



Appendices master's degree programma Astronomy

Appendix I Teaching outcomes of the degree programme (art. 1.3)

1. Knowledge, skills, and insight

- 1.1 The MSc masters the fundamental astronomical and astrophysical concepts as well as the necessary tools from physics, mathematics and computer science, at a level which permits admission to PhD studies
- 1.2 The MSc is familiar with the quantitative character of astronomy and astrophysics, and with the relevant research methods
- 1.3 * The MSc who has completed the Astronomy track has operational knowledge in an observational or theoretical astronomical or astrophysical subarea
 - * The MSc who has completed the Instrumentation and Informatics track has operational knowledge in the area of instrumentation and information technology in astronomy, physics, and/or space research
 - * The MSc who has completed the Business and Policy track has operational knowledge of and insight into the functioning of companies and administrations, as well as the relevant legislation

2. Application of knowledge and skills

- 2.1 The MSc is capable to carry out research, aimed at understanding of astronomical phenomena, both observational and theoretical
- 2.2 The MSc is capable to analyse a (new) complex astrophysical problem, and develop a structured and well-planned research approach
- 2.3 The MSc is capable to apply his/her specific knowledge and skills in his/her own and related subject areas
- 2.4 The MSc is capable to collaborate in a (multi-disciplinary) team

3. Judgement

- 3.1 The MSc is capable to obtain relevant information using modern information channels, and to interpret this information critically
- 3.2 The MSc is capable to judge his/her and others' actions within a scientific context, taking societal and ethical aspects into account
- 3.3 The MSc 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 MSc is capable to communicate clearly, 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 MSc is capable to also address issues outside his/her main subject area, therefore and thereby gaining new knowledge and skills



Appendix II Specializations of the degree programme (art. 2.2)

The degree programme has the following specializations:

- Theoretical and Observational Astronomy (Quantum Universe)
- Instrumentation and Informatics
- Science, Business and Policy

Appendix III Content of degree programme (art. 2.3)

Specialization Theoretical and Observational Astronomy (Quantum Universe)

Module	ECTS	assessment	practical
General Relativity	5	written examination, assignment	
Student seminar Quantum Universe	5	presentations	
Particle Physics Phenomenology	5	written exam	
Electrodynamics of radiation processes	5	written exam	
Astrophysics core courses	20	see appendix IV	see app. IV
Optional courses in Theoretical and Observational Astronomy (Quantum Universe)	20	see appendix IV	see app. IV
Master research / thesis	60	assessment of performance, report, presentation, attendance Astronomy colloquium	x

Specialization Instrumentation and Informatics

Module	ECTS	assessment	practical
General Relativity	5	written examination, assignment	
Student seminar Quantum Universe	5	presentations	
Particle Physics Phenomenology	5	written exam	
Electrodynamics of radiation processes	5	written exam	
Optional courses in Instrumentation and Informatics	30	see appendix IV	see app. IV
Project Information Technology	10	assessment of performance, report, presentation	x
Internship in Industry	20	assessment of performance, report, presentation	x
Master research / thesis	40	assessment of performance, report, presentation, attendance Astronomy colloquium	x



Specialization Science, Business and Policy

module	ECTS	assessment	practical
Astrophysics Core courses	20	see appendix IV	see app. IV
Optional courses in Theoretical and Observational Astronomy (Quantum Universe)	10	see appendix IV	see app. IV
Course Science, Business and Policy	20	assignment, exam, attendance	
Internship Science, Business and Policy	40	assessment of performance, reports	x
Master research / thesis	30	assessment of performance, report, presentation , attendance Astronomy colloquium	x

Appendix IV Optional modules (art. 2.4)

Astrophysics Core Courses

module	ECTS	assessment	practical
<i>Yearly courses</i>			
Statistical Signal Processing	5	written exam, homework assignments, project	x
Formation and Evolution of Galaxies	5	written exam	
<i>Biennial courses, offered in 2013-2014</i>			
High-energy Astrophysics	5	lecture, presentation, project assignment	x
Star and Planet Formation	5	written exam, homework, report	
Dynamics of Galaxies	5	written examination, assignments	
<i>Biennial courses, offered in 2014-2015</i>			
Stellar Structure and Evolution	5	as indicated in appendix IV of the year 2014-2015	
Cosmic Structure Formation	5	as indicated in appendix IV of the year 2014-2015	

Optional Courses in Theoretical and Observational Astronomy (Quantum Universe)

module	ECTS	Assessment	practical
<i>Yearly courses</i>			
Inter Academy Course	5	written exam, assignments	
<i>Biennial courses, offered in 2013-2014</i>			
Active Galactic Nuclei	5	written exam, presentation	
Space Mission Technology	5	written exam	
Basic Detection Techniques	5	written exam, report about experiments	x
Interferometry	5	Written exam, mid-term exam, practical exam	x
<i>Biennial courses, offered in 2014-2015</i>			
Virtual Observations	5	as indicated in appendix IV of the year 2014-2015	x
<i>Capita Selecta courses, offered in 2013-2014</i>			
Milky way	3	literature assignments: discussion, presentation, report, referee	
La Palma Observation Trip	3	collect and analyse data, presentation, report	x



Dark Energy	3	presentations, report
Starburst Galaxies	3	literature assignments: discussion, presentation
Epoch of Reionization	3	Attendance, seminar on a research paper

Capita Selecta courses, offered in 2014-2015

Different capita selecta courses will be offered, as indicated in appendix IV of the year 2014-2015

Quantum Universe Courses

Mathematical Methods in Physics	5	written exam	
Computational Physics	5	computer assignments	x
Atomic and molecular interactions	5	oral or written exam	
Elementary Particle Physics	5	oral examination	
Fundamental constants	5	Assignments, oral presentation	
Geometry and topology	5	assignments, oral presentation, report	
High-energy astrophysics	5	assignments, oral presentation	
Lie groups in physics	5	oral or written exam	
Nuclear astrophysics	5	written exam or presentation	
Plasma physics	5	written exam	
Quantum Field Theory	5	written exam	
Statistical methods in physics	5	written exam	

Optional Courses in Instrumentation and Informatics

module	ECTS	assessment	practical
Interferometry (biennial, offered in 2013-2014)	5	written exam, mid-term exam, practical exam	x
Virtual Observations (biennial, offered in 2014-2015)	5	as indicated in appendix IV of the year 2014-2015	x
Statistical Signal Processing	5	written examination, homework assignments, project	x
Basic Detection Techniques (biennial, offered in 2013-2014)	5	written examination, report about experiments	x
Space Mission Technology (biennial, offered in 2013-2014)	5	written examination	
Numerical Mathematics 2	5	assignments, written exam	x
Instrumentation related physics courses on approval of the board of examiners		as indicated in appendix III or IV of the corresponding MSc Programme	



Appendix V Entry requirements and compulsory order of examinations (art. 3.2)

For students admitted to the programme there are no entry requirements for the individual modules.

Appendix VI Admission to the degree programme and different specializations (art. 4.1.1 + art. 4.2)

Holders 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 Astronomy on that basis:

- BSc Sterrenkunde