university of groningen / faculty of science and engineering / astronomy

Appendices to the Teaching and Examination Regulations for the

Master's degree programme in Astronomy

2026-2027

Appendix I. Learning outcomes of the Master's degree programme (Art. 3.1)

The master graduate in Astronomy:

1. Knowledge and understanding

1.1. masters the fundamental astronomical and astrophysical concepts as well as the necessary tools from physics, mathematics and computer science, including modelling skills, at a level which permits admission to a PhD programme;
1.2. is familiar with the quantitative character of astronomy and astrophysics and with the relevant research methods;
1.3. who has completed:
- the Quantum Universe track has operational knowledge in i) an observational or theoretical astronomical or astrophysical subarea, ii) the area of instrumentation and information technology in astronomy, physics, and/or space research, or iii) the area of data science in astronomy, as well as knowledge of the state-of the art in at least one specific research area;
- the Business, Science and Policy track has operational knowledge of and insight into the functioning of companies and administrations, as well as the relevant legislation and knowledge of the state-of the art in at least one specific research area;

2. Application of knowledge and understanding

2.1. is capable of carrying out research, aimed at understanding of astronomical phenomena, both observational and theoretical;
2.2. is capable of analyzing a (new) complex astrophysical 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 astronomy 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 and has basic skills to manage a (collaborative) project;

3. Assessment

3.1. is capable of obtaining relevant information using modern information channels, and of interpreting this information critically in the context of an absolute standard;
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 of drawing conclusions on the basis of limited or incomplete information, and is able to realize and formulate the limitations of such conclusions;
3.4. is acting and conducting research according to the VSNU Code of Conduct for Academic Practice

4. Communication skills

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

5.1. is capable of addressing issues inside as well as outside the main subject area, therefore and thereby gaining new knowledge and skills.

Appendix II. Tracks/specializations (Art. 3.6)

1. The Master's degree programme in Astronomy offers the following tracks:
   - Quantum Universe
   - Science, Business and Policy

2. Within the Quantum Universe track, the following specializations are offered:
   - Theoretical and Observational Astronomy
   - Instrumentation and Informatics
   - Data Science

Appendix III. Content of the degree programme (Art. 3.7.1)

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.

Quantum Universe Core Courses

Course unit (course code)	ECTS	Entry Requirements
Astroparticle Physics (WMAS027-05)	5	
General Relativity (WMPH009-05)	5	
Particle Physics Phenomenology (WMPH026-05)	5	
Student seminar Quantum Universe (WMPH039-05)	5	

Quantum Universe: Theoretical and Observational Astronomy

Course unit (course code)	ECTS	Entry Requirements
Quantum Universe Core Courses	20	see app. III
Astrophysics Core Courses	20	see app. IV
Optional Courses in Theoretical and Observational Astronomy	20	see app. IV
Master Research Project Astronomy (WMAS901-60)	60	

Quantum Universe: Instrumentation and Informatics

Course unit (course code)	ECTS	Entry Requirements
Quantum Universe Core Courses	20	see app. III
Astrophysics Core Courses	20	see app. IV
Optional courses in Instrumentation and Informatics	20	see app. IV
Industrial Internship (WMPH004-20)	20	
Master Research Project Astronomy (WMAS902-40)	40	

Quantum Universe: Data Science

Course unit (course code)	ECTS	Entry Requirements
Quantum Universe Core Courses	20	see app. III
Introduction to Data Science (WMCS002-05)	5	
Statistical Signal Processing (WMAS011-05) *	5	
Astrophysics Core Courses	20	see app. IV
Optional Courses in Data Science	10	see app. IV
Master Research Project Astronomy (WMAS901-60)	60	

* Only compulsory for students who did not follow the course during their Bachelor's education.

Science, Business and Policy

Course unit (course code)	ECTS	Entry Requirements
Choice [*]	30	
- *Astrophysics Core Courses*		see app. IV
- *Quantum Universe Core Courses* [†]		see app. III
- *Optional Courses in Theoretical and Observational Astronomy*		see app. IV
Master Research Project Astronomy (WMAS902-30)	30	
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).

