University of Basel

Department of Physics

Study Guide

Bachelor and Master Program

Physics

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Study Guide for the Bachelor and Master Program in Physics at the Faculty of Science of the University of Basel

Prepared by the Teaching Committee for Physics in collaboration with the Dean of Studies Office of the Faculty of Science.
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Contents

1 General Information

About this Study Guide

This study guide elaborates on the official study regulations and curricula of the University of Basel, in particular the Faculty of Science regulations for the Bachelor and Master programs dated September 15, 2020, the curricula for the Bachelor and Master programs in Physics dated September 29, 2020 and November 25, 2025, as well as the study regulations for Physics as an extracurricular subject dated May 20 and 29, 2008.

While these formal documents establish the binding rules, this study guide aims to illustrate the principles stated therein, provide practical advice on how to structure your studies, and help you plan your individual academic path. You will find explanations of the structure of the program, guidance on elective options, and tips for a successful course of study.

Studying Physics in Basel

Success in a physics program requires a talent for the natural sciences, analytical thinking, and an enthusiasm for experimental work and mathematical-formal reasoning. Curiosity, perseverance, and the willingness to grapple with complex interrelationships are equally important prerequisites. Physics is fascinating, yet also demanding. You will learn to observe nature through the eyes of science, to ask fundamental questions about the laws governing our world, and to find answers to them.

Research Focus Areas

The Department of Physics at the University of Basel has established an international reputation in two forward-looking research areas. In the field of **Nano and Quantum Physics**, we investigate phenomena on the nanometer scale, from individual atoms to artificial quantum systems. This fundamental research has far-reaching applications in quantum computing, highly sensitive sensing, and novel materials. Work at the department has already led to several groundbreaking discoveries. There are close ties with the Swiss Nanoscience Institute and the Basel Quantum Center.

The second research focus lies in **Cosmology and Particle Physics**. In this area, we investigate the fundamental building blocks of matter and develop physical theories about the evolution of the universe. From the search for new elementary particles at CERN to the study of dark matter and dark energy, we address the great questions of physics. Our researchers participate in major international experiments and make essential contributions to advancing our understanding of the cosmos.

In addition, the department actively participates in the interdisciplinary programs in Nanosciences and Computational Sciences, situated at the interface of physics, chemistry, biology, and computer science.

Career Prospects

A degree in physics opens doors to a wide variety of career paths. The analytical and problem-solving skills acquired during your studies are highly valued in virtually every knowledge-intensive industry and enable you to enter diverse professional fields.

In **Research and Development**, physicists work in high-tech industries such as medical technology, photonics, semiconductor technology, and telecommunications. Physics graduates are also in great demand in materials science and nanotechnology, in renewable energy and environmental technology, and in software development and artificial intelligence. Their ability to approach complex problems systematically and develop innovative solutions makes them valuable contributors to research and development departments.

In **Education and Academia**, you can teach at secondary schools after obtaining a teaching diploma, sharing your enthusiasm for physics with the next generation. Alternatively, a doctoral degree opens the door to a university research and teaching career, or to positions at research institutes and think tanks in Switzerland and abroad. An academic career offers the opportunity to work at the cutting edge of science and generate new knowledge.

Physicists are also highly sought after and successful in **Business and Consulting**. Management consulting firms particularly value the analytical skills and structured thinking of physics graduates. In the finance sector, including banks, insurance companies and asset management firms, physics graduates are employed in quantitative modeling, risk management and data analysis. Exciting opportunities also arise in technology management and innovation consulting.

The variety of career options available demonstrates that a physics degree can lead in many different directions. The analytical thinking, problem-solving, mathematical modeling and experimental methodology skills developed during your studies are universally applicable and in high demand in the modern workforce.

Program Structure

The Credit Point System

The program is based on the European Credit Transfer and Accumulation System (ECTS), recognized across Europe. For each successfully completed course, you receive credit points (CP) that reflect your actual workload. One credit point corresponds to approximately 30 hours of work, including attendance at lectures and exercise sessions as well as time for self-study, preparation, and examinations.

Academic assessment takes two forms. Core lectures are assessed through examinations, which are written or oral tests held at the end of the semester. Other courses are assessed through continuous assessment, such as the submission of problem sets, laboratory reports, presentations or tests held during the semester. You will pass a course when you have fulfilled the participation requirements and successfully completed all assessments. The specific requirements are communicated at the beginning of each course.

In a full-time program, you earn an average of 30 credit points per semester. Due to individual choices and different study paces, this number may vary: some semesters may carry 28 CP, others 32 CP.

Bachelor's and Master's Programs

The Bachelor's program in Physics comprises 180 credit points and normally takes six semesters. It is structured in two sequential phases:

The **Basic Studies** in the first two semesters provide a solid foundation for your entire physics program. During this period, you will acquire systematic knowledge of experimental physics and become familiar with the fundamental phenomena and laws of nature. At the same time, you develop the mathematical foundations in analysis and linear algebra that you will need for more advanced courses. This phase of study is largely structured and follows a well-established curriculum. Nevertheless, it offers initial elective options, allowing you to set priorities and explore your interests.

