Westfälische Wilhelms-Universität Münster

Department of Physics

Course Programme

of the MSc in Physics

- Dekanat des Fachbereichs Physik -
April 2018

INTRODUCTION

The Westfälische Wilhelms-Universität in Münster is located in the cultural centre of Westphalia in close vicinity to the Netherlands. The Treaty of Westphalia, signed in Münster in 1648, ended the Thirty Years' War. For this reason Münster's townhall was awarded with the European Heritage Label. Nearly 60,000 students live in this beautiful town which is known as Germany's bicycle capital. Its economy is based on the service industry and public administration. Students make up about 20% of city's population, resulting in a lively atmosphere. The Department of Physics warmly welcomes foreign students. They are an important factor in creating an open and colourful academic and social life on campus.

We invite foreign students to participate in courses offered by members of the department. The Department of Physics consists of about 25 independent research groups that cover a broad range of specialisations. All courses are open to full time, part time, and exchange students. Moreover, students studying other natural sciences, mathematics or medicine – both at undergraduate and graduate level – are welcome to participate in them.

As a guideline for the selection of appropriate courses, the following list details the contents of lectures, exercises and laboratory courses, which are regularly taught during each academic year. Traditionally, the academic year at German universities is split into two semesters: a Winter Term beginning in October and ending in mid-February, and a Summer Term beginning in April and ending at the end of July. The sequence of courses is largely based on the assumption that students start their studies in the Winter Term of the academic year. In addition to the courses listed here, the department also offers a large number of seminars and special courses with varying subjects. Usually, courses are given in a one or two hours time-slot. Most of them start "c.t." (Latin: cum tempore – with time), which means that they actually start at quarter past the hour. However, "s.t." (Latin: sine tempore – without time) indicates that a course will start punctual. For some of the regularly taught courses times and rooms are given in the list at the end of this document. There, the exact times are given. Note, however, that the times and rooms may be subject to change from one semester to the other and a check in the online course overview of the University for the current semester is recommended.

Courses in the Master programme will be taught in English. In the laboratory courses, experiments are normally conducted in groups of two students under the supervision of an instructor. Here, English and German are equally accepted as a working language for the course work and the reports. It should be noted that some of the elective, interdisciplinary modules in the "General Studies" are taught in German.

In addition to the services provided by the Department of Physics, general support for foreign students is also provided through central university institutions, including the International Office and the Language Centre (Sprachenzentrum).

We look forward to seeing you in Münster.

Tilmann Kuhn

Dean of Studies of the Department of Physics

Münster, April 2018

CONTACT

Admissions Requirement and Studies

Studierendensekretariat – Masterbüro (Student Admissions Office)
Schlossplatz 2, 48149 Münster, Germany

Tina Gerkmann	Room 55b	Phone: +49 (0) 251 / 83-21449
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http://www.uni-muenster.de/studium/en/studierendensekretariat.html

International Office

Schlossplatz 3, 48149 Münster, Germany
e-mail: international.office@uni-muenster.de
http://www.uni-muenster.de/InternationalOffice/en/index.html

Advice for International Students
Astrid Burgbacher
Phone: +49 (0) 251/ 83-22254
e-mail: study@uni-muenster.de
http://www.uni-muenster.de/studieninteressierte/en/index.shtml

Exchange Student Service (ESS)
Verena Ingenleuf
Phone: +49 (0) 251 / 83-22113
e-mail: admin.ess@uni-muenster.de

Die Brücke (Welcome Office) (Wilmergasse 2)
Dana Jacob
Phone: +49 (0) 251 / 83-22228
e-mail: diebruecke@uni-muenster.de
http://www.uni-muenster.de/DieBruecke/en/index.html

Counselling for International Students (Wilmergasse 2, Room 104)
Verena Stenzel
Phone: +49 (0) 251 / 83-21879
e-mail: verena.stenzel@uni-muenster.de
Thu 11:00-13:00

Language Courses

Sprachenzentrum (Language Centre of the University of Münster)
Lehrgebiet Deutsch als Fremdsprache (German as a Foreign Language)
Hüfferstrasse 27 III, Room B3.10
48149 Münster, Germany
Phone: +49 (0) 251/83-32108 (Mon-Thu 9:30-13:30, Fr 9:30-12:30)
Fax: +49 (0) 251/83-38349
e-mail: ldafmail@uni-muenster.de
http://spz.uni-muenster.de/ldaf

Accommodation

Studierendenwerk Münster (Student Welfare Organisation)
- Wohnraumverwaltung
Bismarckallee 5
48151 Münster, Germany
Tel.: +49 (0) 251 / 83-79553 (Tue and Thu 9-12:00, Thu 13-15:00)
e-mail: wohnen@stw-muenster.de
christiane.herding@stw-muenster.de
Phone: +49 (0) 251 / 83-79646
Fax: +49 (0) 251 / 83-79597
https://www.stw-muenster.de/en/home/

