts and fundamental laws of physics
- The specific approach of the physicist, namely that of comprehension, critical analysis and modelling the physical phenomena of nature, with the help of mathematical and numerical tools and experimental techniques proper to physics
- Professional qualities such as the capacity to analyse problems related to physics, abstraction and modelling; rigour in reasoning and expression; a critical mind; self-evaluation capacities and communication skills.

General presentation of the programme

Available as a single programme in itself with minors, or as a reinforcement module in Physics, it comprises theoretical courses, exercices sessions, laboratory work and/or supervised study, and the accomplishment of a personal piece of work (project).
The first year is entirely in common with the bachelor's programme of Mathematical Science.
The possible choice of a minor is made as from the 3rd quadrimester. The minors on offer, at this stage, are : the minor in Mathematics (SC/MATH) and in Applied Sciences and Engineering : Applied Chemistry and Physics (FSA/MAPR).
The student may also choose another minor from the University programme list, on the basis of a project to be elaborated together with the study advisor.
Instead of doing a minor, the student may complete his programme with a complementary training programme in Physics for 30 credits, equally spread over the 2nd and 3rd years. This module comprises both compulsory and optional courses.
Language courses accompany the programme and are aimed at mastering scientific English.

Principal Subjects

The major in Physics comprises the elements listed below and totals 150 credits. The courses numbered must be followed in order ; the details of the prerequisites feature in the specifications of each of the courses.

General Physics (1-2-3) : 37 credits

- Actualities in Mathematics and Physics (2 credits)
- General Physics 1 (8 credits)
- General Physics 2 (8 credits)
- General Physics 3 (4 credits)
- Classical and Optical Electromagnetism (4 credits)
- Integrated Exercises (4 credits)
- Supervised tasks and personal project (7 credits)

Theorical and Mathematical Physics (22 credits)

- Quantum Mechanics 1 (5 credits)
- Quantum Mechanics 2 (5 credits)
- Mathematical Methods in Physics (4 credits)
- Limited Relativity (4 credits)
- General Relativity (4 credits)

Atoms and Molecules, Nuclei, Particules (6 credits)

- Atoms and Molecules (3 credits)
- Elementary Nuclei and particules (3 credits)

Macroscopic and Statistical Physics (12 credits)

- Statistical and Thermodynamic Physics 1 (4 credits, including 1 credit in Chemistry)
- Statistical and Thermodynamic Physics 2 (4 credits, including 1 credit in Chemistry)
- Physics of fluids 1 (3 credits)
- Physics of fluids 2 (3 credits)

Astronomy and Geophysics (2 credits)

Experimental and Numerical Physics (15 credits)

- Numerical Calculations: Methods and Software Tools (7 credits)

- Computing and Numerical Methods (4 credits)
- Numerical Simulation in Physics (4 credits)

Mathematics (43 credits)

- Mathematical Analysis 1 (5 credits)
- Mathematical Analysis 2 (5 credits)
- Linear Algebra (8 credits)
- Geometry 1 (7 credits)
- Mathematical Methods in Classical Mechanics 1 (5 credits)
- Complex Analysis (4 credits)
- Mathematical Methods in Classical Mechanics 2 (4 credits)
- Probability Calculations and Statistical Analysis (5 credits)

Chemistry (2 credits, c.f. Statistical and Thermodynamic Physics 1 et 2)
Optional courses, including Chemistry (3 credits)
English (6 credits)
Philosophy (2 credits)

Minors or other available options

In addition to the major in Physics, the students have three other possibilities :

- either to opt for more in-depth studies in Physics (30 credits), with complements in the different sub-disciplines of Physics
- or to opt for a minor in Mathematics, Geography or Applied Sciences and Engineering : Applied Physics and Chemistry
- or to opt for another minor from the University programme list, on the basis of a project to be elaborated together with the study advisor.

Evaluation

Admission to the programme

Conditions of admission

The conditions and regular admission requirements are specified on the web page :
http://www.ucl.ac.be/etudes/libres/en/acces.html

Special admission conditions

Programme re-orientation is possible from the bachelor programmes in Sciences or Applied sciences.

