S t u d y p r o g r a m m e

Part A) of the study programme *

L e a r n i n g o u t c o m e s

Faculty offering the field of study:	**Faculty of Physics, Astronomy and Informatics**
Field of study:	**Physics and Astronomy**
Level of study:	**second cycle**
Level of the Polish Qualifications Framework:	**level 7**
Degree profile:	**general academic**
Professional degree awarded to the graduate:	**magister**
Allocation of the field of study within academic or artistic discipline(s), to which learning outcomes for a given field of study refer:	**Disciplines:** **- Physical sciences (60%)** **- Astronomy (40%)** **Major discipline: Physical Sciences**

Symbol	**Upon completion the graduate achieves the learning outcomes specified below:**
	KNOWLEDGE
K_W01	Has in-depth knowledge of advanced Mathematics and mathematical methods necessary for solving problems of Physics or Astronomy in the selected areas
K_W02	Knows advanced experimental, observational and numerical techniques which allow to plan a complex physical or astronomical experiment
K_W03	Knows the rules of the functioning of measuring systems and research equipment specific for the area of Physics or Astronomy, or knows advanced methods of theoretical, computational and mathematical Physics or Astronomy
K_W04	Knows the physical processes occurring in stars and galaxies, interstellar and extragalactic medium, has in-depth knowledge of the structure and evolutions of planetary systems, stars, galaxies, and the Universe
K_W05	Knows the processes occurring in atoms, molecules, optical phenomena and condensed matter
K_W06	Has knowledge of contemporary trends in the development of Physics and Astronomy
K_W07	Has basic knowledge of economic, legal, ethical and other conditions related to academic activity and teaching, knows the basic rules of copyrights.
	SKILLS
K_U01	Can apply a scientific method to problem-solving, conducting experiments, drawing conclusions and testing hypotheses
K_U02	Is capable of planning and conducting advanced experiments or observations as well as theoretical considerations in particular fields of Physics or Astronomy and their applications
K_U03	Can critically analyse measurements, observations or theoretical computations, along with evaluations of the results' accuracy
K_U04	Can use and modify available software for numerical modeling of astrophysical objects or physical phenomena
K_U05	Can find relevant information in specialist literature, both from databases and other sources; can recreate the reasoning or the course of an experiment described in literature, taking into account the assumptions and approximations made
K_U06	Can critically compare model data with experimental or observational data

K_U07	Can adapt knowledge and methodology of Physics and Astronomy as well as applied experimental and theoretical methods to the needs of related scientific disciplines
K_U08	Can see the connections between contemporary studies of the Universe and the development of Physics at the fundamental level
K_U09	Can present research findings (experimental, theoretical or numerical) in speech or writing
K_U10	Can efficiently communicate both with specialists and non-specialists in terms of topics relevant to the studied field of Physics or Astronomy
K_U11	Can work both independently and as a member of a team, also assuming the leading role; is aware of the responsibility for jointly-conducted tasks
K_U12	Can define the directions for further improvement of own skills and knowledge (including self-education) within the selected specialisation and beyond it
K_U13	Has language skills in terms of fields of knowledge and disciplines of science relevant to the programme studied, in accordance with the requirements stipulated for the B2+ level of the Common European Framework of Reference
SOCIAL COMPETENCES	
K_K01	Knows the limitations of own knowledge and skills
K_K02	Appreciates the importance of knowledge in solving practical and cognitive problems, understands the need to question experts and authorities
K_K03	Knows and appreciates the importance of intellectual honesty in own actions and the actions of other persons; is aware of ethical problems in the context of research reliability (plagiarism or duplicate publication, data falsification)
K_K04	Understands the need to popularise the knowledge of Physics and Astronomy, including the most recent scientific and technological advances
K_K05	Can formulate opinions related to professional issues as well as opinions on certain topics of public interest such as global warming, renewable energy or atomic energy