[*] Courses with credits adding up to 30 ECTS must be selected.
[†] Quantum Universe Core Courses are: Electrodynamics of Radiation Processes, General Relativity, Particle Physics Phenomenology, Student seminar Quantum Universe.

Appendix IV. Electives (Art. 3.8.1)

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.

Astrophysics Core Courses

Course unit (course code)	ECTS	Entry Requirements
Formation and Evolution of Galaxies (WMAS005-05)	5	
Exoplanets (WMAS026-05)	5	
Astronomical Data Science (WMAS007-05)	5	
Biennial courses, offered in 2026-2027		
Star and Planet Formation (WMAS017-05)	5	
High-Energy Astrophysics (WMAS006-05)	5	
Cosmic Structure Formation (WMAS004-05)	5	
Biennial courses, offered in 2027-2028		
Astrochemistry (WMAS018-05)	5	
Dynamics of Galaxies (WMAS014-05)	5	
Stars, Nucleosynthesis and Chemical Evolution (WMAS010-05)	5	

Capita Selecta Courses

Course unit (course code)	ECTS	Entry Requirements
Dark Matter Detection (WMAS023-03)	3	
Interferometry (WMAS015-03)	3	
Stellar Populations in Galaxies (WMAS029-03)	3	

Optional Courses in Quantum Universe: Theoretical and Observational Astronomy

Course unit (course code)	ECTS	Entry Requirements
Advanced Quantum Mechanics (WMPH032-05)	5	
Basic Detection Techniques (WMAS002-05)	5	
Computational Physics (WMPH007-05)	5	
Deep Learning in Physics (WMPH054-05)	5	
Elementary Particle (WMPH034-05)	5	
Fundamental Constants (WMPH008-05)	5	
Introduction to Plasma Physics (WMPH035-05)	5	
La Palma Observation Trip (WMAS012-05)	5	
Lie Groups in Physics (WMPH011-05)	5	
Mathematical Methods of Physics (WMPH016-05)	5	
Neem Regie (TEM0110-24)	10	
Nuclear Astrophysics (WMPH038-05)	5	
Oriëntatie op Onderwijs in de Bètawetenschappen (WMEC013-05)	5	
Quantum Technology (WMPH057-05)	5	
Quantum Field Theory (WMPH018-05)	5	
Statistical Signal Processing (WMAS011-05)	5	
Biennial courses, offered in 2026-2027		
Geometry and Differential Equations (WMMA017-05)	5	
Gravitational Waves (WMPH022-05)	5	
Biennial courses, offered in 2027-2028		
Geometry and Topology (WMMA018-05)	5	
Particle Cosmology (WMPH025-05)	5	

For the specialization Theoretical and Observational Astronomy (Quantum Universe) a maximum of 20 ECTS may be chosen from the option groups in the table. Students are also allowed to follow courses from the selection of Capita Selecta Courses, though no more than three capita selecta courses are allowed to be used for graduation.

Optional Courses in Quantum Universe: Instrumentation and Informatics

Course unit (course code)	ECTS	Entry Requirements
Applied Optics (WMME010-05)	5	
Basic Detection Techniques (WMAS002-05)	5	
Device Physics (WBPH037-05)	5	This BSc course has been deemed of appropriate level for MSc Astronomy students.
La Palma Observation Trip (WMAS012-05)	5	
Mechatronics (WBIE011-05)	5	This BSc course has been deemed of appropriate level for MSc Astronomy students.
Neem Regie (TEM0110-24)	10	
Nuclear Astrophysics (WMPH038-05)	5	
Oriëntatie op Onderwijs in de Bètawetenschappen (WMEC013-05)	5	
Robotics for IEM (WMIE005-05)	5	
Scientific Visualization (WMCS018-05)	5	
Statistical Signal Processing (WMAS011-05)	5	
Systems Engineering (WMIE021-05)	5	
Biennial courses, offered in 2026-2027		
Gravitational Waves (WMPH022-05)	5	
Biennial courses, offered in 2027-2028		
Particle Cosmology (WMPH025-05)	5	

For the specialization Instrumentation & Informatics a maximum of 20 ECTS may be chosen from the option groups in the table above. Students are also allowed to follow courses from the selection of Capita Selecta Courses, though no more than three capita selecta courses are allowed to be used for graduation.