Admission requests, special rules and regulations

In the case of programme re-orientation, admission requests must be addressed to the Academic Secretary
Address : Place des sciences 2 - 1348 Louvain-la-Neuve

Positioning of the programme

Positioning of the programme within the University cursus

The bachelor's degree in Physical Sciences entitles automatic access to the master's of Physical Sciences, orientated towards the domains of their applications (Medical Physics, Industrial Physics, Meteorology, Simulation Methods, etc.), towards research (doctorate) or towards teaching ("agrégation"), or towards the master's of Spatial Sciences (not organised at UCL).

Other studies accessible upon completion of the programme

Subject to the completion of an appropriate minor, the bachelor's degree entitles direct access to certain orientations of the master's of Mathematical Science and Applied Sciences and Engineering-Physical Engineering (possibly by means of an adapted programme).

Useful contacts

Programme management

PHYS Département de physique
Contact : Nathalie Micha
and the Department of Physics

Study Advisor

B. Piraux et Ph. Ruelle

Exam Juries

1st year

President : Jean Mawhin
Secretary : Jan Govaerts

2nd year

President : Still to be determined
Secretary : Still to be determined

3nd year

President : Still to be determined

Secretary : Still to be determined

List of accessible minors

- Minor in Theology
- Minor in Philosophy
- Minor in Law
- Minor in Criminology
- Minor in Information and Communication (*)
- Minor in Political Sciences
- Minor in Sociology and Anthropology
- Minor in Human and Social Sciences
- Minor in Economics
- Minor in Business Studies
- Minor in Linguistics
- Minor in Hispanic Studies (*)
- Minor in Italian Studies (*)
- Minor in French Studies (*)
- Minor in Latin Studies
- Minor in Greek Studies
- Minor in Oriental Studies
- Minor in Literature Studies
- Minor in History
- Minor in Medieval Studies
- Minor in History of Art and Archaeology (*)
- Minor in Musicology
- Minor in Psychology and Education (*)
- Minor in Human Nutrition
- Minor in General Biomedical Sciences
- Minor in Medication Sciences (*)
- Minor in Physical Activity, Health and Culture of Movement (*)
- Minor in Mathematics
- Minor in Geography
- Minor in Statistics
- Minor in Engineering Sciences : Applied Chemistry and Physics
- Minor in Engineering Sciences : Construction
- Minor in Engineering Sciences : Electricity
- Minor in Engineering Sciences : Applied Mathematics
- Minor in Engineering Sciences : Mechanics
- Minor in Urban Architecture
- Minor in Computing Science (*)
- Minor in Biomedical Engineering
- Minor in Gender Studies
- Minor in Culture and Creation
- Minor in European Studies

(*) Minor with access criteria.

Detailed content of standard programme

MAFY 11BA First year of studies

MAT1131	Linear Algebra[45h+45h] (8 credits)1q (in French)	Jean-Roger Roisin (coord.), Jean-Pierre Tignol
MAT1121	Mathematical analysis 1[30h+30h] (5 credits)1q (in French)	Thierry De Pauw, Patrick Habets, Jean Mawhin (coord.)
PHY1111	General Physics 1[45h+45h] (8 credits)1q (in French)	Denis Favart, Denis Favart (supplée Jan Govaerts), Jan Govaerts
MAFY1181	Actualities in Mathematics and Physics[15h] (2 credits)1q (in French)	Francis Borceux, Bernard Piraux
MAT1122	Mathematical analysis 2[30h+30h] (5 credits)2q (in French)	Thierry De Pauw, Patrick Habets, Jean Mawhin (coord.)
MAT1141	Geometry I[45h+30h] (7 credits)2q (in French)	Francis Borceux

MAT1151	Numerical analysis : tools and software of calculus[30h+45h] (7 credits)2q (in French)	Pierre Bieliavsky
MAT1161	Mathematical methods in classical mathematics 1[22.5h+30h] (5 credits)2q (in French)	Jean Bricmont, Luc Haine
PHY1112	General Physics 2[45h+45h] (8 credits)2q (in French)	Denis Favart, Jan Govaerts
ANG1861	Reading and listening comprehension of scientific texts[6h] (2 credits)2q (in French)	Ahmed Adrioueche, Isabelle Druant, Annick Sonck

One course to be chosen from among the following :

BIO1114	Introduction to biology[30h+7.5h] (3 credits)2q (in French)	Michel Baguette, Claude Remacle, Philippe van den Bosch Sanchez de Aguilar
CHM1112	General Chemistry[22.5h+22.5h] (3 credits)1q (in French)	Jean-Paul Declercq
CHM 1112 - compulsory in the 2nd year if not followed in the 1st year		
ESPO1111A	Political Economics (Part 1)[40h+10h] (4 credits) (in French)	N.
BIR1130A	Introductions aux sciences de la terre[30h] (3 credits)2q (in French)	N.