Part ***B) of the study programme***

Description of the process resulting in the achievement of learning outcomes

Faculty offering the field of study:	Faculty of Physics, Astronomy and Informatics
Field of study:	Physics and Astronomy
Level of study:	second cycle
Level of the Polish Qualifications Framework:	level 7
Degree profile:	general academic
Allocation of the field of study within academic or artistic discipline(s), to which learning outcomes for a given field of study refer:	**Discipline:** - astronomy (40%) - physical sciences (60%) **Major discipline: Physical sciences**
Mode of study:	Full-time programme
Number of semesters:	4
Number of ECTS required for the award of qualifications corresponding to the level:	90
Total number of teaching hours:	approx.1170
Professional degree awarded to the graduate:	magister
The relationship between the study programme and NCU mission and strategy:	NCU operational objectives: 2.1.2. Increase in the number of foreign students and therefore corresponding increase in the number of fields of study in foreign languages 2.1.4. Creating original educational offer in accordance with the idea of the Bologna process. 2.2.1.Making educational offer move attractive through unique interdisciplinary studies and activities related to implementation of the project „Excellence Initiative – Research University”: 7. Creating fields of studies and courses in English language, especially in priority research areas and the increase of international cooperation in education area 9. Best candidates admission for doctoral schools and support for PhD student mobility.

Courses/course modules along with expected learning outcomes

Course module	Course	Expected learning outcomes	Forms and methods of	Methods of

			teaching ensuring the achievement of learning outcomes	verifying and assessing expected learning outcomes achieved by the student
Obligatory courses	Classical and celestial mechanics Stellar physics Advanced mathematical methods Electrodynamics and field theory Atomic and molecular physics General relativity Quantum optics 1 Astrophysics laboratory Radiative processes in astrophysics Condensed matter physics Physics laboratory Astrohydrodynamics Large-scale Universe From complex chemistry to new physics	**Knowledge** **Student:** • knows the basic Newtonian classical mechanics with the focus at the N-body problem and its variants (the planetary problem) • knows the kinematics and dynamics with application of the two-body problem in astrophysics (star-planet, binary stars, planet-moon configurations) • knows the basic theory of the restricted three body problem and its selected application in astrodynamics, galactic dynamics and planetary systems • knows elements of the dynamical systems theory • has advanced knowledge of physical processes which determine the stellar structure and govern the stellar evolution • knows main stellar types and groups, relates them with different lifetime phases • is familiar with contemporary problems of stellar studies • has knowledge of mathematical models used in theoretical physics • is familiar with selected mathematical methods related to tensor calculus, complex analysis and group theory, and their applications in physics, • has knowledge concerning the current trends in the development of mathematical and theoretical physics, • has extensive knowledge about electromagnetism and differential equations, which allows him to solve problems in electrostatics, magnetostatics, and electrodynamics, • possesses knowledge about the independent-particle approximation (Hartree-Fock method) and its properties • is familiar with importance of the electron correlation effects in providing an accurate description of atoms and molecules • is acquainted with the basic methods for electron correlation energy calculations like Moller-Plesset perturbation theory, configuration interaction and coupled-cluster methods in both single- and multi-reference versions, • has basic knowledge of general theory of relativity (GTR),	Expository teaching methods: - informative lecture - problem-based lecture - discussion Exploratory teaching methods: - classic problem-solving - experimental - laboratory - project work	Assessment methods: - written examination - oral examination - final knowledge test - activity in classes - activity in project work - reports from results of experiments

		• knows fundamental effects of GTR and basic cosmological models, • is familiar with gravitational waves, their characteristics and sources, • has in-depth knowledge of physics and mathematical methods necessary for solving problems in Quantum Optics, • knows advanced methods of theoretical Quantum Optics, • is familiar with the processes occurring in atoms, molecules and optical phenomena, • has knowledge of contemporary tendencies in the development of Quantum Optics and Atomic Physics, • knows experimental techniques which allows to plan physical and astronomical experiments, • is familiar with functioning of measuring systems and research equipment specific for particular fields of physics and astrophysics, • knows the physical processes of how primordial perturbations grow gravitationally to form large-scale structure and galaxies, • has knowledge of the Lambda CDM model of cosmology and its observational strengths and weaknesses, • knows and understands the relation of free-licensing of software in relation to the intellectual obligations of scientific understanding, scientific reproducibility, intellectual freedom, universal dissemination of knowledge and non-discrimination in the sense of the International Union of Pure and Applied Physics (IUPAP), • knows basic physical processes that lead to the emission of astronomical objects, • understands how the emission of different astronomical objects is created, • has basic knowledge about acceleration of particles in astronomical objects, **Skills** **Student can:** • use parametrisation of the Keplerian orbits, various types of orbital elements, propagation of the initial condition • use construction of the kinematic merit function for astrophysical observations of binary systems (radial velocities, astrometry, eclipse timing) • use numerical integration of the equations of motion • deduce information on stars from spectroscopy • has basic skills in simulating stellar structure and evolution • is able to derive specific physical quantities using some mathematical models and scientific reasoning,		

