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6 Glossary and Abbreviations

1 Introduction

1.1 The University of Zurich and its physics institutes

The University of Zurich was founded in the year 1833. It is renowned worldwide as a center for education and research. With 3500 faculty members working at approximately 140 institutes, about 26000 students and 4000 graduations per year the UZH is the largest university in Switzerland. The university is committed to the unity of education and research and maintains all areas of foundational scientific research. The university also provides scientific services.

Education and research in physics have played an important role in the scientific life of Zurich since its founding. Amongst the physics professors at the University of Zurich, we find well-known names such as Rudolf Clausius, Max von Laue (Nobel Prize 1914), Albert Einstein (Nobel Prize 1922), Peter Debye (Nobel Prize 1936), Ervin Schrödinger (Nobel Prize 1933), Gregor Wentzel, Walter Heitler, Hans H. Staub and K. Alex Müller (Nobel Prize 1987).

Today, both the institutes of physics (experimental and theoretical physics) www.physik.uzh.ch/ and of computational sciences, www.ics.uzh.ch/ are located on the campus of the University of Zurich-Irchel. Currently, there are approximately 200 students (including PhD students) majoring in physics. 12 professors and about 40 assistants teach these students, along with students in other subjects (studying physics as a minor, as well as those studying biology, chemistry and medicine). On average, 30 to 50 students begin studying physics every year, which enables faculty to provide them with intensive individual assistance. Our flexible degree regulations allow students to adapt their course work to individual needs.

The employees of both institutes are involved actively in many different areas of foundational studies in physics. This includes experimental and theoretical physics, magnetism and superconductivity, surface science, bio- and nanophysics, astrophysics and cosmology. More detailed information about the work of individual research teams can be found on the aforementioned institute websites.

1.2 What will I learn in a physics degree?

Physics is a good starting point for the study of sciences: Physics serves as a foundation for most areas of the natural sciences. The most important prerequisites for studying physics are an interest in the basic questions of nature, enthusiasm and a small measure of natural ability. We offer a broad general education in experimental and theoretical physics, which also includes practical experience in measurement techniques, in experimental methods as well as an education in mathematics and application-focused informatics.

Our degree does not only prepare physicists for scientific research. After graduation, you will be well positioned for work in business, in banks and insurances, as research managers and patent attorneys, in telecommunication and in optics firms, as analytical systems thinkers and generalists.

1.3 Why study physics at the University of Zurich?

The material covered by a degree in physics is the same as at all Swiss universities. Therefore, personal criteria are most important when choosing your location of study, such as:

- Independence
- Mentorship and the number of fellow students
- The emphasis on particular fields of study
- Type of master thesis

In Zurich you can study physics at either the ETH or the university. The quality of education is equivalent and the degrees are equally recognized internationally. Since it is possible to switch university during your course of study, it is possible to choose later. Additionally, students at the UZH and the ETH have the right to attend all events at the other university and receive credit at no additional costs. More information can be found at www.mnf.uzh.ch/studium/reglemente-merkblaetter/bachelor-master.html.

The UZH places strong emphasis on practical experience, for instance by demanding a high degree of independence in students when constructing, measuring and analyzing their experiments in lab. The Faculty of Mathematics and Natural Sciences at the University of Zurich conducts individual module exams independently for every course (usually, lectures are concluded with a module exam, see chapter 5). Thus, students can choose to complete their degree part-time. Studies begin with a relatively comprehensive phenomenological introduction with the lectures physics I – III, along with a mandatory shop course. The compulsory portion of the math curriculum corresponds to the international standard. A master thesis at the university should take approximately 9 months. It is a good preparation for independent scientific work.

The UZH values a broad education. Therefore, students are enabled to choose a minor in a different subject. You receive grades in your minor, which will appear in your diploma. Instead of choosing a minor, you can also arrange modules from a variety of subjects. As in the case of a minor, the modules can be chosen from any subject area taught at either the UZH or the ETH.

To obtain a master's degree, you must study for a minimum of 9 semesters in total. Thanks to the small number of students majoring in physics, the department can closely mentor all its students. Independent work is as a rule highly emphasized.

1.4 Physics Students Organization

The Physics Students' Organization at the University of Zurich (fpu) consists of a team of students in different years. The function of the students' organization is to support students in various ways: Academically, by conducting various information events (for instance, regarding the choice of a minor), mentorship of students in their first semester, maintenance of exam protocols, address lists and of a small library in the students organization room. Moral support is provided by the traditional Winter Dinner, basement parties, barbecues in summer and the coffee machine in the students' organization room. The students' organization also strives to facilitate the exchange of information between students and professors of experimental and

theoretical physics and represents the concerns of students to higher committees (for instance, when it comes to the development of degree structure). The students' organization room is located in 36 J 28 (Building 36, Floor J, Room 28) and is open to all as a place to study and socialize and is highly frequented.

Email: fpu@physik.uzh.ch

Homepage: fpu.physik.uzh.ch

1.5 Job prospects

Physicists can be found in many different professions in a modern society. Consequently, the professional lives of physicists can vary greatly. Physicists often work in jobs where you have to understand and analyze complex systems. This can include technological or natural systems, sections of the economy and even management of large companies.

Various studies have shown that about half of all physicists end up working in research. They are hired by universities, government research centres such as the European CERN in Geneva or the Swiss EAWAG, as well as in the research divisions of industry. Approximately 30% of physicists work in industry in the field of management and consulting, in informatics or in "high tech" fields and about 20% work in education at tertiary and secondary education institutions.

1.6 Women in Physics

Women studying physics have neither more nor fewer difficulties than their male peers. One can perhaps observe tendencies for men to be more interested in technological and experimental problems, while women like to use their mathematical and analytical abilities. Because women decide to study physics out of real interest and used to have to fight against prejudice, many female physicists become very successful. A few years ago, women actually still had to cope with resistance and prejudice. In today's generation, however, such problems no longer exist. A student's success, for women as well as men, depends on their own interest and hard work.

Currently, the fraction of women amongst physics students at the University of Zurich is 20%. Until the year 2000, it was only 11%, but the number has continuously increased since then. For further information, see the Mentorship Program for Female Physicists and Women Interested in Studying Physics at <http://www.gleichstellung.uzh.ch/angebote/nachwuchsfoerderung/mentoringdeutschschweiz.html>.

2 Studying physics at the University of Zurich

These guidelines summarize all information, including from higher-order regulations, which is relevant for studying physics at the University of Zurich (see chapter 5)

2.1 Overview

As of a few years, the university has been using the European Credit Transfer and Accumulation System (ECTS). A degree is composed of individual, thematically more or less independent units (modules), which each have some form of a performance assessment (this often means exams and grades). The structure of studies follows the Bologna-Model. The clear structuring encourages and eases the possibility for students to complete a portion of their degree at a different European University without delays.

Six semesters of study are necessary for a bachelor's degree. The bachelor's degree gives students a solid foundational education in physics and is completed with a bachelor's thesis. The degree "Bachelor of Science UZH in Physics" (BSc UZH in Physics) thus earned serves as a basis for a variety of master's programs.

In a master's program, students specialize in a current field of research over 3 semesters. The main focus of the program is on a master thesis in form of a research project at an advanced level of scientific work. The MSc degree, "Master of Science UZH in Physics," qualifies you for academic work in physics and fulfils the scientific portion of a teaching degree for Swiss "Maturitätsschulen" (university-track secondary schools).

Following a MSc degree, you can complete a mentored, but continually more independent research project over 3 to 4 years to earn a doctoral degree, "Doctor scientiarum naturalium" (Dr.sc.nat. = Ph.D.). A Ph.D. is accepted worldwide as a qualification for independent research.

Students also have the option to reorient their direction of study after completion of their bachelor degree in physics. For instance, you can choose a new subject at the mathematical-natural scientific faculty for your master's degree (i.e. Computational Science, Environmental Studies, see www.mnf.uzh.ch/studium/studierende/studienlehrgaenge.html) or switch to a different university.

The time spent to acquire a degree specified above are based on a full-time investment. Extensions are possible if you for instance are also working part-time (see chapter 3).