PHYS 12BA Second year of studies

MAT1261	Mathematical methods of classic mechanics 2[22.5h+30h] (5 credits)1q (in French)	Jean Bricmont, Luc Haine
MAT1271	Calculation of probability and statistical analysis[30h+30h] (5 credits)1q (in French)	Rainer von Sachs
PHY1211	General Physics 3[30h+30h] (5 credits)1q (in French)	Denis Favart, Jan Govaerts
PHY1223	Special Relativity[22.5h+15h] (4 credits)1q (in French)	Jean-Marc Gérard, Jan Govaerts
PHY1271	Computer Science and Numerical Methods[15h+30h] (4 credits)1q (in French)	Giacomo Luca Bruno
ANG1862	Reading and listening comprehension of scientific texts[30h] (2 credits)1q (in French)	Ahmed Adrioueche
If this course has not been followed in the first year		
CHM1112	General Chemistry[22.5h+22.5h] (3 credits)1q (in French)	Jean-Paul Declercq
SC1120	Philosophy[30h] (2 credits)1q (in French)	Bernard Feltz
SC1120 - compulsory in the 3rd year if not followed in the 2nd year		
MAT1222	Complex analysis[30h+15h] (4 credits)2q (in French)	Luc Haine
PHY1222	Quantum mechanics[45h+30h] (5 credits)2q (in French)	Fabio Maltoni
PHY1251	Statistical physics and Thermodynamics I[30h+22.5h] (4 credits)2q (in French)	Pierre Defrance, Hugues Goosse
PHY1252	A préciser (in French)	
PHY1261	Astronomy and geophysics[15h+7.5h] (2 credits)2q (in French)	Véronique Dehant, Jean-Pascal van Ypersele de Strihou
PHY1212	Integrated exercices in general physics[0h+30h] (4 credits)2q (in French)	Thierry Fichefet, Vincent Lemaitre, Krzysztof Piotrzkowski

Complementary studies in Physics (at least 15 credits)

The students who have opted to further their studies in Physics will take :

One of the two following courses :

PHY1221	Group theory[22.5h+15h] (5 credits) (in French)	Philippe Ruelle
PHY1272	A préciser (in French)	
CHM1243	Introduction to organic chemistry and to biochemistry[22.5h+22.5h] (5 credits) (in French)	Jean-Paul Declercq, Agnès Gnagnarella

Courses to be chosen in the 2nd or in the 3rd year

CHM1251A	Eléments de cristallographie[15h+15h] (2 credits) (in French)	N.

A minimum of 6 credits to be chosen from among the following courses (not taken previously) :

PHY1221	Group theory[22.5h+15h] (5 credits) (in French)	Philippe Ruelle
PHY1272	A préciser (in French)	
BIO1114	Introduction to biology[30h+7.5h] (3 credits)2q (in French)	Michel Baguette, Claude Remacle, Philippe van den Bosch Sanchez de Aguilar
BIR1130A	Introductions aux sciences de la terre[30h] (3 credits)2q (in French)	N.
ESPO1111A	Political Economics (Part 1)[40h+10h] (4 credits) (in French)	N.
MAT1251	Exercises on the use of mathematical software[15h] (2	Christian Fabry

credits)2q (in French)

Minor

The students who have opted for a minor - minor in Mathematics, minor in Geography, minor in Engineering Sciences : Applied Chemistry and Physics or a minor to be chosen from the UCL programme, will choose 15 credits from the programme of the minor chosen.