In the **Advanced Studies** from the third to the sixth semester, you deepen your physical and mathematical competencies considerably. You develop experimental skills in the advanced practical course, learn the methods of theoretical physics, and increasingly set your own priorities through elective courses. Flexibility grows with each semester, enabling you to shape your studies more and more according to your interests.

After completing your Bachelor's degree, you can continue your education with the Master's program, which comprises 120 credit points and lasts four semesters. During the **Master's program**, you will specialize in specific research areas, undertake project work to prepare for independent research, take an oral Master's examination and finally write your Master's thesis within a research group in the department.

Teaching Formats in the Bachelor's Program

The Bachelor's program combines various teaching formats that promote complementary competencies and offer different approaches to physics.

Lectures and Exercises – Building the Theoretical Foundation

The **Introductory Lectures Physics I–IV** provide, from the first semester onward, a systematic overview of all sub-fields of physics. Physics I covers mechanics and thermodynamics, Physics II covers electrodynamics and optics, Physics III covers quantum physics, and Physics IV covers atomic and molecular physics. In parallel, the foundational mathematics courses Analysis I/II and Linear Algebra I/II provide the mathematical toolkit required for the entire remainder of the program.

From the third semester onward, the **Theory Cycle** begins, introducing you to the methods of theoretical physics. This cycle covers the four major pillars: mechanics, electrodynamics, quantum mechanics, and thermodynamics. Here you learn to approach physical problems systematically using mathematical methods and develop a deep understanding of the fundamental principles of physics.

The **Advanced Lectures** on the Structure of Matter impart specialized knowledge in nuclear and particle physics, as well as condensed matter physics. Special topic lectures also offer insights into current research themes and specialized experimental or theoretical methods. If you are particularly interested in theoretical particle physics and cosmology, it is highly recommended that you attend the "Advanced Quantum Mechanics and Quantum Field Theory" lecture in the Bachelor's program, as it lays the theoretical foundation for further study in these areas at Master's level.

Practical Courses – Developing Experimental Competence

Hands-on laboratory work is a central component of your education. In the **Physics Laboratory Course for Beginners**, which spans the second and third semesters, you conduct fundamental experiments and learn to apply the methods of experimental physics. You collect and analyze measurement data, evaluate it critically, and document your work in scientific lab reports. At the same time, you gain practical insight into various sub-fields of physics, from mechanics and optics to thermodynamics.

The **Advanced Physics Laboratory Course** in the fourth and fifth semesters challenges you with more demanding experiments from current research areas. You work on experiments from particle physics, nano and quantum physics, atomic and molecular physics, as well as optics and photonics. Electronic circuits and modern measurement techniques are also part of the repertoire. These experiments require a deeper understanding of the physical foundations and prepare you for independent research.

In the sixth semester, individual **Research Laboratory Courses** offer the opportunity for in-depth experimental work or participation in block courses within the research groups of the department. Here you can already gain first-hand experience in active research.

Proseminars – Learning Scientific Practice

In proseminars, typically attended in the fifth or sixth semester, you develop the skills for scientific work. You learn to research and understand specialist literature on a given topic, to present complex subject matter in a structured way, and to deliver scientific presentations. These competencies are of great importance not only for your continued studies but also for your future professional career.

Individual Design Options

Physics studies in Basel offer you considerable flexibility in shaping your personal academic path. The elective area in the Bachelor's encompasses a total of 56 credit points. Of these, at least 30 CP must be chosen from courses in physics, mathematics, and computer science. Here you can acquire advanced knowledge in areas such as higher quantum mechanics, general relativity, numerical methods, or programming. A further minimum of 12 CP are chosen across disciplines from the entire course directory of the university, for example from chemistry, philosophy, economics, or language courses. On average, 8 CP per semester are available in the elective area (for details see Section 2.4).

Particularly motivated and qualified students may carry out **research projects** in groups of the department. These practical placements are credited to the elective area on the basis of a learning contract agreed in advance. They offer valuable insight into current scientific work, enable participation in international projects, and create contacts for future career steps. They also serve as ideal preparation for Bachelor's and Master's theses.

Course Registration and Administration

Enrolling in Courses

At the University of Basel, you must enroll in advance for all courses you wish to attend. Enrollment is a prerequisite for participating in assessments and earning credit points.

Enrollment takes place twice yearly during fixed windows: for the Spring Semester from January 1 until mid-March, and for the Autumn Semester from July 1 until mid-October. Since no changes are possible after the enrollment deadline, you should carefully review your selection within this period.

The Enrollment Process

All enrollments are made exclusively online via https://services.unibas.ch. Log in with your unibas email address and password and select the service "Enrollment". Then search the online course directory (https://vorlesungsverzeichnis.unibas.ch/en/course-directory) for the desired courses and add them to your watch list. Once you have made your selection, transfer the watch list to the Online Services and confirm your enrollments.

The service "Enrollments" gives you access at any time to your current enrollments, which can still be adjusted within the enrollment period. For technical problems, a support request is available in the Online Services. In addition, before each semester you will receive an information sheet with all important details about the enrollment process along with your enrollment confirmation.

Important Rules

Please note that you can earn credit points only once for the same or similar courses. You can identify the same or similar courses by the first five digits of the course number being identical. Although you may retake a course you have already completed, you will not receive any additional credit points for doing so.