2.2 Bachelor's degree

A bachelor's degree in physics consists of three parts (see Table 1)

- Introductory modules I to III in physics with exemplary experiments and accompanying lab work.
- Higher level courses in areas of experimental physics, sometimes accompanied by a lab.
- A cycle of fundamental lectures in theoretical physics.

This foundational education is completed with lectures in the fundamentals of mathematics, along with elective-compulsory and elective modules and their pro-seminars. During the lecture-free period we offer intensive courses, usually on practical topics such as informatics, electronics or workshops in mechanics.

By regulation, a bachelor can be completed in 6 semesters. 180 credit points are necessary for completion.

When a student successfully completes all requirements, they will receive the diploma “Bachelor of Science UZH in Physics.”

Student’s GPA for their bachelor’s degree is composed of a weighted average of all graded modules according to how many credit points they were worth. Grades from a student’s major in physics and minor are recorded separately.

1	HS	PHY111 General Physics I 8 CP	PHY110 Physics Addendum I 3 CP	PHY112 Physics Laboratory Work I 5 CP	MAT141 Lin. Algebra for Natural Sciences 5 CP	MAT131 Analysis I for Physics Majors 9 CP	Elective Modules and/or Minor Subject
	vfZ	PHY114 Informatics 1 CP					
2	FS	PHY121 General Physics II 8 CP	PHY120 Physics Addendum II 3 CP	PHY122 Physics Laboratory Work II 5 CP	PHY125 Scientific Computing 3 CP	MAT132 Analysis II for Physics Majors 9 CP	
	vfZ	PHY113 Mech. Workshop I 1 CP					
3	HS	PHY131 Physics III / Modern Physics 12 CP	PHY231 Data Analysis 3 CP	PHY312 Mathematical Methods in Physics I 6 CP	PHY311 Mechanics 8 CP		
	vfZ	PHY123 Mech. Workshop II 1 CP					
4	FS	PHY210 Solid State Physics 8 CP	PHY241 Introduction into Astrophysics 6 CP (Elective Module)	PHY322 Mathematical Methods in Physics II 6 CP	PHY321 Electrodynamics 8 CP		
	vfZ						
5	HS	PHY211 Nuclear and Particle Physics I 8 CP			PHY291 Proseminar Experimental Physics 2 CP	PHY331 Quantum Mechanics 8 CP	
	vfZ						
6	FS	PHY399 Bachelor's Thesis 12 CP			PHY391 Proseminar Theoretical Physics 2 CP	Core Elective Module 8 CP	
	vfZ						

HS: fall semester
FS: spring semester
vfZ: semester break
CP: ECTS points

2.2.1 Compulsory modules in the 1st and 2nd semester

The first year of a bachelor's degree emphasizes the phenomenology of classical physics during students' foundational education in mathematics and physics. This also serves the purpose of bringing students from different backgrounds onto the same level. Following modules are compulsory modules:

Table

Sem.	Nr.	Title	Class Time (SWH i.e. weeks)			Exam period*)		Grading	CP
			Lectures	Practice sessions	Lab	Intensive courses			
1	PHY111	Physics I	4	2			1	yes	8
1	PHY112	Lab I			3			yes	5
1	PHY110	Extended Physics I	2					no	3
1	MAT131	Analysis I for Physics Students	4	2			3	yes	9
1	MAT141	Linear Algebra for Natural Sciences	2	2			3	yes	5
lfp	PHY114	Informatics for Physics Students				2		no	1
2	PHY121	Physics II	6 4	2			5	yes	8
2	PHY122	Laboratory II			3			yes	5
2	PHY120	Extended Physics II	2					no	3
2	MAT132	Analysis II for Physics Students	4	2			5	yes	9
2	PHY125	Scientific Computing	1		2			no	3
lfp	PHY113	Workshop I				2		no	1

- PHY113 and PHY 114: half day
 - The requirement of MAT141 Linear Algebra for natural sciences can also be fulfilled with MAT111 Linear Algebra I +II. Students with a minor in Mathematics or taking Mathematics as their second teaching subject (regards certification to teach at Swiss "Maturitätsschulen") must take MAT111.
 - Students, who transferred to the UZH from a different university and had not passed lectures in Linear Algebra and/or Analysis, are considered to be repeating the compulsory modules MAT131, MAT132 and MAT141 (and MAT111 Linear Algebra). As a rule, students are not allowed to substitute MAT131 and MAT132 with MAT121 Analysis I + II, because the contents of these lectures is identical.
- *) In section 2.2.5, you can find the calendar week during the exam period, in which the module exam will be conducted.

2.2.2. Compulsory modules in the 3rd to 6th semester

In the second year, students take Physics III, which provides a phenomenological introduction to Quantum Mechanics. Students are also introduced to theoretical physics. In addition, students study more Mathematics and a few practical topics of their choice.

Sem.	Nr.	Title	Class Time (SWH i.e. weeks)			Exam period	Grading	KP
			Lectures	Practice sessions	Intensive courses			
3	PHY131	Physics III	5	2	3	1	yes	12
3	PHY231	Data Analysis	1	2			no	3
3	PHY311	Mechanics	4	2		3	yes	8
3	PHY312	Mathematical Methods in Physics I	4	2			no	6
lfp	PHY123	Workshop II			2		no	1
4	PHY210	Physics of Condensed Matter	3	1	1	4	yes	8
4	PHY322	Mathematical Methods in Physics II	4	2			no	6
4	PHY321	Electrodynamics	4	2		6	yes	8
5	PHY211	Nuclear and Particle Physics I	3	1	1	1	yes	8
5	PHY291	Pro-seminar Experimental Physics		1			yes	2
5	PHY331	Quantum Mechanics I	3	2		3	yes	8
6	PHY391	Pro-seminar Theoretical Physics		1			yes	2
6	PHY399	Bachelor's Thesis			9		yes	12

- PHY123: half day
- For more details regarding exams and records of performance in modules without exams, see section 2.5.
- The experimental modules include lab experiments, which are conducted during intensive courses in the lecture-free period (for dates, see section 2.2.5). Students set up experiments, obtain measurements and analyze data. The ability of students to analyze data and calculate error, taught in PHY231, is assumed. Students finally complete a written lab report.
- Students, who are minoring in Mathematics, can substitute PHY312 and PHY322 with different lectures in Mathematics. We especially recommend Complex Analysis.
- In the experimentally and the theoretically focused pro-seminars, each student is required to hold a presentation.

Bachelor's Thesis

For their bachelor's thesis, students actively participate in the work of a research group in experimental or theoretical physics. Students record the results of their thesis in a written report and present them to their seminar group. Both the report and presentation will be graded. You can find suggested topics for a bachelor's thesis at www.physik.uzh.ch/lectures/bachelormaster/. You should complete your bachelor's thesis during the last semester of your bachelor's program, as it is required to be able to sign up for a master's program (see section 2.4).

The amount of work necessary for a bachelor's thesis including preparation time (reading relevant literature and discussion with advisors) and compiling of the thesis and presentation is equivalent to 12 credit points (meaning approximately 9 weeks full time studies). You must design a time plan for your work with your advisor before beginning your project. Remember that the experimental work required for a thesis is intrinsically subject to its own schedule when making your time plan. When you have agreed upon a time plan, it must be recorded in writing along with the date on which you will begin and a definitive deadline.

(An information sheet and application form can be found at www.physikstudium.uzh.ch/studienberatung/formulare/)

2.2.3. Elective-compulsory courses in the 4th/6th semester

In the 4th/6th semester, students choose 1 of 4 modules to be their elective-compulsory course. The experimental modules (PHY212 and PHY213) include a lab in form of an intensive course.