PHYS 13BA Third year of studies

PHY1311	Classical electromagnetism[37.5h+15h] (6 credits)1q (in French)	Krzysztof Piotrzkowski
PHY1321	A préciser (in French)	
PHY1322	Quantum Physics 2[45h+22.5h] (6 credits)1q (in French)	Jean Bricmont, Jean-Marc Gérard, Fabio Maltoni, Christophe Ringeval (coord.)
PHY1352	Physics of fluids[45h+22.5h] (6 credits)1q (in French)	Eric Deleersnijder, Eric Deleersnijder

If this course has not been followed in the second year

SC1120	Philosophy[30h] (2 credits)1q (in French)	Bernard Feltz
PHY1331	Elementary nuclei and particules[30h+10h] (4 credits)2q (in French)	Vincent Lemaitre
PHY1341	Atoms and molecules[30h+10h] (4 credits)2q (in French)	Pierre Defrance, André Nauts
PHY1351	Statistical and thermodynamic physics 2[30h+22.5h] (4 credits)2q (in French)	Jean Bricmont
PHY1323	General Relativity[30h+15h] (5 credits)2q (in French)	Jean-Marc Gérard
PHY1371	A préciser (in French)	
ANG1863	Anglais - expression orale[30h] (2 credits)1+2q (in English)	Philippe Denis, Philippe Neyt (coord.), Colleen Starrs, Françoise Stas
PHY1312	Travaux dirigés[0h+60h] (8 credits)1+2q (in French)	Giacomo Luca Bruno, Hugues Goosse, Philippe Ruelle, Xavier Urbain (coord.)

Complementary studies in Physics (at least 15 credits)

The students who have opted to further their studies in Physics will take the following courses :

PHY1342	A préciser (in French)	
PHY1372	A préciser (in French)	

If this course has not been followed in the second year of the bachelor programme

CHM1251A	Eléments de cristallographie[15h+15h] (2 credits) (in French)	N.

A minimum of 9 credits to be chosen from the following courses (not followed previously) :

PHY1221	Group theory[22.5h+15h] (5 credits) (in French)	Philippe Ruelle
PHY1272	A préciser (in French)	
PHY1324	Relativist Quantum Mechanics[15h+15h] (2 credits) (in French)	Jean-Marc Gérard
PHY1373	Signal processing - Information theory[22.5h+15h] (3 credits) (in French)	Giacomo Luca Bruno, René Prieels
MAT1251	Exercises on the use of mathematical software[15h] (2 credits)2q (in French)	Christian Fabry
SC2002	Elements of mathematics and physics history[30h] (4 credits)1q (in French)	Patricia De Grave

Minor

The students who have opted for a minor - minor in Mathematics, minor in Geography, minor in Engineering Sciences : Applied Chemistry and Physics or a minor to be chosen from the UCL programme, will choose 15 credits from the programme of the minor chosen.

Minor in Mathematics (30 credits)

The programme of the minor in Mathematics is made up of 30 credits, according to choice, from among the mathematics courses of the MATH major. These courses may be spread over the second and third years, respecting the different prerequisites. The PHYS bachelors who have already followed this minor will be admitted to the masters of Mathematical Sciences (possibly with an adapted programme). However, any student desirous of making this change in orientation is encouraged to contact the Study Advisor of the MATH department as soon as possible.

MAT1231	Multilinear algebra and group theory[30h+30h] (6 credits)2q (in French)	Jean-Roger Roisin, Jean-Pierre Tignol
MAT1221	Mathematical analysis 3[45h+45h] (9 credits)1q (in French)	Thierry De Pauw, Camille Debière, Jean Mawhin
MAT1223	Differential equations[30h+15h] (5 credits)2q (in French)	Denis Bonheure
MAT1241	Geometry II[45h+15h] (6 credits)2q (in French)	Pierre Bieliavsky
MAT1321	Functional analysis and partial differential	Michel Willem

	equations[45h+45h] (8 credits)1q (in French)	
MAT1322	Measure theory[22.5h+15h] (3 credits)1q (in French)	Camille Debiève
MAT1323	Topology[22.5h+15h] (3 credits)1q (in French)	Yves Félix, Pascal Lambrechts
MAT1331	Commutative algebra[45h] (4 credits)2q (in French)	Jean-Pierre Tignol
MAT1351	A préciser (in French)	
MAT1371	Probability[30h+22.5h] (5 credits)1q (in French)	Jean-Marie Rolin, Johan Segers