		• has skills to adapt knowledge and methodology of tensor calculus, complex analysis, group and representation theory to selected topics in physics, • can model electromagnetic phenomena, • has the basic knowledge about problems related to solving the Schrodinger equation for atomic and molecular systems, • is able to make use of the variational principle to obtain optimal approximate solutions for quantum mechanical problems, can apply perturbation expansion to evaluate most important components of the wave function and the energy in the Schrodinger equation • is capable of presenting the Hartree-Fock equations and discuss different aspects of the method as a zeroth-order approximation • has basic skills in using the second-quantized form of the operators and knows how to apply many-body techniques to derive an explicit form of the equations • can demonstrate and analyze different ways of including the effect of electron correlation in description of atoms and molecules, can discuss assumptions underlying the approaches and their properties • can introduce and discuss multi-reference generalizations of the standard single-reference methods that are designed to describe quasi-degenerate and open-shell systems, • is skilled in tensor calculations, • is capable of solving Einstein equations for the simplest highly symmetric cases, • can explain the concept of black hole and the simplest cosmological models, • can apply the scientific method to problem-solving, drawing conclusions and testing hypothesis, • has the skill of performing theoretical considerations in Quantum Optics and Atomic Physics and their applications, • can conduct a critical analysis of observations or theoretical computations, • can find relevant information in specialist literature, both from databases and other sources; can recreate the reasoning or the course of an experiment described in literature, taking into account the assumptions made and approximation, • can adapt knowledge, methodology and results of Quantum Optics to the needs of related scientific disciplines, • can efficiently communicate both with specialists and non-specialists in terms of the topics relevant to Quantum Optics and		

		Atomic Physics, • can define the directions for further improvement of own skills and knowledge (including self-education) within the selected specialization and beyond, • can apply the scientific method to conducting experiments, drawing conclusions and testing hypothesis, • is capable of planning and conducting advanced experiments in particular fields of Physics, • can conduct a critical analysis of measurements, along with evaluation of the results' accuracy, • has the skill of critical comparison of model data with experimental data, • can use and modify the available free-licensed software for numerical modelling of large-scale physical properties of the Universe and of objects in the Universe, • can see how astronomical evidence suggesting the existence of dark matter and dark energy stimulates research in fundamental physics, • is able to explain various types of emission in astronomical objects, • can create a simple model to explain given type of emission, • is capable to extend his knowledge by reading professional astronomical articles **Social competences** **Student** • understands the fundamental links between the mathematical theory and observations • understands the significance of the Copernicus revolution • is ready to study specialized subjects of astronomy • understands the significance of stellar science to all other areas of astronomy • understands the need for development of physics underlying the energy generation and transport in stars • is aware of numerous unsolved issues • knows the limitations of his own knowledge and skills related to mathematical methods and theoretical physics, • can formulate his own opinions related to some topics of modern physics, • understands the need for proper popularization of relativity concepts • appreciates the meaning of knowledge in solving practical problems, understands the need to question experts, • understands significance of astronomical observations as a natural		

		replacements for some laboratory experiments, especially for those that are impossible to conduct in normal laboratories, • understands the need to popularize the knowledge of Astronomy,		
Elective course module I	Quantum optics 2 Quantum optics laboratory Optoelectronics laboratory Quantum information Statistical physics Biophysics or other from a list published every year on a faculty webpage	**Knowledge:** **Student:** • Has in-depth knowledge of advanced Mathematics and mathematical methods necessary for solving problems of Physics in the selected areas, • Knows advanced experimental or numerical techniques, which allow to plan a complex physical experiment, • Knows the rules of functioning of measuring systems and research equipment specific for the area of Physics • Knows advanced methods of theoretical, computational and mathematical Physics, • Knows the processes occurring in atoms, molecules, optical phenomena and condensed matter, Has knowledge of contemporary tendencies in the development of Physics. **Skills** **Student:** • Can apply the scientific method to problem-solving, conducting experiments, drawing conclusions and testing hypothesis, • Has the skill of planning and conducting advanced experiments or observations as well as theoretical considerations in particular fields of Physics and their applications, • an conduct a critical analysis of measurements or theoretical computations, along with evaluation of the results' accuracy, • Can use and modify the available software for numerical modeling of physical phenomena, • Can find relevant information in specialist literature, both from databases and other sources; can recreate the reasoning or the course of an experiment described in literature, taking into account the assumptions made and approximations, • Has the skill of critical comparison of model data with experimental data, • Can adapt knowledge and methodology of Physics as well as applied experimental and theoretical methods to the needs of related scientific disciplines,	Expository teaching methods: - informative lecture - problem-based lecture - discussion Exploratory teaching methods: - classic problem-solving - experimental - laboratory - project work	Assessment methods: - written examination - oral examination - final knowledge test - activity in classes - activity in project work - reports from results of experiments