Sem.	Nr.	Title	Class Time (SWH i.e. weeks)			Exam period	Grading	CP
			Lectures	Practice sessions	Intensive courses			
6	PHY212	Physics at the Nano-Scale	3	1	1	5	yes	8
6	PHY213	Nuclear and Particle Physics II	3	1	1	5	yes	8
4/6	AST241	Introduction to Astrophysics	3	1		5	yes	6
4/6	PHY341	Thermodynamics	2	1		5	yes	8
6	PHY351	Quantum Mechanics II	3	2		5	yes	8

2.2.4 Elective modules

The remaining credits needed to fulfil the requirement of 180 credit points, which includes a minor (see section 2.6), must be earned in elective modules. Students may choose modules freely amongst the subjects offered at the UZH and ETH. The following elective modules are offered by the physics department:

Sem.	Nr.	Title	Class Time (SWH i.e. weeks)			Exam period	Grading	CP
			Lectures	Practice sessions	Intensive courses			
SS	PHY250	Electronics	2				no	3
lfp	PHY224	Programming in C++			2		no	1
lfp	PHY251	Electronics course			2		no	3
SS/AS	PHY261	Tutorial		6			no	5
	PHY271	Additional Lab Work					yes	2

- PHY224: half day
- PHY261: Leading of labs and practice sessions. The smallest time commitment is equivalent to 6 hours per week during 2 semesters. It must include work on two different topics. Requirements are PHY111/PHY121 (Physics I/II) and PHY112/122 (Lab I/II).
- PHY271: 2 credit points are usually awarded for every successfully completed experiment. Students conduct experiments independently and are not bound to a specific schedule.

Courses from a minor in SPIN (Special Informatics for Natural Sciences, see section 2.6.6) are also recommended as individual elective modules.

This is also where remaining credit points from elective-compulsory intensive courses are accredited (section 2.2.3.).

Courses taken at the Language Center cannot be counted as elective modules.

Elective modules at the ETH

All UZH students, who complete a performance assessment at the ETH, must be registered as “auditors” (www.rektorat.ethz.ch/students/admission/auditors/external) at the ETH, must book the units of performance and must additionally sign up for the end of semester or end of session exams via myStudies (www.mystudies.ethz.ch). Just like ETH students, UZH students can view their grades on myStudies. In addition, UZH students receive a written confirmation of any performance assessments they took by post.

2.2.5. Booking of the lecture-free period

Following table shows how to book the lecture-free period with intensive courses, labs and module exams. We offer certain courses on multiple dates depending on the number of students that sign up. The dates will be released during the preceding semester in the lecture catalogue. Intensive courses in workshop and informatics are independent modules and students must sign up for them on time.

After the fall semester (Christmas until mid-February)

Calendar week		2	3	4	5	6	7
Exam period		P(1)	P(2)			P(3)	
1. sem	Module exam	Physics I					Analysis I / Lin. Alg.
	Intensive course		Informatics for Physics Students		Informatics for Physics Students		
3. sem	Module exam	Physics III				Mechanics	
	Intensive course		Lab for Physics III / Workshop II, course 1	Lab for Physics III / Workshop II, course 2	Workshop II, course 1		Workshop II, course 2
5.sem	Module exam	Nuclear and Particle				QM I	
	Intensive course		Lab for Nuclear and Particle				

After the spring semester (Early June until mid-September)

Calendar week		23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Exam period		P(4)		P(5)											P(6)	
2. sem.	Module exam				Physics II Analysis II										(Math. as a minor)	
	Intensive course												Workshop I		Workshops I	
4. sem.	Module exam	Condensed Matter		WP: Astrophysics										Elektro-dynamics		
	Intensive course		Lab for FK										Program. in C++		electronics course / ogram. in C++	
6. sem.	Module exam			WP												
	Intensive course					Lab for NanoP	Lab for KTII									

- EC: elective-compulsory courses (nuclear and particle physics II, physics on a nanometer scale, quantum mechanics II), see section 2.2.3)
- Intensive courses Workshop I/II and Informatics I/II are half days for two weeks.

2.3 Material covered in the modules of a bachelor's degree in physics

The material covered in a course is not regulated in detail. It depends on each lecturer. In later semesters, material may even be adapted to the requests of students. Hence, the following description is only intended as a general orientation. More detailed information will be posted on the lecture catalogue every semester (www.vorlesungen.uzh.ch/).

2.3.1 Compulsory modules in the 1st to 2nd semester

Physics I and II (PHY111, PHY121)

Labs for Physics I and II (PHY112, PHY122)

Extended Physics I and II (PHY110, PHY120)

Scientific Computing (PHY125)

Analysis for physics students I and II (MAT131, MAT132)

Linear Algebra for Physics Students (MAT141)

Courses during the lecture-free period from the 1st to 3rd semesters (PHY113 and PHY123, PHY114 and PHY124)

2.3.2 Compulsory modules in the 3rd to 6th semester

Physics III (PHY131)

Data Analysis (PHY231)

Physics of Condensed Matter (PHY210)

Nuclear and Particle Physics (PHY211)

Mathematical Methods in Physics I and II (PHY312 and PHY322)

Mechanics (PHY311)

Electrodynamics (PHY321)

Quantum Mechanics I (PHY331)

2.3.3 Elective-compulsory courses in the 4th/6th semester

Physics at the Nanometer Scale (PHY212)

Nuclear and Particle Physics II (PHY213)

Introduction to Astrophysics (AST241)

Thermodynamics (PHY341)

Quantum Mechanics II (PHY351)

2.4 Master's degree

With a “Bachelor of Science UZH in Physics” or a bachelor's degree in physics from any other Swiss university, you are automatically admitted to our master's program in physics. You must have successfully completed all compulsory and elective-compulsory modules (including your bachelor's thesis) to sign up for the master's program. If you earned any credit points for compulsory or elective-compulsory modules of the master's program before signing up for the master's program, you will receive credit maximally for two of these modules. Elective courses and courses belonging to a minor are not subject to these constraints.

Faculty members individually evaluate bachelor's degrees from foreign universities. Any documents must be handed in together with the application for matriculation at the Dean's Office (Kanzlei) or at the Admission's Office for Students with a Foreign Degree. Depending on what students have studied previously, they may be required to complete additional coursework during the master's program.

During a master's program in physics at the University of Zurich, students may begin to specialize in a current field of research. The program begins in the fall and continues, under normal circumstances, for three semesters.

The department of physics at the UZH essentially has three different areas of research: Condensed Materials (mainly experimental, in the teams of Professors Fink, Keller, Osterwalder and Schilling), Particle Physics (experimental in the teams of Professors Baudis, Canelli, Kilminster and Straumann, theoretical in the teams of Professors Gehrman and Wyler) and Astrophysics and Cosmology (Professors Moore, Seljak and Lake). You may find a summary of current research in annual reports at www.physik.uzh.ch/report.shtml and at the websites of each research team at www.physik.uzh.ch/research.shtml and www.itp.uzh.ch.

Graduates receive a degree of “Master of Science in Physics”. 90 credit points are necessary to obtain a master's degree. During the first and second semester, the program consists of lectures, practice sessions and labs in students' chosen area of specialization as well as an elective field of study.

In the master's program, lectures are held in English and German.

Master's thesis and exam

The central focus of the master's program is a master's thesis. It consists of an independent research contribution within one of the research teams in physics at our university. The work required for a master's thesis along with the preparation for the module exam corresponds to 45 credit points, meaning 9 months of full time work. All master's theses must be documented in a written report, which will be graded.

Theses may also be completed with an external research team (for instance Biomedical Imaging, Medical Physics). Students must submit a written request along with a work outline to a faculty member in the UZH's physics department, who has to be willing to accept responsibility for the thesis and designate the courses the students should attend. Such a thesis must centre on a question within the field of

physics. Theses with external research groups need to meet the requirements of a master's thesis in physics at the UZH in duration, quality, mentorship and grading. The corresponding credit points will therefore be counted as credit points earned at the University of Zurich.

The module exam for the master's thesis consists of two parts, which each take about 30 minutes and are both graded. Firstly, students present their master's thesis in a public presentation. In the second part, which is not open to the public, students must defend their thesis against a minimum of two faculty members. They are asked questions focusing on the field of the thesis.

The overall grade for a student's master's thesis is composed of a weighted average of their written report (2/3) and their module exam (1/3). A student must achieve at least a 4.0 for both his thesis and his exam.

