university of groningen / faculty of science and engineering / physics

Appendices to the Teaching and Examination Regulations for the

Master's degree programme in Physics

2025-2026

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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 acquired specific knowledge and mathematical, experimental, and computer skills to solve physical problems in the relevant subject area, as well as related subject areas and fields;
   - 2.4. is capable of collaborating in a (multi-disciplinary) team;

3. **Assessment**
   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 assessing personal 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 the 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 the main subject area, therefore and thereby gaining new, updated knowledge and skills.

Appendix II. Tracks/specializations (art. 3.6)

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. 3.8)

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

3.1 Track Advanced Materials

Course unit (course code)	ECTS	Entry Requirements
Advanced Quantum Mechanics (WMPH032-05)	5	
Characterisation of Materials (WMPH021-05)	5	
Computational Physics (WMPH007-05)	5	
Mathematical Methods of Physics (WMPH016-05)	5	
Nanomaterials Synthesis and Engineering (WMPH052-05)	5	
Statistical Mechanics (WMPH029-05)	5	
Choice (either or both)*: - Properties of Functional Materials (WMPH051-05) - Structure at Macro, Meso and Nano Scale (WMPH020-05)	5 - 10	
Optional Courses in Advanced Materials	15 - 20	See appendix IV
Physics Master Research Project (WMPH902-60)	60	Passed 45 ECTS of the Masters's degree programme

* Regarding the option group consisting of "Properties of Functional Materials" (WMPH051-05) and "Structure at Macro, Meso and Nano Scale" (WMPH020-05): A student can choose to follow one of the two courses or both. Based on this choice, the student must complete 3 or 4 optional courses from the list in Appendix IV. In total, the student is required to complete 12 courses, amounting to 60 ECTS, within the first year of the master.

3.2 Track Quantum Universe

Course unit (course code)	ECTS	Entry Requirements
Advanced Quantum Mechanics (WMPH032-05)	5	
Computational Physics (WMPH007-05)	5	
Astroparticle Physics (WMAS027-05)	5	
General Relativity (WMPH009-05)	5	
Mathematical Methods of Physics (WMPH016-05)	5	
Particle Physics Phenomenology (WMPH026-05)	5	
Statistical Mechanics (WMPH029-05)	5	
Student Seminar Quantum Universe (WMPH039-05)	5	
Optional Courses in Quantum Universe	20	See appendix IV
Physics Master Research Project (WMPH902-60)	60	The student must have passed 45 ECTS of courses in the Physics Masters's degree programme.

3.3 Track Science, Business and Policy

Course unit (course code)	ECTS	Entry Requirements
Computational Physics (WMPH007-05)	5	
Mathematical Methods of Physics (WMPH016-05)	5	
Four course units to be selected from either the track Quantum Universe or the track Advanced Materials.	20	See app. III or IV for the corresponding programme
Physics Master Research Project (SBP) (WMPH005-30)	30	The student must have passed 15 ECTS of courses in the Physics Masters's degree programme.
Introduction Science and Business (WMSE001-10)	10	
Introduction Science and Policy (WMSE002-10)	10	
Work placement Business & Policy (WMSE902-40)	40	The student must have successfully completed "Introduction Science and Business" (WMSE001-10), "Introduction Science and Policy" (WMSE002-10), and "Physics Master Research Project (SBP)" (WMPH005-30).

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. 3.9.1)

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

4.1 Optional Courses in Advanced Materials

Course unit (course code)	ECTS	Entry Requirements
Atomic and (Bio-)Molecular Interactions (WMPH046-05)	5	
Bioinspired Designer Materials (WMCH009-05)	5	
Biophysical imaging & manipulation techniques (WMPH047-05)	5	
Many-particle Systems (WMPH036-05)	5	
Mechanical Properties (WMPH023-05)	5	
Mesoscopic Physics (WMPH037-05)	5	
Nanoscale Material Modelling (WMPH053-05)	5	
Neem Regie (TEM0110-24)	10	
Oriëntatie op Onderwijs in de Bètawetenschappen (WMEC013-05)	5	
Physics of Lasers (WMPH027-05)	5	
Physics with Industry (WMPH041-05)	5	
Supramolecular Chemistry (WMCH020-05)	5	
Surfaces and Interfaces (WMPH014-05)	5	
Theoretical Condensed Matter Physics (WMPH031-05)	5	
Ultrafast Time-resolved Spectroscopy (WMPH040-05)	5	

4.2 Optional Courses in Quantum Universe

Course unit (course code)	ECTS	Entry Requirements
Collider Experiments (WMPH033-05)	5	
Deep Learning in Physics (WMPH054-05)	5	
Elementary Particles (WMPH034-05)	5	
Exoplanets (WMAS026-05)	5	
Formation and Evolution of Galaxies (WMAS005-05)	5	
Fundamental Constants (WMPH008-05)	5	
Hamiltonian Mechanics (WMMA019-05)	5	
Neem Regie (TEM0110-24)	10	
Introduction to Plasma Physics (WMPH035-05)	5	
Lie groups in Physics (WMPH011-05)	5	
Nuclear Astrophysics (WMPH038-05)	5	
Oriëntatie op Onderwijs in de Bètawetenschappen (WMEC013-05)	5	
Physics with Industry (WMPH041-05)	5	
Quantum Experiments (WMPH017-05)	5	
Quantum Field Theory (WMPH018-05)	5	
Statistical Methods in Physics (WMPH030-05)	5	
Biennial courses, offered in 2025-2026		
Cosmic Structure Formation (WMAS004-05)	5	
Dynamics of Galaxies (WMAS014-05)	5	
Geometry and Topology (WMMA018-05)	5	
Particle Cosmology (WMPH025-05)	5	
Stars, Nucleosynthesis, and Chemical Evolution (WMAS010-05)	5	
Biennial courses, offered in 2026-2027		
Geometry & Differential Equations (WMMA017-05)	5	
Gravitational Waves (WMPH022-05)	5	
High-energy astrophysics (WMAS006-05)	5	
Star and Planet Formation (WMAS017-05)	5	

Appendix V. Entry requirements and compulsory order (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.