The specific conditions for assessments and the rules for registration and withdrawal are set out in the respective study regulations. After completion of each course, your results are automatically recorded online. You have the right to verify the accuracy of your assessments and may at any time request a full transcript of all completed work from the Dean of Studies Office or via https://services.unibas.ch.

Timely Planning is Essential

Most courses are only offered once a year, either in autumn or spring. You should therefore attend any required courses as soon as they are offered. Waiting a year can quickly lead to delays and hinder your academic progress.

2 Bachelor's Program in Physics

The Bachelor's program comprises 180 credit points and normally takes six semesters. The semester schedule presented below (according to the curriculum of September 29, 2020) shows a typical course of study. Treat it as a guide, not a rigid prescription. In practice, the concrete sequence depends primarily on course availability and your individual interests. Attend all courses that interest you and for which you meet the prerequisites.

2.1 Modules

The Bachelor's program is organized into modules that group thematically related courses. To participate in an assessment, you must first enroll in the corresponding lecture of a module. A module is considered successfully completed when you have passed all associated assessments. Detailed information on the content, prerequisites, and examination procedures of individual courses is available in the course directory at https://vorlesungsverzeichnis.unibas.ch/en/course-directory.

The table below gives an overview of the modules in the Bachelor's program in Physics:

Module	Courses	CP
Experimental Physics I	Introduction to Physics I: Mechanics and Thermodynamics	4
	Exercise: Introduction to Physics I	2
	Introduction to Physics II: Electrodynamics and Optics	4
	Exercise: Introduction to Physics II	2
Mathematics	Analysis I/II (annual course)	8
	Exercise Analysis I (standard program)	2
	Exercise Analysis II (standard program)	2
	Linear Algebra I/II (annual course)	8
	Exercise Linear Algebra I (standard program)	2
	Exercise Linear Algebra II (standard program)	2
Laboratory Course I	2 semesters Physics Laboratory Course for Beginners I/II	2 x 4
Experimental Physics II	Introduction to Physics III: Quantum Physics	4
	Exercise: Introduction to Physics III	2
	Introduction to Physics IV: Atomic and Molecular Physics	3
	Exercise: Introduction to Physics IV	1
Theoretical Physics I	Mechanics	4
	Exercise: Mechanics	2
	Electrodynamics	4
	Exercise: Electrodynamics	4
Laboratory Course II	2 semesters Advanced Physics Laboratory Course I/II	2 x 4
Mathematical Methods	Complex Analysis and Vector Analysis	4
	Exercise: Complex Analysis and Vector Analysis	2
Structure of Matter I	Selection of lectures announced in the course directory (e.g., Astrophysics and Cosmology)	6
Theoretical Physics II	Quantum Mechanics	4
	Exercise: Quantum Mechanics	4
	Thermodynamics and Statistical Mechanics	4
	Exercise: Thermodynamics and Statistical Mechanics	4
Structure of Matter II	Condensed Matter Physics (with exercises)	6
	Introduction to Nuclear and Particle Physics	4
	Exercise: Introduction to Nuclear and Particle Physics	2
	Special lecture from the (Master's) module Specialized Courses	4

2.2 Semester Schedule

The following semester overview shows a possible chronological sequence of courses over six semesters. Note, however, that deviations from this order are not only possible but are often sensible and depend on current course availability, your personal interests, and your individual study progress.

Sem[1]	Course	SWH	CP
	Basic Studies		
1st	Introduction to Physics I: Mechanics and Thermodynamics	4	4
	Exercise: Introduction to Physics I	1	2
	Analysis I[2]	4	4
	Exercise Analysis I (standard program)	1	2
	Linear Algebra I	4	4
	Exercise Linear Algebra I (standard program)	1	2
	Elective area		12
2nd	Introduction to Physics II: Electrodynamics and Optics	4	4
	Exercise: Introduction to Physics II	1	2
	Analysis II	4	4
	Exercise Analysis II (standard program)	1	2
	Linear Algebra II	4	4
	Exercise Linear Algebra II (standard program)	1	2
	Physics Laboratory Course for Beginners I I	4	4
	Elective area		8
	Advanced Studies		
3rd	Introduction to Physics III: Quantum Physics	4	4
	Exercise: Introduction to Physics III	1	2
	Physics Laboratory Course for Beginners II	4	4
	Mechanics	4	4
	Exercise: Mechanics	1	2
	Complex Analysis and Vector Analysis	4	4
	Exercise: Complex Analysis and Vector Analysis	1	2
	Elective area		8
4th	Introduction to Physics IV: Atomic and Molecular Physics	3	3
	Exercise: Introduction to Physics IV	1	1
	Advanced Physics Laboratory Course[3]	4	4
	Electrodynamics	4	4
	Exercise: Electrodynamics	2	4
	Lecture (with exercises) from the module Structure of Matter I	4 + 1	6
	Elective area		8
5th	Quantum Mechanics	4	4
	Exercise: Quantum Mechanics	2	4
	Advanced Physics Laboratory Course	4	4
	Condensed Matter Physics (with exercises)	4 + 1	6
	Introduction to Nuclear and Particle Physics	4	4
	Exercise: Nuclear and Particle Physics	1	2
	Elective area		6
6th	Thermodynamics and Statistical Mechanics	4	4
	Exercise: Thermodynamics and Statistical Mechanics	2	4
	Special lecture from the (Master's) module Specialized Courses (with exercises)	3	4
	Proseminar	2	4
	Elective area		14

The first two semesters are largely prescribed. From the third semester onward, freedom of choice increases progressively; the semester assignments in the overview above

1. Sem = Semester, SWH = semester weekly hours

2. The 8 CP for the annual course Analysis I/II are only awarded together at the end of the 2nd semester. The same applies to Linear Algebra I/II.