Dates for the master's thesis and module exam are set individually in consultation with the responsible faculty member. Students must have earned all other credit points required in the master's program before they may register for the module exam of their master's thesis. The forms necessary to sign up can be found at www.physikstudium.uzh.ch/index.php?id=85.

Research seminar

You are required to attend research seminars on the topic of your chosen field of research in all master's programs. The seminar organizer must confirm your attendance. Relevant forms may be found at www.physikstudium.uzh.ch/index.php?id=85.

Choice of additional lecture modules

Besides following the regulations of each master's program, we recommend you seek a conversation with the various research teams before choosing your program of study. In special cases, it is possible and useful – in consultation with the responsible professors – to substitute modules of the master's program with specialized courses in your chosen field of research.

Minor

See section 2.6. Credit points earned in this subject during the bachelor's program are also counted towards the necessary amount for a minor (they are not, however, counted towards the 90 credit points required for a master's degree).

Grading

Student's GPA for their master's degree is composed of a weighted average of the grades of all modules belonging to the master's program in accordance to how many credit point they each were worth.

2.4.1 Physics of Condensed Matter

Coordinator: Professor Andreas Schilling

This master's program offers an advanced education in experimental Condensed Matter. The first semester consists of lectures, which are accompanied by practice sessions and labs. In the second semester, students are required to spend less time in lectures. Therefore, they can begin work on their master's thesis once they have written a careful research proposal in direct consultation with a faculty member. The master's thesis is an independent research project, which takes 9 months under normal circumstances and will be completed at the end of the third semester.

Compulsory modules

Sem.	Nr.	Title	Class Time			Performance assessment	Grading	CP
			Lectures	Practice sessions	Lab			
1	PHY401	Condensed Matter	4	2		Module exam	Yes	10
1 or 2	PHY403	Master's Thesis Proposal				Report	No	2
2 and 3	PHY447	Research seminar	1.5			Participation	No	2
2 and 3	PHY448	Master's Thesis				Grading for thesis (2/3) and module exam (1/3)	Yes	45

The remaining credit points missing from the total of 90 must be earned through elective-compulsory and elective modules offered at the UZH, ETHZ or another university. Whether a module will receive credit is determined individually in consultation with the coordinator of the master's program "Condensed Matter."

Elective-compulsory modules

Within the field of Condensed Matter, students must take at least one experimentally oriented foundations course as well as a theoretically oriented lecture course.

Elective modules

At least 2/3 of the credit points of the remaining modules (elective modules) should be covered by lectures which contribute to the master's thesis. The remaining credit points can be chosen from general lectures connected to physics, material science or measurement techniques

Course contents for compulsory and elective-compulsory modules

PHY401 Condensed Matter

Phenomenological description of

- Energy bands and Fermi surfaces
- Optical properties
- Superconductivity
- Dielectric and ferroelectric materials
- Magnetic properties
- Surface effects
- Electron optics and applications of focused electron beams
- Microstructuring on the micron and nanometer scale
- Lithographic methods
- Mesoscopic physics

PHY403 Proposal for a master's thesis

Students must hand in their proposal before beginning with their master's thesis. It should be 2-5 pages long and be structured as follows: summary, motivation, how much you have researched, research plan (including measurement methods)

PHY447 Research seminar

Students are required to regularly attend a research seminar on a topic related to their thesis work during their second and third semester. Instead of attending a single seminar, students may also opt combined lectures from a variety of seminars (for instance from the Colloquium in Physics).

PHY411: Theory of Condensed Matter

- Electrons and phonons
- Spectra and band theory
- Applications of group theory
- Second quantization
- Many-body physics
- Electron-phonon interaction
- Superconductivity
- Magnetism

You can find a list of additional elective-compulsory and elective modules in the lecture catalogue with commentary at www.physikstudium.uzh.ch/index.php?id=vorlesungen, "Physics of Condensed Matter." You may receive credit for other independently selected modules as long as the coordinator of the master's program has approved them.

2.4.2 Particle Physics

Coordinator: Professor U. Straumann

This master's program offers an advanced education in theoretical and experimental Particle Physics. Faculty members at the ETH and the UZH jointly offer courses in this program. After introductory lectures, practice sessions and labs, students begin their master's thesis that should take 9 months.

Compulsory modules

Sem.	Nr.	Title	Class Time			Performance assessment	Grading	CP
			Lectures	Practice sessions	Lab			
1	PHY451	Phenomenology I	3	2		Module exam	Yes	10
1	PHY461	Exp. Methods und Instruments	3	1		Module exam	Yes	6
2	PHY452	Phenomenology II	2	1		Module exam	Yes	6
2 and 3	PHY497	Research seminar	1.5			Participation	No	2
2 and 3	PHY498	Master's thesis				Grade from thesis (2/3) and module exam (1/3)	Yes	45

Elective-compulsory modules

Students must chose at least two of the following modules to fulfil the elective-compulsory requirement.

Sem.	Nr.	Title	Class Time			Performance assessment	Grading	CP
			Lectures	Practice sessions	Lab			
1 or 2	PHY463	Research lab			4-6 weeks	Report	Yes	6
1	PHY551	Quantum Field Theory	4	2		Module exam	Yes	10
2	PHY465	Experimental Astro-Particle Physics	2	2		Module exam	Yes	6
1	AST513	Theoretical Cosmology	4	2		Module exam	Yes	10
2	PHY552	Quantum Field Theory	3	2		Module exam	Yes	8

Elective modules

The remaining credits needed to fulfil the requirement of 90 credit points must be earned in elective modules. Students can also choose additional courses amongst the elective-compulsory listing. Every year, specialized lectures are offered on topics of current research. Credits earned in intensive courses for graduate education will also be counted.

Course content of elective-compulsory and elective module

PHY451/452 Phenomenology of Particle Physics I and II

- relativistic kinematics
- cross section and phase space
- introduction to quantum-electrodynamics
- unitary symmetries and QCD
- electroweak interaction
- flavour physics
- beyond standard model (GUT and SUSY etc.)

PHY551 Quantum Field Theory

- relativistic wave equations
- quantisation of free fields
- renormalisation
- perturbation theory

PHY461 Experimental Methods and Instruments in Particle Physics

- physics and setup of particle accelerators
- basic concepts of particle detectors
- tracking and vertex detectors, calorimeters, particle identification
- special applications like Cerenkov detectors, air shower detection, direct dark matter searches, emulsion experiments
- simulation methods, readout electronics, trigger and data acquisition
- key experiments

PHY463 Research internship

This internship lasts for 4 to 6 weeks, during which students construct, conduct and evaluate an experiment using a particle laser beam at CERN or PSI or some other accelerator. For instance, you might do an internship at PSI, where you work in a group for three weeks planning and constructing an experiment that uses the PSI's secondary laser secondary beams and conducting it jointly in the shift operation. Then you must evaluate your data and complete a report.

Please check on the terminology in this paragraph.

AST513 Theoretical Cosmology

(See master's studies in Astrophysics and cosmology)

PHY552 Quantum Field Theory II

advanced topics like

- renormalisation group
- abelian and non-abelian gauge theories
- standard model of particle physics, Higgs mechanism
- path integral

PHY497 Research seminar

Students are required to regularly attend a research seminar in Particle Physics during their second and third semester ("topics on particle and astroparticle physics" or "theoretical particle physics").

2.4.3. Astrophysics and cosmology

Coordinator: Professor B. Moore

This master's program offers an advanced education in astrophysics and cosmology. After introductory lectures, practice sessions and labs, students begin with their master's thesis that should take 9 months.

Compulsory modules

Sem.	Nr.	Title	Class Time		Performance assessment	Grading	CP
			Lectures	Practice sessions			
1	PHY511	General Relativity	4	2	Module exam	Yes	10
1	AST512	Theoretical Astrophysics	4	2	Module exam	Yes	10
2	AST513	Theoretical Cosmology	4	2	Module exam	Yes	10
2 and 3	AST547	Research seminar	1		Participation	No	2
2 and 3	AST548	Master's thesis			Grade from thesis (2/3) and module exam (1/3)	Yes	45

Elective modules

The remaining credits needed to fulfil the requirement of 90 credit points must be earned in elective modules. For instance, we recommend: QGD411 Computational Science I, QTF1 (PHY551) or specialized astrophysics modules that take place every year (for instance, Stellar Structure and Evolution).