Appendix VI. Admission to the degree programme (art. 2.1A.1 + 2.1B.1)

Direct admission
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

BSc Life Science & Technology
Graduates of the Bachelor's degree programme in Life Science & Technology of the University of Groningen are admissible if they followed the Physics specialisation within their Bachelor's consisting of one of the following dedicated 60 ECTS programmes.

Version TER 2024/2025:

- Mechanics and Relativity 2 (WBPH021-05; 5 ECTS)
- Waves and Optics (WBPH032-05; 5 ECTS)
- Electricity and Magnetism (WBPH033-10; 10 ECTS)
- From Atoms to Molecules (WBPH085-10; 10 ECTS)
- Calculus 2 (for Physics) (WBMA058-05; 5 ECTS)
- Mathematical Physics (WBPH049-05; 5 ECTS)
- One of the following:
  Solid State Physics (WBPH068-05; 5 ECTS) or
  Quantum Physics 2 (WBPH052-05; 5 ECTS) or
  Subatomic physics: concepts and experiments (WBPH088-05; 5 ECTS) or
  Particle Physics (WBPH081-05; 5 ECTS) or
  Experimental Particle Physics (WBPH040-05; 5 ECTS)
- Bachelor Research Project Physics for LST (WBPH904-15; 15 ECTS)

Version TER 2025/2026:

- Waves and Optics (WBPH032-05; 5 ECTS)
- Electricity and Magnetism (WBPH033-10; 10 ECTS)
- From Atoms to Molecules (WBPH085-10; 10 ECTS)
- Calculus 2 (for Physics) (WBMA058-05; 5 ECTS)
- One of the following:
  Mechanics and Relativity 2 (WBPH021-05; 5 ECTS) or
  Mechanics for IEM (WBIE024-05; 5 ECTS)
- One of the following:
  Mathematical Physics (WBPH049-05; 5 ECTS) or
  Differential Equations (for Physics) (WBPH089-05; 5 ECTS)
- One of the following:
  Experimental Particle Physics (WBPH040-05; 5 ECTS) or
  Particle Physics (WBPH081-05; 5 ECTS) or
  Quantum Physics 2 (WBPH052-05; 5 ECTS) or
  Solid State Physics (WBPH068-05; 5 ECTS) or
  Statistics for Modern Physics (WBPH080-05; 5 ECTS) or
  Symmetry in Physics (WBPH047-05; 5 ECTS)
- Bachelor Research Project Physics for LST (WBPH904-15; 15 ECTS)

Bachelor Life Science & Technology graduates who successfully completed the mandatory programme of the first two years and followed the courses listed above in their third year are considered admissible into the Master's degree programme of Physics.

Admissions Office
Students with a background in a physics or related bachelor's degree programme and interested in pursuing a master's degree programme in Physics are encouraged to apply through the Admissions Office of the Faculty of Science and Engineering. The Board of Admissions of Physics and Applied Physics will then assess the application and decides whether the applicant has sufficient background to register for the programme, possibly after following a bridging pre-master's programme.

Appendix VII. Pre-master programmes (art. 2.3)

The Faculty of Science and Engineering (FSE) does not provide fixed pre-master's programmes for entry into the MSc Physics programme.

Depending on the previous education of an applicant, there is the possibility to follow a tailored pre-master's programme, up to a maximum of 60 ECTS, which facilitates entry into the MSc Physics programme. Admission to this pre-master's programme is determined on an individual base by the Board of Admissions, which also designs the programme's content.

Appendix VIII. Transitional provisions (art. 7.1)

8.1 Transitional arrangement 2025-2026

No transitional arrangements.

8.2 Transitional arrangement 2024-2025

Discontinued course units				**Substitute course units**				
Course code	*Course name*	*ECTS*	*Final exam*	*Course code*	*Course name*	*ECTS*	*Explanation*	*Equivalent Yes/No*
WMAS008-05	Electrodynamics of Radiative Processes	5	24/25	WMAS027-05	Astroparticle Physics	5	New course	Yes *

* Students who already followed the course "Astroparticle Physics" (WBPH036-05) during their bachelor's degree programme in Groningen are not allowed to follow this course (WMAS027-05) in their master's and should follow an additional elective as listed in Appendix IV (section 4.2).

8.3 Transitional arrangement 2023-2024

Discontinued course units				**Substitute course units**				
Course code	*Course name*	*ECTS*	*Final exam*	*Course code*	*Course name*	*ECTS*	*Explanation*	*Equivalent Yes/No*
WMPH049-05	Cross-disciplinary Materials Science	5	23/24	WMPH078-05	Nanomaterials Synthesis and Engineering	5	Replacement	Yes
WMPH015-05	Functional Properties	5	23/24	WMPH051-05	Properties of Functional Materials	5	New name	Yes
WMPH024-05	Non-linear Optics	5	23/24	-	-	-	-	-

8.4 Transitional arrangement 2022-2023

No transitional arrangements.

8.5 Transitional arrangement 2021-2022

No transitional arrangements.

Appendix IX. Additional Requirements Open Degree Programmes (Art. 3.10)

Students wishing to pursue an open degree programme may file a request with the Board of Examiners of Physics. The Board of Examiners will evaluate whether the proposed curriculum meets the learning outcomes of the degree programme.