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

**2019-2020**

**Master's degree programme in Physics**



## 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.

#### 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

#### 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

\* Four out of five courses should be chosen



**Track Science, Business and Policy**

<b>Course unit</b>	<b>ECTS</b>	<b>Practical</b>	<b>Entry Requirements</b>
Advanced Quantum Mechanics	5		
Computational Physics	5	X	
Mathematical Methods of Physics	5		
Statistical Mechanics	5		
Two courses offered in the track Advanced Materials, the track Quantum Universe, or in the degree programme Applied Physics.	10	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	



## Appendix IV Electives (art. 3.7)

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

### Optional Courses in Advanced Materials

Course unit	ECTS	Practical	Entry Requirements
Atomic and Molecular Interactions	5		
Many Particle Systems	5		
Mechanical Properties	5		
Mesoscopic Physics	5		
Micromechanics	5		
Modern Laser Microscopy	5	X	
Non Linear Optics	5		
Physics of Lasers	5	X	
Polymer Physics	5		
Statistical Methods in Physics	5		
Statistical Signal Processing	5		
Surfaces and Interfaces	5		
Theoretical Condensed Matter Physics	5		
Ultrafast Time-Resolved Spectroscopy	5	X	
The student is allowed to choose courses in Applied Physics or Quantum Universe, on individual approval of the Board of Examiners (max. 10 ECTS)		See app. III or IV of the corresponding programme	See app. III or IV of the corresponding programme

### 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		
Hamiltonian Mechanics	5		
Laser Cooling and Trapping	5		
Lie groups in Physics	5		
Nuclear Astrophysics	5		
Particle Cosmology	5		
Quantum Experiments	5		
Quantum Field Theory	5		
Statistical Methods in Physics	5		
The student is allowed to choose courses in Applied Physics, Astronomy or Advanced Materials, on individual approval by the Board of Examiners (max. 10 ECTS)		See app. III or IV of the corresponding programme	See app. III or IV of the corresponding programme
<b>Biennial courses, offered in 2019-2020</b>			
Dynamics of Galaxies	5		



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Geometry and Topology	5		
High-energy astrophysics	5		
<b><i>Biennial courses, offered in 2020-2021</i></b>			
Cosmic Structure Formation	5		
Star and Planet Formation	5		
Stars, Nucleosynthesis, and Chemical Evolution	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. 2.1.1 + art. 2.2)**

Candidates possessing one of the following Bachelor's degrees from the University of Groningen are considered to have sufficient knowledge and skills and will be admitted to the Master's degree programme in Physics on that basis:

- BSc Physics
- BSc Applied Physics



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

There are no transitional provisions for Physics students.



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

**Programmes starting on 1 September 2020 and 1 February 2021**

<b>Programme</b>	<b>Deadline of Application for 1 September</b>	<b>Deadline of decision for 1 September</b>	<b>Deadline of Application for 1 February</b>	<b>Deadline of decision for 1 February</b>
Applied Mathematics	1 May 2020	1 June 2020	15 October 2020	15 November 2020
Applied Physics	1 May 2020	1 June 2020	15 October 2020	15 November 2020
Artificial Intelligence	1 May 2020	1 June 2020	15 October 2020	15 November 2020
Astronomy	1 May 2020	1 June 2020	15 October 2020	15 November 2020
Chemical Engineering	1 May 2020	1 June 2020	15 October 2020	15 November 2020
Chemistry	1 May 2020	1 June 2020	15 October 2020	15 November 2020
Computing Science	1 May 2020	1 June 2020	15 October 2020	15 November 2020
Farmacie	1 May 2020	1 June 2020	15 October 2020	15 November 2020
Industrial Engineering and Management	1 May 2020	1 June 2020	15 October 2020	15 November 2020
Mathematics	1 May 2020	1 June 2020	15 October 2020	15 November 2020
<b>Physics</b>	<b>1 May 2020</b>	<b>1 June 2020</b>	<b>15 October 2020</b>	<b>15 November 2020</b>