university of groningen / faculty of science and engineering / astronomy

# Appendices to the Teaching and Examination Regulations for the

# Bachelor's degree programme in Astronomy

# 2025-2026

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# Appendix I. Learning outcomes of the Bachelor's degree programme (art. 3.1)

## A. Generic learning outcomes – Knowledge

A1. Bachelor's graduates have general knowledge of the foundations and history of mathematics, natural sciences and technology, in particular those of astronomy.

A2. Bachelor's graduates have mastered the basic concepts of astronomy (see the Degree programme-specific learning outcomes, listed below, for further specification) to a certain extent and are familiar with the interrelationships of these concepts within astronomy as well as with other disciplines.

A3. Bachelor's graduates have in-depth knowledge of several contemporary topics within astronomy.

A4. Bachelor's graduates are familiar with the quantitative character of the fields of mathematics and natural sciences and have an understanding of the methods used in these fields, and particularly within astronomy, including computer-aided methods.

A5. Bachelor's graduates have sufficient knowledge and understanding of mathematics and natural sciences to successfully complete a follow-up Master's degree programme in astronomy.

A6. Bachelor's graduates are aware of the societal, ethical and social aspects involved in the fields of mathematics and natural sciences, and act accordingly.

## B. Generic learning outcomes – Skills

B1 (Research) Bachelor's graduates are able to draw up a research question, design, plan and conduct research and report on it with an appropriate degree of supervision. Bachelor's graduates are able to evaluate the value and limitations of their research and assess its applicability outside their own field.

B2 (Designing) Bachelor's graduates are able to translate an astronomy problem, in particular a design problem, into a plan of approach and – taking into account the practical boundary conditions – find a solution.

B3 (Gathering information) Bachelor's graduates are able to gather relevant information using modern means of communication and to critically interpret this information.

B4 (Collaborating) Bachelor's graduates are able to collaborate in teams on technical-scientific problems.

B5 (Communicating) Bachelor's graduates are able to communicate in English, both orally and in writing in academic and professional contexts, with both colleagues and others. They are familiar with the relevant means of communication.

B6 (Reflecting) Bachelor's graduates are able to assess their own actions and those of others in a natural sciences context, bearing in mind the social/societal and ethical aspects.

B7 (Learning skills) Bachelor's graduates are able to apply learning skills that enable them to pursue a follow-up degree and acquire knowledge in new fields with a high level of autonomy.

B8 Additional subject-specific skills are listed below in Degree programme-specific learning outcomes – Skills.

**Degree programme-specific learning outcomes – Basic Knowledge**

1. The bachelor's graduate in Astronomy
   1.1. has some knowledge of the historical development of the astronomical worldview;
   1.2. is familiar with the principles of positional astronomy;
   1.3. masters the basic astrophysics of planets, stars and galaxies, interstellar medium and cosmology;
   1.4. knows the basic principles concerning conducting astronomical observations in different wavelength regimes and processing the obtained observational data;
   1.5. has a thorough knowledge of theoretical astrophysics;
   1.6. has a thorough knowledge of general mathematics (calculus, linear algebra, complex analysis, error analysis, and statistics);
   1.7. has a thorough knowledge of general physics (classical mechanics, electromagnetism, quantum physics, thermodynamics, statistical physics, wave phenomena, oscillations and optics, matter: structure and interactions);
   1.8. (minor) has a deeper knowledge of subjects within their own discipline or a broad general knowledge of a different discipline.

**Degree programme-specific learning outcomes – Skills**

2. The bachelor's graduate in Astronomy
   2.1. is on an elementary level able to obtain, analyse, and present observations in different wavelength regimes of objects like stars, galaxies, and star forming regions;
   2.2. is able to conduct basic astronomical observations with an optical telescope;
   2.3. is familiar with the use of computers and computing in astronomy research:
      - has experience in working with astronomical observations and/or astronomical simulations;
      - is able to write software in a common programming language.

## Appendix II. Majors and Minors of the Bachelor's degree programme (art. 3.7 and 7.1.3)

The degree programme consists of the Astronomy major (150 ECTS) and a free minor (30 ECTS).

**Major:**
The Astronomy major of 150 ECTS is mandatory for all Astronomy students.

**Minors:**
1. The Bachelor's degree programme of Astronomy offers the following deepening minors:
   - Astronomy (30 ECTS)
   - Instrumentation & Informatics (30 ECTS)

   These deepening minors are offered for students in the Bachelor's degree programme of Astronomy.