		• Can present research findings (experimental, theoretical or numerical) in the written or oral form, • Can efficiently communicate both with specialists and non-specialists in terms of the topics relevant to the studied field of Physics, • Can work both independently and as a member of a team, also taking a leading role, is aware of the responsibility for jointly-conducted tasks, • Can define the directions for further improvement of own skills and knowledge (including self-education) within the selected specialization and beyond it, • Has language skills in terms of fields of knowledge and disciplines of science relevant to the program studied, in accordance with the requirements set for the B2+ level of the Common European Framework of Reference. **Social competences** **Student:** • Knows the limitations of own knowledge and skills • Appreciates the meaning of knowledge in solving practical and cognitive problems, understands the need to question experts and authorities, • Knows and appreciates the importance of intellectual honesty in own and others' actions, is aware of ethical problems in the context of research reliability (plagiarism or duplicate publication, data falsification), • Understands the need to popularize the knowledge of Physics including the latest scientific and technological advances, • Can formulate opinions related to professional issues, as well as opinions on some topics of public interest, such as the global warming, renewable energy or atomic energy		
Elective course module II	Astrophysics Galaxies: formation and evolution Physics of planetary systems Theoretical astrophysics laboratory Interstellar medium Astrochemistry and astrobiology or other from a list published	**Knowledge** **Student:** • Has in-depth knowledge of advanced Mathematics and mathematical methods necessary for solving problems of Astronomy in the selected areas, • Knows advanced observational and numerical techniques, which allow to plan a complex astronomical experiment, • Knows the rules of functioning of measuring systems and research equipment specific for the area of Astronomy, • Knows advanced methods of theoretical, computational Astronomy, • Knows the physical processes occurring in stars and galaxies, interstellar and extragalactic medium, has in-depth knowledge of the structure and evolutions of planetary systems, stars, galaxies, and the Universe,	Expository teaching methods: - informative lecture - problem-based lecture - discussion Exploratory teaching methods: - classic problem-solving - experimental - laboratory - project work	Assessment methods: - written examination - oral examination - final knowledge test - activity in classes - activity in project work - reports from results of experiments

	every year on a faculty webpage	• Has knowledge of contemporary tendencies in the development of Astronomy. **Skills** **Student:** • Can apply the scientific method to problem-solving, conducting experiments, drawing conclusions and testing hypothesis, • Has the skill of planning and conducting advanced observations as well as theoretical considerations in particular fields of Astronomy and their applications, • Can conduct a critical analysis of observations or theoretical computations, along with evaluation of the results' accuracy, • Can use and modify the available software for numerical modeling of astrophysical objects • Can find relevant information in specialist literature, both from databases and other sources; can recreate the reasoning or the course of an experiment described in literature, taking into account the assumptions made and approximations, • Has the skill of critical comparison of model data with experimental or observational data, • Can adapt knowledge and methodology of Astronomy as well as applied experimental and theoretical methods to the needs of related scientific disciplines, • Can see the connections between contemporary studies of the Universe and the development of Physics at the fundamental level, • Can present research findings (experimental, theoretical or numerical) in the written or oral form, • Can efficiently communicate both with specialists and non-specialists in terms of the topics relevant to the studied field of Astronomy, • Can work both independently and as a member of a team, also taking a leading role, is aware of the responsibility for jointly-conducted tasks, • Can define the directions for further improvement of own skills and knowledge (including self-education) within the selected specialization and beyond it, • Has language skills in terms of fields of knowledge and disciplines of science relevant to the program studied, in accordance with the requirements set for the B2+ level of the Common European Framework of Reference. **Social competences** **Student:** • Knows the limitations of own knowledge and skills • Appreciates the meaning of knowledge in solving practical and cognitive problems, understands the need to question experts and authorities		