3. Students in the Honors Track with a particular interest in theoretical physics may attend the Advanced Physics Laboratory Course in the 5th and 6th semesters instead. In that case, the required theory course "Quantum Mechanics" and the elective course "Advanced Quantum Mechanics and Quantum Field Theory" (with exercises) are moved to the 3rd and 4th semesters respectively (see Section 2.6).

serve merely as guidance. Make use of this flexibility and shape your academic path according to your personal interests and the current course offerings.

Of the total 56 CP in the Bachelor's elective area, at least 30 CP must be earned in courses in physics, mathematics, and computer science, and at least 12 CP must be earned **across disciplines** (see Section 2.4).

2.3 Proseminar

The proseminar is your introduction to scientific work and is typically attended in the fifth or sixth semester. It develops essential competencies that are valuable well beyond your studies: you learn to research and understand scientific literature, to organize complex content in a structured way, and to present it convincingly both in writing and orally.

The Department of Physics regularly offers proseminars in various research areas, including experimental nano and quantum physics, condensed matter physics, computational physics, and nuclear and particle physics. Each proseminar addresses current topics from the respective research field and is based on relevant scientific publications or textbooks.

During the semester you give a talk on a selected topic, presenting results from scientific publications or specialist literature. Your talk should begin with an accessible introduction that makes the topic approachable for fellow students without prior knowledge, followed by a presentation of the main results. A discussion follows each talk, allowing you to deepen your understanding and develop your ability to argue your case.

At the start of the proseminar, a list of possible topics and associated publications is presented. For each topic, you receive recommendations for background literature to help you get started. Detailed information on individual proseminars is available in the course directory.

2.4 Elective Area – Your Personal Academic Profile

The elective area, with 56 credit points, is a central element of your Bachelor's program and offers you the opportunity to develop an individual academic profile. It is organized in two areas:

Subject-Specific Elective Area (at least 30 CP)

You choose at least 30 credit points from courses in physics, mathematics, and computer science. Here you can deepen your knowledge in areas of particular interest. In physics, for example, you might take advanced lectures on quantum mechanics, quantum field theory, general relativity, cosmology, or semiconductor physics. From mathematics you might choose numerical methods, stochastics, or advanced complex analysis. Computer science courses on programming and algorithms are also possible. You may also carry out additional laboratory courses or project work in research groups, or attend block courses on special topics.

Interdisciplinary Elective Area (at least 12 CP)

You earn a further minimum of 12 credit points across disciplines from the entire course directory of the University of Basel. This broadens your horizons and enables interdisciplinary perspectives. Popular options include courses in Chemistry, Biology, or Geo Sciences, which introduce you to related natural sciences. Philosophy and History of Science as well as Philosophy of Science and Ethics offer reflection on the foundations and societal significance of science. Economics can be valuable for later careers in industry and consulting. Language courses or other courses from any faculty are also available.

If you are already particularly interested and performing strongly in the Bachelor's program, you may also take courses from the Master's program in advance, provided you meet the prerequisites. Please note, however, that these cannot then be credited toward the Master's degree.

Research Internships – Early Entry into Research (maximum 8 CP)

As an advanced Bachelor's student, you have the opportunity to carry out an independent research internship in a research group of the department. This allows you to gain deep insight into current research beyond the regular laboratory courses and to make your first independent scientific contributions.

The process is as follows: you arrange this with a research group, jointly define the scope and goals of the internship, and set these out in a learning contract. This contract must be approved by the program coordinator before the internship begins. The research internship is then credited to the elective area and counts toward your 56 elective credit points.

Research internships are particularly valuable if you wish to develop a specialization early or are pursuing an academic career. You make contacts with researchers, learn modern laboratory methods or simulation techniques, and can often continue your Bachelor's or Master's thesis in the same group. A maximum of 8 CP may be earned through research internships in the Bachelor's program.

2.5 Examinations and Assessments

Examinations – The Exclusion-Relevant Tests

Four central modules of your Bachelor's program are assessed through formal examinations, which are graded written or oral tests taken at the end of the semester or academic year. These exams test your understanding of the core lectures and represent important milestones in your academic journey.

Module	**Examination Time**
Experimental Physics I	End of 1st and 2nd semester
Mathematics	End of 2nd semester
Experimental Physics II	End of 3rd and 4th semester
Theoretical Physics I	End of 3rd and 4th semester

Repeat Policy

Should you fail an examination, you have the opportunity to retake it once. This repeat must take place within one year of the first attempt. Prepare well and make use of the support resources offered by the department.

Important: Failing the same examination a second time results in exclusion from the physics program and all other programs in which this examination is a mandatory component. This is a university-wide regulation under §11 of the Bachelor's Framework Regulations (https://philnat.unibas.ch/de/examen/) and underscores the importance of these examinations.