2. The Bachelor's degree programme of Astronomy offers the following University Minor:
   - Astronomy through space and time (15 ECTS)

   This university minor is offered university wide and as such not available for students from the bachelor degree programmes Astronomy, Physics, and Applied Physics.

## Appendix III. Course units in the first year of the degree programme

- **List of course units; art. 4.1.1**
- **Compulsory order of examinations; art. 9.3**

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.

| Course unit (course code) | ECTS | Entry requirements |
|---|---|---|
| Calculus 1 (for Physics) (WBPH057-05) | 5 | |
| Calculus 2 (for Physics) (WBPH058-05) | 5 | |
| Differential Equations (for Physics) (WBPH089-05) | 5 | |
| Electricity and Magnetism (WBPH033-10) | 10 | |
| Introduction to Programming and Computational Methods (WBAS013-05) | 5 | |
| Linear Algebra (for Physics) (WBPH054-05) | 5 | |
| Mechanics and Relativity (WBPH001-10) | 10 | |
| Observational Astronomy (WBAS015-05) | 5 | |
| Physics Lab: Skills (WBPH077-05) | 5 | |
| Choice:<br>- Introduction to Astronomy (WBAS007-05)<br>- Introduction to Energy & Environment (WBPH019-05)<br>- Introduction to Nanophysics (WBPH055-05)<br>- Medical Physics & Biophysics (WBPH022-05)<br>- Physics of Modern Technology (WBPH027-05)<br>- Physics of the Quantum Universe (WBPH028-05) | 5 | |

# Appendix IV. Course units second and third years of the degree programme

- **List of course units; art. 7.1.1**
- **Compulsory order of examinations; art. 9.3**

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 Astronomy major programme

| Course unit (course code) | ECTS | Entry requirements |
|---|---|---|
| *Year 2* | | |
| Complex Analysis (WBPH059-05) | 5 | |
| Numerical Methods (WBAS014-05) | 5 | |
| Physics of Galaxies (WBAS016-05) | 5 | |
| Physics of Stars (WBAS017-05) | 5 | |
| Astronomy & Society: Ethical and Professional Aspects (WBAS019-05) | 5 | |
| Quantum Physics 1 (WBPH014-05) | 5 | |
| Quantum Physics 2 (WBPH052-05) | 5 | |
| Statistics for Astronomy (WBAS004-05) | 5 | |
| Thermal Physics (WBPH002-10) | 10 | |
| Waves and Optics (WBPH032-05) | 5 | |
| Choice:<br>- From Atoms to Solids 1 (WBPH086-05)<br>- Subatomic physics: concepts and experiments (WBPH088-05) | 5 | |
| *Year 3* | | |
| Advanced Electrodynamics (WBPH079-05) | 5 | |
| Astrophysical Hydrodynamics (WBAS011-05) | 5 | |
| Interstellar Medium (WBAS012-05) | 5 | |
| *Minor* | 30 | Depending on the minor |
| Astronomy Bachelor Research Project (WBAS901-15) | 15 | Requires 150 ECTS of the Bachelor's degree programme completed. Additionally, third-year BSc Astronomy students who have obtained 135 ECTS of the degree programme within the first three years of registration are also allowed to start the Astronomy Bachelor Research Project. |

### 4.2 Minor: Astronomy

The Minor comprises of 30 ECTS and is a coherent and deepening package of course units.

| Course unit (course code) | ECTS | Entry requirements |
|---|---|---|
| Cosmology (WBAS001-05) | 5 | |
| Introduction to Radio Astronomy (WBAS008-05) | 5 | |
| Planetary Systems (WBAS002-05) | 5 | |
| Choice:<br>- Atoms and Molecules (WBPH003-05)<br>- Space Mission Technology (WBAS003-05) | 5 | |
| Choice:<br>- Advanced Mechanics (WBPH017-05)<br>- Introduction to Science Communication (WBEC001-05)<br>- Nuclear Physics (WBPH011-05)<br>- Oriëntatie op Onderwijs in de Bètawetenschappen (WBEC002-05)<br>- Statistical Signal Processing (WBAS009-05) | 10 | Regarding WBEC001-05 and WBEC002-05: additional course specific entry requirements may apply. |