		• Knows and appreciates the importance of intellectual honesty in own and others' actions, is aware of ethical problems in the context of research reliability (plagiarism or duplicate publication, data falsification) • Understands the need to popularize the knowledge of Astronomy, including the latest scientific and technological advances • Can formulate opinions related to professional issues, as well as opinions on some topics of public interest, such as the global warming, renewable energy or atomic energy		
University-wide courses	University-wide courses (from a list of courses)	**Knowledge** **Student:** • Has basic knowledge of economical, legal, ethical and other conditions related to scientific and didactic activity • Knows and understands the basic terms and rules of copyrights **Skills** **Student:** • Can adapt knowledge and methodology of Physics and Astronomy as well as applied experimental and theoretical methods to the needs of related scientific disciplines • Can define the directions for further improvement of own skills and knowledge (including self-education) within the selected specialization and beyond it • Has language skills in terms of fields of knowledge and disciplines of science relevant to the program studied, in accordance with the requirements set for the B2+ level of the Common European Framework of Reference **Social competences** **Student:** • Knows the limitations of own knowledge and skills • Can formulate opinions related to professional issues, as well as opinions on some topics of public interest, such as the global warming, renewable energy or atomic energy	In agreement with subject description	In agreement with subject description
Monographic lectures	Monographic lectures (from a list of courses)	**Knowledge** **Student:** • Knows the physical processes occurring in stars and galaxies, interstellar and extragalactic medium, has in-depth knowledge of the structure and evolutions of planetary systems, stars, galaxies, and the Universe • Knows the processes occurring in atoms, molecules, optical phenomena and condensed matter • Has knowledge of contemporary tendencies in the development of Physics and Astronomy **Skills**	Expository teaching methods: - informative lecture - problem-based lecture - discussion	Assessment methods: - written examination - oral examination - final knowledge test

		Student: • Can find relevant information in specialist literature, both from databases and other sources; can recreate the reasoning or the course of an experiment described in literature, taking into account the assumptions made and approximations • Has the skill of critical comparison of model data with experimental or observational data • Can see the connections between contemporary studies of the Universe and the development of Physics at the fundamental level **Social competences** **Student:** • Knows the limitations of own knowledge and skills • Appreciates the meaning of knowledge in solving practical and cognitive problems, understands the need to question experts and authorities • Understands the need to popularize the knowledge of Physics and Astronomy, including the latest scientific and technological advances • Can formulate opinions related to professional issues, as well as opinions on some topics of public interest, such as the global warming, renewable energy or atomic energy		
Diploma project	Diploma proseminar Diploma seminar Master thesis	**Knowledge** **Student:** • Has knowledge of contemporary tendencies in the development of Physics and Astronomy • Has basic knowledge of economical, legal, ethical and other conditions related to scientific and didactic activity • Knows and understands the basic terms and rules of copyrights **Skills** **Student:** • Can apply the scientific method to problem-solving, conducting experiments, drawing conclusions and testing hypothesis • Has the skill of planning and conducting advanced experiments or observations as well as theoretical considerations in particular fields of Physics or Astronomy and their applications • Can conduct a critical analysis of measurements, observations or theoretical computations, along with evaluation of the results' accuracy • Can use and modify the available software for numerical modeling of astrophysical objects or physical phenomena • Can find relevant information in specialist literature, both from databases and other sources; can recreate the reasoning or the course of an experiment described in literature, taking into account the	Expository teaching methods: - informative lecture - problem-based lecture - discussion - presentation	Assessment methods: - written examination - oral examination - quality and correctness of presentation

<table>
<tr><td></td><td></td><td>assumptions made and approximations

Has the skill of critical comparison of model data with experimental or observational data
Can adapt knowledge and methodology of Physics and Astronomy as well as applied experimental and theoretical methods to the needs of related scientific disciplines
Can see the connections between contemporary studies of the Universe and the development of Physics at the fundamental level
Can present research findings (experimental, theoretical or numerical) in the written or oral form
Can efficiently communicate both with specialists and non-specialists in terms of the topics relevant to the studied field of Physics or Astronomy
Can define the directions for further improvement of own skills and knowledge (including self-education) within the selected specialization and beyond it
Has language skills in terms of fields of knowledge and disciplines of science relevant to the program studied, in accordance with the requirements set for the B2+ level of the Common European Framework of Reference

Social competences
Student:

Knows the limitations of own knowledge and skills
Appreciates the meaning of knowledge in solving practical and cognitive problems, understands the need to question experts and authorities
Knows and appreciates the importance of intellectual honesty in own and others’ actions, is aware of ethical problems in the context of research reliability (plagiarism or duplicate publication, data falsification)
Understands the need to popularize the knowledge of Physics and Astronomy, including the latest scientific and technological advances
Can formulate opinions related to professional issues, as well as opinions on some topics of public interest, such as the global warming, renewable energy or atomic energy
</td><td></td><td></td></tr>
<tr><td>Foreign language classes</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="5">Internships**</td></tr>
<tr><td>Duration of internships</td><td colspan="4" rowspan="2">Not applicable</td></tr>
<tr><td>Form of internships</td></tr>
</table>