Optional Courses in Quantum Universe: Data Science

Course unit (course code)	ECTS	Entry Requirements
Basic Detection Techniques (WMAS002-05)	5	
Deep Learning in Physics (WMPH054-05)	5	
Information Systems (WMCS009-05)	5	
La Palma Observation Trip (WMAS012-05)	5	
Modelling and Simulation (WMCS003-05)	5	
Neem Regie (TEM0110-24)	10	
Neural Networks and Computational Intelligence (WMCS010-05)	5	
Nuclear Astrophysics (WMPH038-05)	5	
Oriëntatie op Onderwijs in de Bètawetenschappen (WMEC013-05)	5	
Pattern Recognition (for CS) (WMCS011-05)	5	
Scalable Computing (WMCS017-05)	5	
Scientific Visualization (WMCS018-05)	5	
Software Maintenance and Evolution (WMCS013-05)	5	
Systems Engineering (WMIE021-05)	5	
Biennial courses, offered in 2026-2027		
Gravitational Waves (WMPH022-05)	5	
Biennial courses, offered in 2027-2028		
Particle Cosmology (WMPH025-05)	5	

For the specialization Data Science & Systems Complexity a maximum of 10 ECTS may be chosen from the option groups in the table above. Students are also allowed to follow courses for the selection of Capita Selecta Courses, though no more than three capita selecta courses are allowed to use for graduation.

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, 2.1A.2 and 2.1B.1)

Direct admission
Graduates with a degree from one of the following degree programmes and universities are considered to have sufficient knowledge and skills and will be admitted to the Master's degree programme in Astronomy on that basis:

- BSc Astronomy, University of Groningen
- BSc Physics, University of Groningen
- BSc Applied Physics, University of Groningen
- BSc Astronomy, Leiden University
- BSc Physics, Leiden University
- BSc Physics & Astronomy, University of Amsterdam/Vrije Universiteit Amsterdam
- BSc Physics & Astronomy, Radboud University
- BSc Natuur- en sterrenkunde/Physics and Astronomy, Utrecht University

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 Astronomy are encouraged to apply through the Admissions Office of the Faculty of Science and Engineering. The Board of Admissions of Astronomy will then assess the application and decides whether the applicant has sufficient background to register for the programme, possibly after following an individually determined pre-master's programme.

Appendix VII. Pre-master's programmes and Fast-Track programmes (Art. 2.3)

A. Pre-Master's programmes

The MSc Astronomy programme does not provide fixed pre-master's programmes for entry into the MSc Astronomy 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 Astronomy 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.

B. Fast-Track programmes

The MSc Astronomy degree programme does not offer Fast-Track programmes for entry into the MSc Astronomy programme.

Appendix VIII. Transitional provisions (Art. 7.1)

8.1 Transitional arrangement 2026-2027

No transitional arrangements.

8.2 Transitional arrangement 2025-2026

The course Astroparticle Physics (WMAS027-05) was not given in 2025/2026. Consequently, the students fulfilled the requirements of the programme by taking an additional elective offered within their track and/or specialisation.

8.3 Transitional arrangement 2024-2025

As of academic year 2024/2025 the Capita Selecta courses will no longer be offered.

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 Astrophysics Core Course as listed in Appendix IV.

8.4 Transitional arrangement 2023-2024

No transitional arrangements.

8.5 Transitional arrangement 2022-2023

No transitional arrangements.

Appendix IX. Additional Requirements Open Degree Programmes (Art. 3.9.2)

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.