Registration and Withdrawal

Registration for all examinations is done exclusively via the Online Services at https://services.unibas.ch. Make sure you register by the deadline, as you will not be admitted to the examination otherwise. Further details on deadlines and procedures can be found on the Faculty of Science website: https://philnat.unibas.ch/de/examen/.

If you need to withdraw from an examination, this is only possible in writing using the official withdrawal form (available at the same web address). Up to three weeks before the examination date you may withdraw without giving reasons. Within the last three weeks before the examination, withdrawal is only possible for compelling reasons (e.g., illness with a medical certificate).

Continuous Assessments

All other courses in the Bachelor's program are assessed through continuous assessments, which take place during or immediately after the course.

The specific forms vary by course: written tests or oral examinations during the lecture period or at the end of the semester are common. In exercise courses you must regularly solve problem sets and may need to achieve a minimum score. In practical courses you document your experiments in scientific lab reports. In seminars you give presentations.

The exact criteria and requirements for each course are listed in the course directory and explained by the instructors at the start of the semester. Inform yourself early so that you know what is expected of you.

The Bachelor's Grade

Your final grade for the Bachelor's degree is the average of the graded results in six core modules: Mathematics, Experimental Physics I and II, Theoretical Physics I and II, and Structure of Matter II. These modules form the foundation of your physics education and reflect your competencies in the three pillars of experimental physics, theoretical physics, and mathematics.

Applying for the Bachelor's Degree

Once you have completed all required work and are aiming for your Bachelor's degree, you must notify the Dean of Studies Office of the Faculty of Science. This is done via the "Declaration of Intent to Complete the Bachelor's Degree" form, which you can find at https://philnat.unibas.ch/de/studium/bachelor/absichtserklaerung/. The Dean of Studies Office will then verify that all requirements for graduation have been met and initiate the issuance of your diploma.

2.6 Honors Track – Excellence Program in the Bachelor's in Physics

For particularly talented and high-achieving students, the Department of Physics offers an Honors Track. It is characterized by early integration into a research group of the department, the completion of a research internship, and individual support and mentoring by a professor. Successful participation is confirmed by a departmental certificate at the end of the Bachelor's program.

You can apply for the Honors Track after completing your first year of study, provided you have achieved excellent results in all the required courses. Direct admission at the start of studies is also possible in special cases, for example, for graduates of the high school study program with outstanding results or prize winners of physics competitions.

A central component is a mandatory research internship (8 CP) in one of the research groups of the department, typically carried out in the fifth or sixth semester and organized via a learning contract (see Section 2.4). Depending on your area of interest, you may choose between experimental and theoretical physics: students focusing on experimental physics follow the regular sequence of required courses, while students focusing on theoretical physics attend Quantum Mechanics in the third semester and Advanced Quantum Mechanics and Quantum Field Theory in the fourth semester, in order to be able to carry out their research placement in a theoretical group. This specialization does not restrict your freedom of choice in the subsequent Master's program.

Further information on the application process and the conditions of the Honors Track can be found on the Department of Physics website or from the program coordination.

2.7 Admission to Master's Programs

A Bachelor's degree in Physics opens many paths. At the University of Basel, you can move directly into the Master of Science in Physics and deepen your physics education. In addition, the Bachelor's in Physics also qualifies you for interdisciplinary Master's programs such as Nanosciences or Computational Sciences, located at the interface of physics, chemistry, biology, and computer science.

Numerous opportunities also exist outside Basel. The Bachelor's degree is internationally recognized and in principle entitles you to apply for Master's programs at other Swiss universities, in Germany, Austria, and worldwide. Depending on the university and program, however, additional requirements may apply, such as proof of specific

prior knowledge, language certificates, or admission interviews.

If you are considering a move into a related field, for example materials science, astrophysics, applied mathematics, or engineering, you should inform yourself early about the specific admission requirements. The Physics program coordination is happy to advise you in planning your further education.

3 Master's Program in Physics

The Master's program can be started in either the Autumn or the Spring Semester. Students who did not complete their Bachelor's degree in Basel are recommended to start in the Autumn Semester. The Master's program comprises 120 credit points, normally lasts four semesters, and is taught entirely in English. It is the second academic degree after the Bachelor's and leads to the internationally recognized title "Master of Science in Physics." The Master's program gives you the opportunity to specialize in selected research areas and prepares you optimally for a career in research, development, or other demanding fields.

3.1 Admission to the Master's Program

If you have completed a Bachelor of Science in Physics at the University of Basel, you are admitted to the Master's program without further conditions. The following Bachelor's degrees from the University of Basel also entitle you to direct admission to the Master's in Physics:

- Bachelor's degree in Nanosciences (with successfully completed elective courses Quantum Mechanics and Electrodynamics)
- Bachelor's degree in Computational Sciences with specialization in Computational Physics

If you have obtained your Bachelor's degree from another institution or in a different program, the Examination Commission decides on your admission. The prerequisite is a Bachelor's degree of 180 credit points equivalent to the Basel Bachelor of Science in Physics. For questions about admission, please contact the central Student Admission Office of the University of Basel.