Course contents in the compulsory modules

PHY511 General Relativity

- repetition of special relativity
- principle of equivalence
- motion in the gravitational field, gravitational red-shift
- tensors in Riemann-Space
- covariant derivative, parallel transport
- Riemann tensor, Bianchi-Identities
- Einstein's field equations
- Schwarzschild-solution
- precession of the perihelion, deflection of light
- geodesic precession
- gravitational waves
- black holes
- Friedman-Robertson-Walker universe

AST512 Theoretical Astrophysics

- radiative processes in the interstellar medium
- Sternaufbau
- Sternentwicklung
- Supernovae
- Weisse Zwerge
- Neutronensterne
- Black holes
- Planet formation

AST513 Theoretical Cosmology

- big bang and early universe
- nucleosynthesis
- inflation
- relativistic perturbation theory and growth of structure
- cosmic microwave background and large scale structure
- dark matter and dark energy

Research seminar

During their second and third semesters, students are required to attend at least one seminar per week: www.itp.uzh.ch/seminars.html

2.4.4 Theoretical Physics

Coordinator: Professor Thomas Gehrmann

This master's program allows students to specialize in an area of theoretical physics that is not offered in any of the other master's programs. Together with a faculty member in theoretical physics, students determine an area of specialization and choose modules they will complete in addition to the compulsory modules listed in the table below. The master's thesis should take approximately 9 months.

Compulsory modules

Sem.	Nr.	Title	Class Time		Performance assessment	Grading	CP
			Lectures	Practice sessions			
1	PHY511	General Relativity	4	2	Module exam	Yes	10
1	PHY551	Quantum Field Theory	4	2	Module exam	Yes	10
2 and 3	PHY597	Research seminar	1.5		Participation	No	2
2 and 3	PHY598	Master's thesis			Grade from thesis (2/3) and module exam (1/3)	Yes	45

Elective modules

The remaining credits needed to fulfil the requirement of 90 credit points for a master's degree must be earned in elective modules. Students should choose their electives to fit their thesis topic.

2.5 Examinations and performance assessments

The procedure of **module examinations** is regulated in the General Regulations and the Study Program Regulations at the Faculty of Mathematics and Natural Sciences. The most important regulations are also listed in section 5.6 of these Study Regulations. Oral exams usually take 20 minutes, while written exams take 2 hours. At the beginning of the semester, the responsible faculty member in each module states what kind of examination there will be. This faculty member is also responsible for the content and conducting of the module exam and should be available for questions regarding the exam.

Students may **repeat** a module exam if they received a failing grade. As a rule, repetition exams in the bachelor's program follow this calendar (CW= calendar week).

Exam period	CW	Repetition period	CW
1	51, 1, 2	3	6, 7
2	3, 4	6	35 - 37
3	6, 7	6	35 - 37
4	22, 23	6	35 - 37
5	25, 26	6	35 - 37
6	35 - 37	3	6, 7

Instead of participating in the repetition exam, there is the possibility to repeat the complete module. Exercises have to be repeated if they are part of the performance assessment of a module. Labs, which are part of a module, do not need to be repeated (e.g. PHY117, PHY127, PHY111, PHY121).

In the module PHY131 Physics III and the modules in experimental physics (PHY210 Solid state physics, PHY211 Nuclear and particle physics I, PHY212 Physics at the nanometer scale, PHY213 Nuclear and particle physics II), module grades are composed of 75% module exam grades and 25% lab grades. To pass these modules, both the grades in the exam and in lab must be passing.

In addition, students may be required to complete further **records of performance** (such as completing practice problems). The responsible faculty member will determine these at the beginning of the semester.

In modules without a module exam, records of performance may be conducted during lecture periods such as an ungraded attendance exercise or a quiz.

2.6 Minors for students with a major in physics

It is possible, but not compulsory, for students to choose one or more minors within the intended elective modules. They may elect any minor offered at either UZH or ETH. A minimum of 20 credit points must be earned for a minor. However, the department offering the minor may require a higher number of credit points. Before choosing a minor, students must clarify, which modules are compulsory for the minor with the respective departmental advisors. Grades in a minor are determined by an average of the grades received in modules, which are weighted according to how

many credit points the modules were worth. Every successfully completed minor along with the grade received will be shown in the bachelor or master's diploma.

We especially recommend following minors for physics students:

2.6.1 Mathematics

A minor in mathematics requires 36 credit points. The compulsory modules are MAT111 Linear Algebra, MAT131 Analysis I and MAT132 Analysis II.

The modules Linear Algebra and Analysis consist of the lectures Linear Algebra and Analysis I, II, respectively, along with a practice session, just like in the major program.

Students may expand their minor with elective modules in mathematics.

Compulsory modules

Nr.	Title	Class Time (SWH i.e. weeks)		Exam period	Grading	CP
		Lectures	Practice sessions			
MAT111	Linear Algebra	4	2	6	Yes	18
MAT131	Analysis I	4	2	2	Yes	9
MAT132	Analysis II	4	2	5	Yes	9

MAT111 Linear Algebra covers 2 semesters and begins in the fall.

For physics students with a minor in mathematics, MAT111 Linear Algebra may substitute MAT141 Linear Algebra for Physics Students.

2.6.2 Astrophysics

The Institute of Theoretical Physics at the UZH offers a minor in astrophysics.

The material covered in Physics I and II (PHY111, PHY121, PHY131) are required.

Compulsory modules

Sem.	Nr.	Titel	Präsenzzeiten		Prüfungs- periode	Note	Kredit- punkte
			Vor- lesung	Übungen			
Spring	AST241	Introductory Astrophysics	3	1	5	Yes	6
Autumn	AST202	Planets and Aliens	2	1		Yes	5

Spring or Autumn	AST243	Lab. Astrophysics	Comput.			Report	No	9
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2.6.3 Chemistry

A minor in chemistry requires the module CHE156 General Chemistry for Natural Scientists, Part I (compulsory module) as well as an additional 20 credit points amongst the lab modules CHE111/112 Foundations Lab in Chemistry, CHE171/173 Lab in General and Inorganic Chemistry for Biology, Lab in Organic Chemistry for Biology, and chemistry modules from the second to fifth years.

At least half of all credit points must have been earned in graded modules. The grade of the minor consists of the average of all graded modules in the minor weighted according to the credit point value.

More detailed and up-to-date information can be found in the study guidance for chemistry at www.chemie.uzh.ch.

2.6.4 Informatics

The Institute of Informatics offers, amongst other possibilities, a minor of 30 credit points:

Minor in informatics	30 CP
Assessment level	
Informatics I	9
Formal foundations in informatics	3
Assessment level total	12
Advanced level	
Informatics IIa	3
Subject work	3
Modules from the elective-compulsory courses	12
Total advanced level	18

More detailed and up-to-date information can be found in the Study Regulations for Minor for Students at the University of Zurich at <http://www.ifi.uzh.ch/teaching/studiengaenge/>.

2.6.5 Neuroinformatics

A minor in neuroinformatics gives students the opportunity to choose lectures and practice sessions at the Institute for Neuroinformatics as well as additional, topically related lectures, practice sessions and semester papers at other institutes and faculties. The List A, which shows modules offered in neuroinformatics, and the List B, which shows modules from other fields that can be counted towards the minor,

can be viewed at www.ini.uzh.ch/teaching/nebenfach. Occasionally, the institute's study coordinator will allow a student to take a course not included in List B at his or her request.

A minor in neuroinformatics requires 20 credit points, of which 12 must be from List A and at least 8 from List B.

2.6.6 Minor Special Informatics for Natural Scientists (SPIN)

The Institute of Physical Chemistry, the Physics Institute and the Institute of Informatics jointly offer this interdisciplinary minor. Students receive insight into the application of informatics for model calculations and simulations as well as for regulation and data collection in experiments.

