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## **Appendices to the Teaching and Examination Regulations**

**2021-2022**

### **Master's degree programme in Physics**

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- I. Learning outcomes
- II. Tracks/specializations
- III. Content of the degree programme
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## Appendix I Teaching outcomes of the degree programme (art. 3.1)

### 1. Knowledge and understanding

The master graduate in Physics

- 1.1. understands the advanced concepts of physics, including the necessary mathematics and computer science, at a level which permits admission to a PhD programme;
- 1.2. is familiar with the advanced quantitative character of physics and with the relevant research methods;
- 1.3. [Advanced Materials track] has a thorough understanding of the current state of the art in materials science, more specifically of the structure, functional properties and characterisation of advanced materials;
- 1.4. [Quantum Universe track] has a thorough understanding of the main fields and presently active topics in theoretical physics, more specifically in the fields of general relativity, statistical mechanics, quantum mechanics, particle physics and radiation processes
- 1.5. [Science, Business and Policy track] has operational knowledge of, and insight into, the present functioning of companies and administrations, as well as the relevant legislation, in relation to physics oriented working areas;

### 2. Application of knowledge and understanding

The master graduate in Physics

- 2.1. is capable of carrying out research, aimed at the understanding of physical phenomena and their description in scientific terms;
- 2.2. is capable of analyzing a (new) complex physical problem, and to use modelling skills to develop a structured and well-planned research approach;
- 2.3. is capable of applying his/her specific knowledge and mathematical, experimental, and computer skills to solve physical problems in his/her own and related fields;
- 2.4. is capable of collaborating in a (multi-disciplinary) team;

### 3. Judgement

The master graduate in Physics

- 3.1. is capable of obtaining relevant information using modern information channels, and to interpret this information critically;
- 3.2. is capable of managing and judging his/her and others' actions within a highly scientific and professional context, taking societal and ethical aspects into account;
- 3.3. is able to draw conclusions on the basis of limited or incomplete information, and is able to realize and formulate the limitations of such conclusions;

### 4. Communication skills

The master graduate in Physics

- 4.1. is capable of communicating clearly in English, both verbally and in writing, on his/her subject and relevant applications, at a level which is understandable to experts and non-experts, and using modern communication tools;

### 5. Learning skills

The master graduate in Physics

- 5.1. is capable of addressing issues on new developments (using e.g. literature research) inside as well as outside his/her main subject area, therefore and thereby gaining new, updated knowledge and skills.



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## **Appendix II Tracks of the degree programme (art. 3.5)**

The Master's degree programme in Physics offers the following tracks:

- Advanced Materials
- Quantum Universe
- Science, Business and Policy



### Appendix III Content of the degree programme (art. 3.6)

The assessment method(s) of the courses below can be found in the assessment plan of the degree programme and on Ocasys.

#### 3.1 Track Advanced Materials

Course unit	ECTS	Practical	Entry Requirements
<i>Choice</i> * Characterisation of Materials Cross-disciplinary Materials Science Functional Properties Structure at Macro, Meso and Nano Scale Supramolecular Chemistry	20		
Advanced Quantum Mechanics	5		
Computational Physics	5	X	
Mathematical Methods of Physics	5		
Statistical Mechanics	5		
Optional Courses in Advanced Materials	20	See app. IV	See appendix IV
Master's Research Project (Advanced Materials)	60	X	Passed 45 ECTS of the masters's degree programme

\* Four out of five courses should be chosen

#### 3.2 Track Quantum Universe

Course unit	ECTS	Practical	Entry Requirements
Advanced Quantum Mechanics	5		
Computational Physics	5	X	
Electrodynamics of Radiation Processes	5		
General Relativity	5		
Mathematical Methods of Physics	5		
Particle Physics Phenomenology	5		
Statistical Mechanics	5		
Student Seminar Quantum Universe	5		
Optional Courses in Quantum Universe	20	See app. IV	See appendix IV
Master's Research Project (Quantum Universe)	60	X	Passed 45 ECTS of the masters's degree programme



### 3.3 Track Science, Business and Policy

Course unit	ECTS	Practical	Entry Requirements
Computational Physics	5	X	
Mathematical Methods of Physics	5		
Four course units to be selected from either the track Quantum Universe or the track Advanced Materials.	20	See app. III or IV of the corresponding programme	See app. III or IV of the corresponding programme
Introduction Science and Business	10		
Introduction Science and Policy	10		
Internship Science, Business and Policy	40	X	
Master's Research Project (Science, Business and Policy)	30	X	

### 3.4 Double master's degree in Mathematics and Physics

If a student desires to obtain a master's degree in Mathematics and a master's degree in Physics at the same time, the student has the possibility to follow a specific double master's programme. The student has to fulfil the requirements of the Mathematics as well as the Physics degree programme with some adaptations.

A complete overview of all obligations and modifications within both programmes is provided in the Teaching and Examination Regulations of the Master's degree programme in Mathematics.