3.2 Structure of the Master's Program

The Master's program is divided into five modules covering different aspects of your scientific education:

Module	Content	CP
Specialized Courses	Advanced lectures for specialization	40–50
Project Work	Project work in a research group	12
Master's Examination	Oral Master's examination	8
Master's Thesis	Master's thesis	50
Electives	Freely selectable courses	0–10
Total		**120**

Specialized Courses (40–50 CP)

In the module "Specialized Courses" you can deepen your knowledge in selected specialist areas of physics. You attend thematically coherent, advanced lectures forming a unified specialization, and complement these with further lectures from the faculties of physics, mathematics, and computer science. Within the area "Specialized Courses," a proseminar must be included. Credit points may also be earned through research practical placements, up to a maximum of 12 CP.

Possible specialization areas include, for example, quantum physics and condensed matter, particle physics and cosmology, or interdisciplinary combinations. The exact composition can be discussed with the Studies Coordinator to ensure that your choice is academically coherent and aligned with your career goals.

All courses in the Master's program are assessed through continuous assessment, for example through active participation, written or oral examinations, presentations, or lab reports. The specific requirements are communicated at the beginning of each course.

Electives (0–10 CP)

The "Electives" module provides additional space for individual priorities. You may attend any lectures from departments outside physics, mathematics, and computer science. This module can be seen as an "extra-disciplinary elective area" and allows you to refine your academic profile according to your personal interests and professional goals.

3.3 Project Work (12 CP)

The Project Work is a central component of the Master's program. It should be completed in the first year of the Master's program and gives you a first independent entry into research. As a rule it encompasses 9 weeks of full-time work. If you are concurrently attending other courses, the duration extends accordingly. The project work is completed with a written report and is graded.

In terms of content, the project work can take different forms: you may work on a smaller experimental or theoretical research project, carry out a comprehensive literature review on a current topic, or develop simulations and analyze data. You work closely with the researchers in the relevant group, learn modern methods and tech-

niques, and gain insight into current scientific questions. The project work thus helps you to find your academic bearings and to make contacts for your Master's thesis.

To arrange supervision, contact a research group directly with a general inquiry or a concrete proposal. External project work, for example in other faculties or in companies, is also possible. Before the start, a learning contract is created in the Online Services at https://services.unibas.ch between you and the supervising instructor.

3.4 Master's Examination (8 CP)

The Master's examination is a 45-minute oral examination that must be passed before beginning the Master's thesis. It tests your in-depth scientific knowledge in your area of specialization and requires an understanding that goes beyond the content of individual courses, for example through independent study of the literature, the inclusion of topics from the proseminar, or connections to content from the introductory lectures (in consultation with the examiners). You choose the examination topics yourself from a list of courses approved by the Teaching Committee from the module "Specialized Courses." This allows you to focus specifically on areas that particularly interest you and are relevant to your future career.

The Master's examination is conducted either jointly by the instructors of two selected lectures, or by one instructor together with a postdoctoral examiner. The aim is to demonstrate that you have understood physical interrelationships and can place them in broader contexts. Upon passing the Master's examination you also earn 8 CP. Registration takes place via the Physics program secretariat. Any conditions attached to your admission to the Master's program must be fulfilled before sitting the examination.

3.5 Master's Thesis (50 CP)

The Master's thesis marks the end of your Master's program and your entry into independent scientific research. You can start writing your thesis once you have finished your Project Work and passed your Master's examination. The entire process, from induction to completion and submission of the written report, takes nine months.

To register your Master's thesis, contact a research group of your choice independently. Once you have agreed on the topic and supervision, you and both assessors fill out the learning contract for the Master's thesis together (form available on the Faculty of Science website). The first assessor must be habilitated or equivalently qualified; the second assessor must hold at least a doctoral degree. The completed learning contract must be signed by the chair of the Teaching Committee before the Master's thesis begins. Submit it to the Student Secretariat of the Department of Physics.

As a general rule, you will carry out your Master's thesis in a research group within the Department of Physics, working on an up-to-date scientific question. However, it is also possible to conduct your Master's thesis research externally, for example in an external research group or company. If you choose this option, it is important that either the first or second assessor holds a professorship at the University of Basel's Department of Physics, to ensure disciplinary connection and compliance with the program's

scientific standards. In this case, the external supervisor may be listed as either the first or second assessor.

During the Master's thesis you work largely independently while receiving academic supervision. The Master's thesis demonstrates that you are capable of tackling a complex scientific problem systematically, applying modern research methods, and presenting your results appropriately. After completing the experimental or theoretical work, you write a scientific report and present your results orally. Your Master's thesis is assessed by both assessors, who agree on a joint grade. This grade is entered in the learning contract, which you then submit to the Student Secretariat of the Department of Physics.

3.6 Master's Grade and Graduation

Your final grade for the Master's degree is calculated as the weighted average of three components: the Project Work counts for one quarter, the Master's examination also for one quarter, and the Master's thesis for one half of the overall grade. The Master's thesis thus carries the greatest weight, underscoring its central importance for your scientific qualification.

4 Advice for a Successful Program of Study

A physics program is demanding and requires careful planning as well as active engagement. The following recommendations are based on the experiences of many students and are intended to help you complete your studies successfully and efficiently.

Strategic Study Planning

Plan your studies with a long-term perspective, not merely semester by semester. Since many courses are offered only once a year, missing an important lecture can lead to unwanted delays. Inform yourself early about the prerequisites for advanced courses and ensure that you acquire the necessary foundations in time. The course directory and module descriptions will help you with your planning.