Any students may do this minor, but we particularly recommend it to students in physics and chemistry. The program has no special requirements.

To begin with, students take the compulsory module Informatics 1 offered at the Institute for Informatics. It provides an introduction to the basic techniques of informatics and programming. Further courses consist of four elective-compulsory modules on numeric simulations and model calculations as well as experimenting with computer support. The methodological focus lies on practical application.

Sem.	Nr.	Title	Class time		Performance assessment	Grade	CP
			Lecture	Practice sessions			
1	AINF1100	Informatics 1			Module exam	Yes	9

Elective-compulsory modules

Students must choose two out of these four modules:

	Nr.	Title	Times (per week)		Performance assessment	Grade	Credit points
			Lecture	Practice sessions			
Spring	SPI201	Application of Computer Simulations I	1	3	Module exam	Yes	6
Autumn	SPI202	Application of Computer Simulations II	1	3		No	5
Autumn	SPI301	Computer supported experimenting I	1	3	Module exam	Yes	6
Spring	SPI302	Computer supported experimenting II		4		No	5

Module AINF1100 is completed with a module exam in exam period 1. The responsible faculty member will provide additional information. The module exams for SPI201 and SPI 301 are oral exams and should each take 20 minutes. The

responsible faculty member will inform students of the exact time of the exam. The performance assessments in modules SPI202 and SPI302 take the form of active participation in the labs.

2.7 Physics as a minor for students with another major

Following offerings are directed at students of different subjects that chose physics as a minor or for whom physics is a compulsory foundational subject. You may find further information in the Study Regulations of the respective major.

Physics as a minor of 20 credit points (for instance for geography majors):

- PHY116 and PHY126 (7 cp each): like PHY111 and PHY121, but with slightly reduced requirements for exams and practice sessions.
- PHY112 and PHY122 laboratory (5 cp each).

Physics as a minor for chemistry majors

The 20 CP program consists of the following compulsory modules:

- PHY117 and PHY127 (6 cp each)
- PHY139 Physics III for minoring students (8 cp each)

Physics as a minor for mathematics majors:

The program of 45 cp includes following compulsory modules:

- PHY116 Physics I for students with a minor (7 cp)
- PHY110 Extended Physics I (3 cp)
- PHY112 Lab I (5 cp)
- PHY126 Physics II for students with a minor (7 cp)
- PHY120 Extended Physics II (3 cp)
- PHY122 Lab II (5 cp)
- PHY139 Physics III for students with a minor (8 cp)

In addition, students must attend further modules from the bachelor's program for a total of 11 cp, excluding PHY312/PHY322

This 45 cp minor leads into a 20 cp minor at the master's level, during which students may continue to attend modules from the bachelor's program in physics, except for PHY312/PHY322 and PHY399.

Students may also choose the 20 cp minor described above as part of their bachelor or master's degree.

Physics as a foundations course for biology, chemistry, biochemistry or economics majors:

- PHY117 and PHY127 (6 cp each): 3h lecture, 3h practice sessions, or lab every other week.

Physics as a foundations course for earth sciences majors and earth systems sciences majors:

- PHY116, PHY126, lab PHY112 for earth sciences
- PHY116, lab Phy112 and PHY114 Informatics for earth systems scientists.

Physics as a small minor for students at the Faculty of Philosophy (31 CP):

The curriculum includes the following compulsory modules:

- PHY116 Physics I for minoring students (7cp)
- PHY112 Lab I (5 cp)
- PHY126 Physics II for minoring students (7 cp)
- PHY139 Physics III for minoring students (8 cp)
- MAT182 Analysis for the natural sciences (6 cp)

In addition, students must take further modules in experimental physics on the level PHY2xx for a total of 4 cp.

Physics as a large minor for students at the Faculty of Philosophy (60 CP):

1. With a concentration in phenomenology

The curriculum includes following compulsory modules:

- PHY116 Physics I for minoring students (7cp)
- PHY112 Lab I (5 cp)
- PHY110 Extended Physics I (3 cp)
- PHY126 Physics II for minoring students (7 CP)
- PHY122 Lab II (5 cp)
- PHY120 Extended Physics II (3 cp)
- MAT182 Analysis for the natural sciences (6 cp)
- MAT183 stochastic for the natural sciences
- Physics III (12 cp)

The remaining 16 cp can be earned from a combination of any of the following courses:

- PHY114 Informatics for physic students (1 cp)
- PHY224 Programming in C++ (1 cp)
- PHY231 Data analysis (2 cp)
- PHY210 Physics of Condensed Matter (8 cp)
- PHY211 Nuclear and Particle Physics (8 cp)
- AST241 Introduction to astrophysics (6 cp)

2. With a concentration in mathematical physics:

The curriculum includes following compulsory modules:

- PHY116 Physics I for minoring students (7 cp)
- PHY112 Lab I (3 cp)
- PHY110 Extended Physics I (3 cp)
- MAT131 Analysis I for physics majors (9 cp)
- MAT141 Linear Algebra for physics majors (5 cp)
- PHY126 Physics II for minoring students (7 cp)
- PHY120 Extended Physics II (3 cp)
- MAT132 Analysis II for physics majors (9cp)

The remaining 10 cp can be earned from a combination of any of the following courses:

- PHY311 Mechanics (8 cp)
- PHY331 Quantum mechanics I (8 cp)
- PHY341 Thermodynamics (5 cp)
- PHY139 Physics III for minoring students (8 cp)

Instead of the modules PHY116/126/139 (Physics I/II/III for minoring students), students may choose to take PHY111/121/131 (Physics I/II/III for physics majors).

We strongly recommend all students to contact the departmental advisors before registering for a minor in physics.

2.8 Teaching degree for Swiss “Maturität” schools (university-track secondary schools)

The Institute of Gymnasial and Professional Pedagogy offers the necessary training for a teaching degree for “Maturität” schools. As the program is constantly being remodelled, it is best to look up detailed information at www.ife.uzh.ch/llbm.html.

The program covers 60 cp. You may choose whether to complete the degree in one or two subjects (i.e. to primarily teach physics, but have mathematics as a secondary subject).

The requirement for admission to a teaching program at “Maturität” schools is a master’s degree in physics or an equivalent degree.

Overview of the program:

	Program for a degree in 1 subject	Program for a degree in 2 subjects
Pedagogy (compulsory)	At least 16 cp	At least 16 cp
Elective-compulsory courses:		
Didactic method in the 1st subject - 3 compulsory modules - exams on one or more modules	At least 10 cp	At least 10 cp
Didactic method in the 2nd subject		At least 10 cp
Practical professional training in the 1st subject 50 lessons (30 + 20)	At least 15 p	At least 14 cp
Practical professional training in the 2nd subject 30 lessons (20 + 10)		At least 7 cp
Further education in your subject with a focus on pedagogy Subject specific coursework with a focus on teaching at “Maturität” schools	12 cp	
Exams covering one or more modules - Pedagogy - Subject specific didactic method - Practical professional exam in the 1 st subject - Practical professional exam in the 2 nd subject		

Physics as a 2nd subject for a teaching degree at “Maturität” schools

The coursework required for a degree in teaching physics as a 2nd subject involves 70 cp:

- PHY116 and PHY126 (7 cp each): they are like PHY111 and PHY121, but with only 4 hours of lecture per week. Labs are the same as in PHY11/121.
- PHY112 and PHY122 lab of 5 cp each.

- PHY139 (8 cp): same as PHY 131, but without a lab.
- PHY291
- 2 elective-compulsory modules in experimental physics. The choice is between PHY210, PHY211, PHY212, and PHY213 (8 cp each).
- 2 elective-compulsory modules in theoretical physics. The choice is between PHY311, PHY321, PHY331, PHY351) (8 cp each)

A remaining 4 cp must be earned from elective modules in physics.