### 4.3 Minor: Astronomy Instrumentation and Informatics

The Minor comprises of 30 ECTS and is a coherent and deepening package of course units.

| Course unit (course code) | ECTS | Entry requirements |
|---|---|---|
| Control Engineering (for BME) (WMBE024-05) | 5 | |
| Cosmology (WBAS001-05) | 5 | |
| Principles of Measurement Systems (WBPH029-05) | 5 | |
| Space Mission Technology (WBAS003-05) | 5 | |
| Statistical Signal Processing (WBAS009-05) | 5 | |
| Choice:<br>- Introduction to Radio Astronomy (WBAS008-05)<br>- Introduction to Science Communication (WBEC001-05)<br>- Oriëntatie op Onderwijs in de Bètawetenschappen (WBEC002-05) | 5 | Regarding WBEC001-05 and WBEC002-05: additional course specific entry requirements may apply. |

## Appendix V. Contact hours (art. 3.6)

| **Bachelor's year 1** | |
|---|---|
| **Structure contact hours** | **Contact hours per year** |
| Lectures | 346 |
| Tutorial/Practicals | 288 |
| Projects | 140 |
| Tutoring | 32 |
| Examinations | 45 |
| Other structured hours | 50 |

| **Bachelor's year 2** | |
|---|---|
| **Structure contact hours** | **Contact hours per year** |
| Lectures | 334 |
| Tutorial/Practicals | 288 |
| Projects | 71 |
| Tutoring | 8 |
| Examinations | 45 |
| Other structured hours | 18 |

| **Bachelor's year 3 *** | |
|---|---|
| **Structure contact hours** | **Contact hours per year** |
| Lectures | 88 |
| Tutorial/Practicals | 56 |
| Projects | 460 |
| Tutoring | 8 |
| Examinations | 12 |
| Other structured hours | 24 |

*only semester 2

## Appendix VI. Additional Requirements Open degree Programmes (art. 7.3)

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.

# Appendix VII. Transitional provisions (art. 12.1)

## 8.1 Transitional arrangement 2025-2026

| **Discontinued course units** | | | | **Substitute course units** | | | | |
|---|---|---|---|---|---|---|---|---|
| *Course code* | *Course name* | *ECTS* | *Final exam* | *Course code* | *Course name* | *ECTS* | *Explanation* | *Equivalent Yes/No* |
| WBPH049-10 | Mathematical Physics | 5 | 24/25 | WBPH089-05 | Differential Equations (for Physics) | 5 | Substituting course | Yes |

## 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* |
| WBPH046-05 | Structure of Matter 1 | 5 | 24/25 | WBPH086-05 | From Atoms to Solids 1 | 10 | Substituting course | Yes * |
| WBPH046-05 | Structure of Matter 1 | 5 | 24/25 | WBPH088-05 | Subatomic physics: concepts and experiments | 10 | Substituting course | Yes * |
| WBPH082-05 | Physics, Astronomy & Society: Ethical and Professional Aspects | 5 | 23/24 | WBAS019-05 | Astronomy & Society: Ethical & Professional Aspects | 5 | Substituting course | Yes |

* The course "Structure of Matter 1" will be replaced by a set of electives, both replacing the old course.

## 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* |
| WBPH013-05 | Physics Laboratory 1 | 5 | 23/24 | WBPH077-05 | Physics Lab: Skills | 5 | Name change | Yes |
| WBPH036-05 | Astroparticle Physics | 5 | 24/25 | WBAS019-05 | Advanced Electrodynamics | 5 | Substituting course | Yes |

## 8.4 Transitional arrangement 2022-2023

| **Discontinued course units** | | | | **Substitute course units** | | | | |
|---|---|---|---|---|---|---|---|---|
| *Course code* | *Course name* | *ECTS* | *Final exam* | *Course code* | *Course name* | *ECTS* | *Explanation* | *Equivalent Yes/No* |
| WBMA003-05 | Calculus 1 | 5 | N/A | WBPH057-05 | Calculus 1 (for Physics) | 5 | Substituting course | Yes |
| WBMA003-05 | Calculus 2 | 5 | N/A | WBPH058-05 | Calculus 2 (for Physics) | 5 | Substituting course | Yes |
| WBMA018-05 | Complex Analysis | 5 | N/A | WBPH059-05 | Complex Analysis (for Physics) | 5 | Substituting course | Yes |

### 8.5 Transitional arrangement 2021-2022

No transitional arrangements.