Active Learning and Social Integration

Regular attendance at lectures and exercise sessions is central to academic success. Physics is not learned through passive listening, but through active engagement, asking questions, and solving problems independently. Form study groups with fellow students: discussing difficult concepts together greatly deepens understanding and makes studying more enjoyable. In exercise sessions you have the opportunity to ask questions directly and benefit from the explanations of the teaching assistants.

The Physics Student Association (*Fachgruppe Physik*) is the student representative body for physics students and an important point of contact throughout your studies. It or-

ganizes social events, study sessions, and represents the interests of students vis-à-vis the department. Through the association you can meet other students, exchange experiences, and become actively involved in student life. Further information is available at: https://fg.physik.unibas.ch/de/

Practical Experience and Research Contacts

Make the most of the laboratory courses to put your theoretical knowledge into practice and develop your experimental skills. Hands-on laboratory work imparts competencies that cannot be acquired through lectures alone. If you are interested in scientific research, establish contacts with research groups early on, for example through practical placements or by having personal conversations with instructors. These contacts could be invaluable for your Bachelor's and Master's theses, as well as for your future career.

Setting Individual Priorities

Make use of the extensive elective options in the Bachelor's and Master's programs to shape your studies according to your interests. Whether you are passionate about theoretical physics, experimental physics, or interdisciplinary areas, the elective areas allow you to develop a personal profile. Also consider a period of study abroad during the Master's program, to gain international experience, get to know different research cultures, and expand your network.

Actively Seeking Support

Do not hesitate to seek support when you have questions or uncertainties. The program coordination and the general study advisory service are available for all questions related to your studies. Instructors and teaching assistants are also happy to answer technical questions or help with academic difficulties. Asking questions early is wiser than putting off problems for too long.

5 Credit Transfer

If you have already completed academic work at other universities or institutions of higher education (for example, during a study abroad semester, following a change of program, or after transferring from another institution), this work may, under certain conditions, be credited towards your degree in Basel.

Credit transfer is granted by the Dean of Studies Office of the Faculty of Science upon your written application. The prerequisite is that the work is comparable in content and scope to courses in the Physics program at the University of Basel. It must also have been completed at a recognized institution and may not already have been used toward another degree.

Submit your application for credit transfer as early as possible, ideally at the beginning of your studies or immediately upon returning from a period abroad. Include all required documents: an official transcript of your results as well as detailed module descriptions or course programs showing the content and scope of the courses completed. The Dean of Studies Office will then determine whether and to what extent a credit transfer is possible.

6 Quality Assurance in Teaching

The quality of teaching in the Department of Physics is a central concern. Our instructors are highly motivated to deliver excellent lectures and to develop innovative teaching concepts. We continuously work to provide you with the best possible education and to further develop our courses.

All courses are regularly evaluated by students. Your honest feedback in these evaluations is valuable and taken seriously. The evaluation results are discussed in the Teaching Committee, which consists of instructors, students, and the program coordination. On this basis, instructors receive constructive feedback and can specifically improve their courses.

Alongside formal evaluations, we encourage open communication between students and instructors. Please feel free to provide constructive criticism or suggestions for improvement directly, whether in person, via email or through the student representatives on the Teaching Committee.

The entire program is also accredited and evaluated externally at regular intervals, with international experts assessing the quality of the education. These external perspectives help us to benchmark quality in national and international comparison and to ensure that our graduates are optimally equipped for their careers.

As students, you are warmly invited to play an active role in improving the quality of teaching. You can do this by taking part in evaluations, providing direct feedback, or getting involved in the Teaching Committee and other student bodies.

7 Contact Points and Advisory Services

For questions about your studies, various contact points are available to you. Depending on the nature of your question, please contact the appropriate office:

Physics Studies Coordinator
For all academic questions about the physics program, study planning, elective options, and research practical placements, the program coordination is your first point of contact.
Email: studium-physik@unibas.ch

University of Basel Student Administration Office
For administrative questions about enrollment, de-enrollment, enrollment certificates, and general academic matters.
Petersplatz 1, 4001 Basel
Tel. +41 (0)61 207 30 23
Contact: unibas.ch/studseksupportEN

University Study Advisory Service
For personal advising on choice of studies, study orientation, change of program, or personal difficulties in your studies.
Steinengraben 5, 4051 Basel
Tel. +41 (0)61 207 29 29/30
Email: studienberatung@unibas.ch

Dean of Studies Office, Faculty of Science
For questions about examinations, credit transfer, degrees, and legal aspects of the curriculum.
Klingelbergstr. 50, 4056 Basel
Tel. +41 (0)61 207 30 54
Email: studiendekanat-philnat@unibas.ch

Teacher Training Advisory Service
For students aiming for a teaching career who have questions about combining subject studies with a teaching diploma.
Email: lehramt-physik@unibas.ch

8 Validity

This study guide replaces the study guide of May 25, 2021 and applies from the Autumn Semester 2026 onward to all students enrolled in Physics programs at the University of Basel.