Mathematics as a 2nd subject for a teaching degree at “Maturität” school

Physicists who want to teach mathematics as their second subject must minor in mathematics. They must attend the introductory lectures MAT111 Linear Algebra and MAT121 Analysis, as well as four lecture-based modules (9 cp each) in four different areas and two seminars (4 cp each).

Further education in “Physics” with a focus on pedagogy

A teaching degree in a high school subject requires the attendance of subject-specific courses that focus on teaching at “Maturität” schools. The following modules count towards these courses, even if they were already counted toward a bachelor’s degree

- AST241 Introduction to Astrophysics
- PHY250 Electronics
- PHY251 Electronics course
- PHY261 Tutorial
- PHY262 teaching assistantship for Physics I
- PHY263 teaching assistantship for Physics II
- PHY271 additional lab experiments
- PHY272 Semester project
- PHY291 Proseminar in experimental Physics
- PHY391 Proseminar in theoretical Physics

3 How to organize your studies

3.1 Duration of Studies

The standard duration of studies as described in these Study Regulations is six semesters. If students only complete their bachelor's thesis during the summer vacation, studies will take three full years. Obtaining a master's degree should take another three semesters.

At most, students are allowed to take twice the amount of time as intended to complete the bachelor and master's program, counting from the start of the respective direction of study. Students who failed to fulfil the program in the anointed time period may no longer obtain a degree at the Faculty of Mathematics and Natural Sciences. The Faculty may grant an extended period for study upon a well-founded request.

Departmental advisors are happy too assist in a sensible spreading out of the required course load over an extended duration of studies.

3.2 Personal mentoring, Advising

When students begin a program at the institute, they are each assigned a professor as an advisor. Advisors will help students at their request in questions concerning physics, their studies, and personal goals up until they earn their bachelor's degree. Once you have been assigned an advisor, you are asked to contact him or her independently.

3.3 Time commitment for your studies and a part-time job

The standard duration of studies is based on a full-time course load. Thanks to the flexibility of the Study Program Regulations, students can potentially keep a part-time job. However, even with a comparatively small part-time job, students should expect a slightly longer duration of studies.

Most modules require students to complete exercises and lab reports independently. This work usually takes as much time as actual class time. To be able to follow lectures, students will discover how important it is to work over material after class for, on average, one hour for every lesson.

Breaks are another opportunity to have a part-time job, though you must keep the scheduling of exams and intensive courses in mind (see section 2.2.5). We recommend that students discuss details carefully with the departmental advisors.

3.4 Research internships

Opportunities often arise for students to work with research teams in their labs, where they can get to know the current topics of research and the researchers. Students who are interested should address the team leaders directly or else contact the departmental advisors. In addition, the research centres at the CERN (Geneva), DESY (Hamburg) and PSI (Villigen in Kanton AG) offer programs for students over the summer, which involve practical work as well as theoretical education.

3.5 Military

Lectures and labs during the semester, intensive courses in the lecture-free period as well as dates for module exams may overlap with recruit schooling and other military training events. Therefore, we recommend students to complete their service before beginning their studies. If students do have to attend training events during their studies, they should be in touch with the departmental advisors. However, absence due to military service will never lead to a reduction of demands in a module exam or other controls of performance.

3.6 Mobility

At the university level, national as well as international projects and scholarships strongly encourage student mobility. A certain degree of mobility is expected of future academics in light of the growing globalization in economics and technology. For instance, physicists should be well versed in English, since pretty much all primary literature and international conferences are in English.

We recommend for students to complete at least one semester of their studies at a university in a foreign country, so they can gain new experiences, widen their horizons and work together with people from different cultural backgrounds. Interested students must apply for admission to a foreign program independently. You can find further information on the university website or directly with the official mobility positions (www.int.uzh.ch/in/programme.html).

4. Addresses and Information Services

These Study Regulations: www.physikstudium.uzh.ch/index.php?id=bachelor

Information about the study of physics: www.physikstudium.uzh.ch

Homepages of the Physics Institutes: www.physik.uzh.ch and www.itp.uzh.ch

Postal address: Physik-Institut der Universität, Winterthurerstr. 190, CH-8057 Zürich

Departmental advisors:

Prof. U. Straumann, Tel. 044 635 57 68, strauman@physik.uzh.ch, office 36 J 48

Dr. Simone von Burg Black, Tel. 044 635 58 35, studium@physik.uzh.ch, office 27 K 06

Dr. Matthias Hengsberger, Tel. 044 635 58 35, Matthias.hengsberger@physik.uzh.ch, office 11 G 06

The university's lecture catalogue with commentary: www.vorlesungen.uzh.ch

Women in physics:

"Physics is my subject": A mentoring project for female physicists and interested female students. For more information see www.unibas.ch/phys-mentoring

Events at the UZH: www.agenda.uzh.ch

Regulations and information sheets for the Faculty of Mathematics and Natural Sciences: www.mnf.ch/studium/reglemente-merkblaetter.html

Dean's Office for requests and general questions: www.mnf.ch/studium/beratung-und-gesuche.html

5 Frequently asked questions and answers regarding a degree at the MNF

5.1 What documents contain the regulation of a degree at the MNF?

These Study Regulations are designed to be informative. However, we have included all information that is relevant to studying at the institute from the superordinate regulations, which have been listed below.

The binding superordinate regulations are (see www.mnf.uzh.ch/studium/reglemente-merkblaetter/bachelor-master.html):

- a) General Regulations for studying in the bachelor and master's programs at the Faculty of Mathematics and Natural Sciences at the University of Zurich.
- b) Study Program Regulations for studying in the bachelor and master's programs at the Faculty of Mathematics and Natural Sciences at the University of Zurich.
- c) Doctorate Regulations

The General Regulations contains the general ordinances for the bachelor and master's programs. The Study Program Regulations describe each program's contents. The Doctorate Regulations regulates the doctoral program, which is not included in these Study Regulations.

Present Study Regulations and the regulations a), b) and c) will be in effect for the foreseeable future. The Lecture Catalogue with Commentary (www.vorlesungen.uzh.ch), which is put out every semester, contains more current information, such a detailed description of course offerings.

In addition to the electronic Lecture Catalogue with Commentary, the university puts out a printed version every semester, which contains a summary of all course offerings as well as further information about the university (institutes, faculty, etc.).

5.2 How is a program constructed? What academic degrees can I attain?

The various programs of study at the MNF are structured in levels. The first level leads to a bachelor's degree, the next level to a master's degree. The bachelor's program provides students with solid foundational knowledge and trains them in structured scientific thinking. The master's program then provides an advanced scientific education and trains students to work in the sciences independently.

The bachelor's program serves as a foundation for further studies at the master's level, be it in the same subject at our or a different university, or be it in a different subject. The Study Program Regulations determine under which conditions changing subjects between the bachelor and master's program is possible.

At the third level following a master's degree, students may begin doctoral studies, as long as they have found an advisor willing to oversee their dissertation. During doctoral studies in physics, the university usually provides students with financial support.

A master's degree provides the necessary training in a subject necessary to obtain a teaching degree for "Maturität" schools.

5.3 What is a minor?

A minor is a different subject from a major, in which students must earn no less than 20 credit points (see the following section). It will be listed in the bachelor and master's diploma.

5.4 How does the credit point system work?

All programs of study are planned according to the principles of the credit point system. This means that all academic performances will be awarded with credit points (cp) in conjunction with a control of performance (i.e. an exam or a paper). The system follows these principles:

- No credit points will be awarded without a control of performance.
- One credit point approximately corresponds to 30 hours of work. This time period should include class time as well as time needed for independent work (going over lectures, solving problems, writing papers and reports, preparing for exams, etc.).
- One semester of full-time study (including the lecture-free period) corresponds to 30 cp.

5.4.1 How many credit points do I need? How much time do I have?

180 cp are necessary for a bachelor's degree, an additional 90 cp are needed for a master's degree. This means that the bachelor's program will usually take six, the master's program three more semesters (the intended duration of study)

At most, students are allowed to take twice the intended duration of study to complete their degree, counting from the start of a specific direction of study. If a student fails to complete the requirements necessary for a bachelor's or master's degree in this time period, they will no longer be permitted to earn a degree at the Faculty of Mathematics and Natural Sciences. The Faculty may permit an extended duration of study upon a well-founded request.