Rules of internships	

Detailed allocation of ECTS credits

Academic or artistic disciplines, to which learning outcomes refer:

	Artistic or academic discipline	ECTS credits	
		number	%
1.	Astronomy	48	40
2.	Physical sciences	72	60

Course modules	Course	No of ECTS credits	No of ECTS credits in the discipline: *(enter names of disciplines)****				No of ECTS credits for elective courses	No of ECTS credits obtained by the student in classes conducted with direct contact with the teacher or tutor	No of ECTS credits obtained by the student as a result of: courses related to academic activity within a discipline or disciplines, to which the field of study is assigned *****/ courses focused on training practical skills ******
			astronomy	Physical sciences	Social and humanities sciences				
Obligatory courses	Classical and celestial mechanics	**5**	**5**					**2,5**	**3**
	Stellar physics	**5**	**5**					**2,5**	**3**
	Advanced mathematical methods	**6**		**6**				**3**	**2**
	Electrodynamics and field theory	**6**		**6**				**3**	**2**

	Atomic and molecular physics	**5**		**5**				**2,5**	**2,5**
	General relativity	**6**		**6**				**3**	**2**
	Quantum optics 1	**5**		**5**				**2,5**	**3**
	High-energy astrophysics	**3**	**3**					**1,5**	**2**
	Condensed matter physics	**3**		**3**				**1,5**	**1,5**
	Physics laboratory	**5**		**5**				**3**	**2,5**
	Astrohydrodynamics	**4**	**4**					**2**	**2**
	Large-scale Universe	**3**	**3**					**1,5**	**1,5**
	From complex chemistry to new physics	**4**		**4**				**2**	**2**
Summary for obligatory courses		60	20	40				30,5	29
Elective course module I	Quantum optics 2	**5**		**5**			**5**	**2,5**	**4**
	Quantum optics laboratory	**5**		**5**			**5**	**3,5**	**4**
	Optoelectronics laboratory	**5**		**5**			**5**	**3,5**	**4**
	Quantum information	**3**		**3**			**3**	**1,5**	**2**
	Statistical physics	**5**		**5**			**5**	**2,5**	**2**
	Biophysics	**5**		**5**			**5**	**2,5**	**3**
Elective course module II	Introduction to astrophysics[1]	**3**	**3**				**3**	**1,5**	**1**
	Galaxies: formation and evolution	**5**	**5**				**5**	**2,5**	**2,5**

[1] Not for BSc in astronomy

	Physics of planetary systems	**5**	**5**				**5**	**2,5**	**3**
	Theoretical astrophysics laboratory 1	**3**	**3**				**3**	**2**	**2**
	Theoretical astrophysics laboratory 2	**3**	**3**				**3**	**2**	**2**
	Theoretical astrophysics laboratory 3	**3**	**3**				**3**	**2**	**2**
	Astrochemistry and astrobiology	**3**	**3**				**3**	**1,5**	**1,5**
Summary for elective course modules		**18**	**0-18**[2]	**0-18**[1]			**18**	**11,5**	**10**
Astrophysics laboratory (elective, 3 ECTS)	Optical astrophysics laboratory	**3**	**3**				**3**	**2**	**2**
	Radioastronomy laboratory	**3**	**3**				**3**	**2**	**2**
University-wide courses	University-wide courses (from a list of courses)	**9**			**9**		**9**	**5**	**0**
Monographic lectures	Monographic lectures (from a list of courses)	**6**	**0-6**[1]	**0-6**[1]			**6**	**3**	**6**
Diploma project and/or diploma examination	Diploma proseminar	**2**	**0-2**[1]	**0-2**[1]				**1**	**2**
	Diploma seminar	**2**	**1**	**1**				**1**	**2**
	Master thesis	**20**	**10**	**10**			**20**	**6,5**	**20**
	IN TOTAL:	**120** **100%**	**47** **39,2%**	**64** **53,3%**	**9** **7,5%**		**56** **46,7%**	**60,5** **50,4%**	**71** **59,2%**

[2] The score depends on a particular path of courses chosen.

*** the description of a course sylabus is attached to the study programme**

This study programme is effective as of winter semester of the academic year 2020/2021.