## Appendix IV Electives (art. 3.7.1)

The assessment method(s) of the courses below can be found in the assessment plan of the degree programme and on Ocasys.

### 4.1 Optional Courses in Advanced Materials

Course unit	ECTS	Practical	Entry Requirements
Atomic and (bio-)molecular Interactions	5		
Basics of Teaching	5		
Bioinspired designer materials	5		
Biophysical imaging & manipulation techniques	5	X	
Internship in secondary education 1 TE	5	X	
Many-particle systems	5		
Mechanical Properties	5		
Mesosopic Physics	5		
Non-linear Optics	5		
Physics of Lasers	5	X	
Surfaces and Interfaces	5		
Theoretical Condensed Matter Physics	5		
Ultrafast Time-resolved Spectroscopy	5	X	



#### 4.2 Optional Courses in Quantum Universe

Course unit	ECTS	Practical	Entry Requirements
Collider Experiments	5		
Elementary Particles	5		
Formation and Evolution of Galaxies	5		
Fundamental Constants	5		
Gravitational Waves	5		
Introduction to Plasma Physics	5		
Lie groups in Physics	5		
Nuclear Astrophysics	5		
Quantum Experiments	5		
Quantum Field Theory	5		
Statistical Methods in Physics	5		
Basics of Teaching	5		
Internship in secondary education 1 TE	5	X	
<b><i>Biennial courses, offered in 2021-2022</i></b>			
Dynamics of Galaxies	5		
Geometry and Topology	5		
Stars, Nucleosynthesis, and Chemical Evolution	5		
<b><i>Biennial courses, offered in 2022-2023</i></b>			
Cosmic Structure Formation	5		
High-energy astrophysics	5		
Star and Planet Formation	5		
Geometry & Differential Equations	5		



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## **Appendix V Entry requirements and compulsory order of examinations (art. 4.4)**

For students admitted to the degree programme the conditional entry requirements for individual modules and order of examinations are listed in Ocasys.





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## **Appendix VI Admission to the degree programme and different tracks (art. 2.1A.1 + 2.1B.1)**

Graduates of the following Bachelor's degree programmes of the University of Groningen are considered to have adequate knowledge and skills to be admissible into the Master's degree programme in Physics:

- BSc Physics
- BSc Applied Physics



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## **Appendix VII Transitional provisions (art. 7.1)**

There are no transitional provisions for Physics students.



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## **Appendix VIII Additional Requirements Open degree Programmes (Art. 5.6)**

In exceptional circumstances students wishing to pursue an open degree programme may file a request with the Board of Examiners of Physics and Applied Physics. The Board of Examiners will evaluate whether the proposed curriculum meets the learning outcomes of the degree programme.



## Appendix IX Application deadlines

Application and decision deadlines for admission  
(art. 2.6.1 and 2.6.3)

### Programmes starting on 1 September 2021

Programme	Deadline of Application	Deadline of decision
Behavioural and Cognitive Neurosciences	1 May 2021	1 June 2021
Biology	1 May 2021	1 June 2021
Biomedical Engineering	1 May 2021	1 June 2021
Biomedical Sciences	1 May 2021	1 June 2021
Biomolecular Sciences	1 May 2021	1 June 2021
Ecology and Evolution	1 May 2021	1 June 2021
Energy and Environmental Sciences	1 May 2021	1 June 2021
Human-Machine Communication	1 May 2021	1 June 2021
Marine Biology	1 May 2021	1 June 2021
Mechanical Engineering	1 May 2021	1 June 2021
Medical Pharmaceutical Sciences	1 May 2021	1 June 2021
Nanoscience: for non-EU/EEA students	1 February 2021	1 June 2021
Nanoscience: for EU/EEA students	1 May 2021	1 June 2021
Science Education and Communication	1 May 2021	1 June 2021

### Programmes starting on 1 September 2021 and 1 February 2022

Programme	Deadline of Application for 1 September	Deadline of decision for 1 September	Deadline of Application for 1 February	Deadline of decision for 1 February
Applied Mathematics	1 May 2021	1 June 2021	15 October 2021	15 November 2021
Applied Physics	1 May 2021	1 June 2021	15 October 2021	15 November 2021
Artificial Intelligence	1 May 2021	1 June 2021	15 October 2021	15 November 2021
Astronomy	1 May 2021	1 June 2021	15 October 2021	15 November 2021
Chemical Engineering	1 May 2021	1 June 2021	15 October 2021	15 November 2021
Chemistry	1 May 2021	1 June 2021	15 October 2021	15 November 2021
Computing Science	1 May 2021	1 June 2021	15 October 2021	15 November 2021
Farmacie	1 May 2021	1 June 2021	15 October 2021	15 November 2021
Industrial Engineering and Management	1 May 2021	1 June 2021	15 October 2021	15 November 2021
Mathematics	1 May 2021	1 June 2021	15 October 2021	15 November 2021
Physics	1 May 2021	1 June 2021	15 October 2021	15 November 2021