Therefore, part-time students in particular have the possibility of continuing their studies for, at most, twice the intended duration of study. On the other hand, with a bit of an extra effort, it may also be possible to earn the required credit points in less than the intended time period.

5.4.2 Can I compile my credit points freely?

No. Students may not choose the courses through which they earn credit points freely. These Study Regulations and the Study Program Regulations describe which courses are compulsory as well as where there is room for choice. For further information see section 5.5.

5.4.3 How can I find my credit point status?

Once per semester, students receive a transcript of the credit points they have thus far earned along with any grades received. Students are obliged to report any discrepancies to the dean's office within four weeks.

5.5 How is the degree structured? What are modules?

All program's of study are structured into modules. One module may consist of one or more courses. Credit points are only awarded for modules. At most, a module may extend over two semesters. Completion of a module may be dependent on the fulfilment of requirements; the Lecture Catalogue with Commentary provides further information on the matter (www.vorlesungen.uzh.ch/).

5.5.1 What types of modules are there?

We differentiate between three types of modules:

- Compulsory module: a module that all students in a specific program must complete.
- Elective-compulsory module: a module that must be chosen from a predetermined list of options.
- Elective module: a module that may be chosen freely from all the course offerings of one subject or group of subjects.

The Study Program Regulations of the MNF specifies the compulsory, elective-compulsory and elective modules of each program of study, including the corresponding credit points. The determination of elective and elective-compulsory modules may also be put out in the Lecture Catalogue with Commentary.

5.5.2 Who is responsible for modules (including examinations or other performance records)?

Each module has a responsible faculty member, who is listed in the Lecture Catalogue with Commentary.

5.5.3 How do I register for a module?

You may register for a module according to the general regulations of the UZH. You will find the current link for booking modules at www.students.uzh.ch/booking.html.

5.5.4 How do I earn my credit points?

Credit points are only awarded after controls of performance. Scheduling, form and breadth of these performance controls will be announced in the Lecture Catalogue with Commentary.

If students are discovered in an act of dishonesty at a performance control, the performance control will be recorded as having been failed.

5.6 What are module examinations? How are they conducted?

A module exam is a written or oral exam on the material covered in a module. The responsible faculty member decides whether the exam will be written or oral. Module exams are graded on the standard scale of 1 through 6 (half grades are possible). If the grade for the entire module is 4 or higher, students receive credit for the module. If the grade is lower than 4, students will not receive credit. The grade from a module exam is calculated into the final grade of your bachelor or master's diploma in proportion to how many credit points it was worth.

5.6.1 Do I have to register for individual module exams? Can I cancel my registration?

Once you have registered for a module, you are automatically signed up for the respective module exam. However, you may drop the module, including the exam, without explanation up until the end of the first half of the lecture period. The exact final date of cancellation is provided in the Lecture Catalogue with Commentary.

5.6.2 Will I receive an invitation for each of my module examinations?

Not necessarily. You will not receive an invitation to written exams. The responsible faculty member will provide the necessary information for written exams. The responsible faculty member must also announce the time and date of oral module examinations. In addition, the administration at the physics institutes will send you an invitation to oral module exams at the physics institute.

5.6.3 When are the module examinations held?

Every year faculty members can choose between six time periods to schedule their module exams. The Study Program Regulations and the Lecture Catalogue with Commentary specify in which of these time periods the respective module exam will be held. There should only be one period per module.

The exam periods are thus defined:

Period 1: Calendar weeks 51 and 1/2

Period 2: Calendar week 3 and 4

Period 3: Calendar weeks 6 and 7

Period 4: Calendar weeks 22 and 23

Period 5: Calendar weeks 25 and 26

Period 6: Calendar weeks 36 and 37

5.6.4 How and when will I receive the results of my module examinations?

Following every exam period, a commission of faculty members validates results. Then you can view your results on a personal account.

5.6.5 What are my possibilities for repetition?

A module exam that was not passed can be taken over once, but only once. If a student does not pass a module exam for a compulsory module on his or her second try, he or she will be barred from continuing studies in any program for which this

module is compulsory. If a student does not receive a passing grade for an elective module on his or her second try, he or she may replace the course with a different module. Elective modules can always be replaced with a different module after repetition.

If you should not pass a module exam, you will receive a registration form for the repeat exam along with your results. The registration form will inform you of the date by when you must enter a binding registration for the exam. If you do not register in time, you will have to retake the whole module and may repeat the exam only once more. Upon request, you may be allowed to repeat the exam of a single compulsory module a second time. This does not apply to the bachelor's thesis.

5.6.6 What happens if I fail to attend an exam or a repetition exam? What should I do in this case?

Anyone who fails to attend a module exam will fail the module. The Faculty may allow for exceptions where there are good reasons or a doctor's attestation. If this is the case, you must hand in a written request including necessary papers or attestations with the dean's office at latest five days after the exam.

In general, you will need to retake you exam on the date for repetition exams of the respective module.

5.6.7 How are performance controls conducted in modules for which no exam is intended?

In this case, the responsible faculty member is in charge of the situation. Their choice will be recorded in the Lecture Catalogue with Commentary. Even without an exam performance may be graded.

If you are prevented from attending such a performance control because of your health or another important reason, you must contact the responsible faculty member without delay. The responsible faculty member should then determine a date for repetition.

If a performance control is not completed successfully, the regulations for the repetition of an exam apply.

If you do not fulfil the requirements of a performance control, you will be given the opportunity to do them over. Depending on the type of performance control, this may mean that you will have to retake the entire module.

5.7 What do we need to know about bachelor or master's thesis?

A bachelor's thesis in physics involves working within a research team. Students present their results in a written report and an oral presentation. The bachelor's thesis is graded.

A master's thesis is expected to take 9 months of work. The thesis consists of advanced research, of which the results must be presented in a written report. The

results must also be presented during a presentation within a seminar. The master's thesis and the presentation will be graded.

You may make a second attempt at a thesis with a new topic, but only once. The report must be written in German or English, or with the permission of your advisor in French or Italian.

5.8 Will I receive a bachelor's or master's degree automatically if I fulfil the necessary requirements?

No. These degrees are not awarded automatically when the necessary credit points have been earned. First, you must submit a request for completion of the bachelor or master's program. You will find the necessary forms at www.physikstudium.uzh.ch/index.php?id=85. If you have fulfilled all requirements, the Faculty will award you your title at the next gathering of the Faculty, as long as you submitted the request three weeks beforehand. Otherwise, you will receive your title at the next gathering.

5.9 How will my diploma look?

The diploma is written out in both German and English. It will also contain a grade, which is calculated according to the Study Program Regulations from the grades you received over the course of your studies. Grades in your major and minor will be recorded separately. In addition to your diploma, you will receive an academic record of all completed modules with their respective credit point values, as well as a diploma supplement, which contains general information about program's of study in Switzerland, especially at the University of Zurich.

5.10 Can I switch university every semester?

Yes. In general, credit points will be counted at all universities as long as they also follow the ECTS credit point system. A new university is however allowed to determine certain requirements for a program of study if their program of study is significantly different from the one at the UZH. However, if you wish to receive a bachelor's degree from the MNF, you will have to earn at least 90 of the 180 necessary credit points at the University of Zurich, though the Faculty may make exceptions upon request.

6 Glossary and Abbreviations

MNF	Faculty of Mathematics and Natural Sciences: an organizational entity at the University of Zurich, which contains all natural sciences and mathematics.
CP	Credit points, ECTS points
ECTS	European Credit Transfer and Accumulation System
MSc	Master of Science
BSc	Bachelor of Science
SWH	Semester week hours (amount of hours per week per semester)
Dean	Head of the Faculty
Dean's office	Administrative office of the Faculty, at the Uni Irchel in Building Y-10

AS	Autumn semester
SS	Spring semester
General Dean's office	Administrative office of the entire university, in the main building at the university center.
lfp	Lecture-free period