9 Appendix 1: Physics as an Extracurricular Subject

9.1 Physics as an Extracurricular Subject in the Bachelor's Program

Physics can be studied not only as a standalone Bachelor's program but also as an extracurricular subject within other programs. The extracurricular subject Physics is available to students of the Faculty of Humanities and Social Sciences who wish to take physics as a minor, as well as to students of Sports Science at the Faculty of Medicine, for whom physics serves as a natural science foundation.

The extracurricular subject Physics in the Bachelor's program comprises a total of 76 credit points and imparts solid foundational knowledge in experimental physics, mathematical methods, and practical laboratory work. It offers you the opportunity to develop physical thinking and experimental skills without completing a full degree in physics.

Module Structure and Requirements

The extracurricular subject is divided into eight modules that build on one another and cover various aspects of physics. You need:

- 12 CP from the module Experimental Physics I
- 10 CP from the module Laboratory Course I
- 24 CP from the module Mathematics
- 10 CP from the module Experimental Physics II
- 8 CP from the module Laboratory Course II
- 6 CP from the module Mathematical Methods
- 4 CP from the module Computer Science
- 2 CP from the module Physics in School (SEKI subject Physics)

The subject is successfully completed when you have earned all required credit points from these modules.

Required Courses

The table below lists all required courses for the subject. Note that in the Mathematics module two variants are available, depending on whether you wish to attend the specialized mathematics lectures for physics students (Variant 1) or the regular mathematics lectures for mathematics students (Variant 2).

Module	Courses	CP
Experimental Physics I	Introduction to Physics I: Mechanics and Thermodynamics	4
	Exercise: Introduction to Physics I	2
	Introduction to Physics II: Electrodynamics and Optics	4
	Exercise: Introduction to Physics II	2
Laboratory Course I	2 semesters Physics Laboratory Course for Beginners	2×4
	Extended Physics Laboratory Course for Beginners (Aufbaupraktikum) in Physics	2
Mathematics	**Either (Variant 1)**	
	Mathematical Methods I with exercises	4 + 2
	Mathematical Methods II with exercises	4 + 2
	Complex Analysis and Vector Analysis	4
	Exercise: Complex Analysis and Vector Analysis	2
	Differential Equations	4
	Exercise: Differential Equations	2
	or (Variant 2)	
	Analysis I/II (annual course)	8
	Exercise Analysis I (standard program)	2
	Exercise Analysis II (standard program)	2
	Linear Algebra I/II (annual course)	8
	Exercise Linear Algebra I (standard program)	2
	Exercise Linear Algebra II (standard program)	2
Experimental Physics II	Introduction to Physics III: Quantum Physics	4
	Exercise: Introduction to Physics III	2
	Introduction to Physics IV: Atomic and Molecular Physics	3
	Exercise: Introduction to Physics IV	1
Practical Course II	2 semesters Advanced Physics Laboratory Course	2×4
Mathematical Methods	**With Variant 1 in the Mathematics module:**	
	Further courses from mathematics (Bachelor-level) or Theoretical Physics I and II	6
	With Variant 2 in the Mathematics module:	
	Complex Analysis and Vector Analysis	4
	Exercise: Complex Analysis and Vector Analysis	2
Computer Science	Introduction to Programming	4
Physics in School (SEKI subject Physics)	In-depth Insights into Physics for School Teaching	2

The choice between the two mathematics variants should be made in consultation with the program coordination. Variant 1 offers an application-oriented approach, while Variant 2 follows a more mathematical approach and corresponds to the required program of the Physics Bachelor's degree.

9.2 Physics as a Extracurricular Subject in the Master's Program

The extracurricular subject Physics can also be studied at the Master's level within the Master's program at the Faculty of Humanities and Social Sciences or in the Master's program in Sports Science at the Faculty of Medicine. It comprises 35 credit points and enables you to engage in depth with advanced topics in physics.

In contrast to the Bachelor's, the subject Physics in the Master's program offers considerably more flexibility. You need only meet two minimum requirements: at least 6 credit points from the modules Structure of Matter I and II, and at least 6 credit points from the modules Theoretical Physics I and II. These ensure that you become familiar with both experimental and theoretical aspects of modern physics.

The remaining credit points needed to reach the total of 35 CP may be chosen freely from the Advanced Studies in Physics or from courses in the Master's program in Physics. Please note that courses you have already successfully completed in the Bachelor's program cannot be credited again. This freedom of choice allows you to tailor the subject to your interests and to specialize in areas particularly relevant to your main program or your professional goals.

10 Appendix 2: Secondary School Teacher Training

If you aim to become a teacher at secondary school level II (Gymnasium), the "Master of Science in Physics" is the subject-specific foundation for the teaching subject Physics. With this degree you demonstrate the required disciplinary qualification to subsequently obtain the teaching diploma for upper secondary schools.

The subject-specific Master's program is complemented by subject-pedagogical and educational science training at the University of Teacher Education of the University of Applied Sciences and Arts Northwestern Switzerland (PH FHNW). After or alongside the Master's program, you complete the teaching diploma for upper secondary schools there, which qualifies you to teach at Gymnasiums.

If you choose Physics as a second teaching subject (second teacher training subject), the specific regulations of PH FHNW for the combination of teaching subjects apply. Inform yourself early at PH FHNW about the requirements and possibilities in order to plan your studies optimally.

For further information and advice on teacher training, please contact the Teacher Training Advisory Service: lehramt-physik@unibas.ch

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