Department of Physics

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International Coordinator
Prof. Dr. Helmut Kohl, Room 323 (3rd floor)
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48149 Münster, Germany
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Study Coordinator
Apl. Prof. Dr. Hartmut Bracht, Room 613b (6th floor)
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Phone: +49 (0) 251 / 83-39004
e-mail: bracht@uni-muenster.de

Prüfungsamt der Math.-Nat. Fakultät (Examination Office)
Orléans-Ring 10
48149 Münster, Germany
Jana Kupetz (responsible for the MSc in physics and geophysics) Room 111
Phone: +49 (0) 251 / 83-35005
e-mail: jana.kupetz@uni-muenster.de
http://www.uni-muenster.de/MNFak/Pruefungsamt/

Description of the Modules of the Degree Programme

Physics

(Master of Science)

Department of Physics
University of Münster

Recommended Study Organisation

<table>
<tr><th>Semester</th><th colspan="4">Module</th></tr>
<tr><td>1 (WS)</td><td rowspan="2">Elective Studies in Physics
6-18 CP</td><td rowspan="2">Physical Specialisation I
14 - 18 CP</td><td rowspan="2">Physical Specialisation II
14 - 18 CP</td><td rowspan="2">General Studies
12 – 15 (24) CP</td></tr>
<tr><td>2 (SS)</td></tr>
<tr><td>3 (WS)</td><td colspan="4">Professional Specialisation and Project Design
30 CP</td></tr>
<tr><td>4 (SS)</td><td colspan="4">Master’s Thesis
30 CP</td></tr>
</table>

WS: Winter Semester SS: Summer Semester

The total credit of the modules “Elective Studies in Physics”, “Physical Specialisation I and II“ and “General Studies” must amount to at least 60 CP.

Modules of the first year (1st and 2nd semester)

Note that the courses given in this list as well as the times and lecture rooms may be subject to change. Please check with the online course overview of the University.

Module 1	**Elective Studies in Physics**
Semester	1st and 2nd semester
Person in charge	Dean of Studies
Components (course, duration, CP, term)	Free choice o courses among: Lectures (1 h/w, corresponds to roughly 1 CP) Exercises to lectures (1 h/w, corresponds to roughly 2 CP) Experimental exercises/practical course (1 h/w, corresponds to roughly 1,5 CP) Seminars (1 h/w, corresponds to roughly 1 CP)
Credit points/ Work load	6-18 CP/ 180-540 h (approx. 1/3 in-class and 2/3 self-studies)
Learning targets	This module permits students to obtain knowledge in physical subjects of free choice. With the chosen courses the students are able to integrate new knowledge and decide on their further specialisation offered by the modules Physical Specialisation I and II.
Contents	In agreement with the person in charge of each course.
Exam	To obtain the CPs for certain courses, it may be obligatory to submit assignments. One has to pass at least one exam or submit a graded assignment (e.g., a seminar) to get the CPs allocated. The grade of the module does not contribute to the overall grade of the MSc.
Prerequisites for attending	In agreement with person in charge of each course.

Module 2	**Physical Specialisation: Functional Nanosystems**
Semester	1st and 2nd semester
Person in charge	Prof. Dr. H. Fuchs, Prof. Dr. H. Arlinghaus
Components (course, duration, CP, term)	14 – 18 CP, according to agreement with the person in charge, consisting of: Laboratory course in nanophysics (6 CP) At least 2 advanced lectures in nanophysics (4 CP) At least 1 seminar in nanophysics (2 CP) At least 1 more course by choice in nanophysics (2 CP)
Credit points/ Work load	14 – 18 CP / 420 – 540 h (approx. 1/3 in-class, 2/3 self-studies)
Learning targets	Advanced knowledge of modern analytical methods for the characterisation of nanostructures and their functionalities, familiarisation with current topics of research.
Contents	Basics of nanophysics (fundamental atomic and molecular interactions, nanomaterials, nanofabrication, functional properties) with an emphasis on modern analytical tools.
Requirements to meet	Successful participation (including talk/presentation) in a seminar in nanophysics. Successful completion of a laboratory course.
Exam	30 – 45 minutes oral exam. The grade of the module counts 1/6 to the overall grade of the MSc.
Prerequisites for attending	None

Module 3	**Physical Specialisation: Nuclear and Particle Physics**
Semester	1st and 2nd semester
Person in charge	Prof. Dr. G. Münster
Components (course, duration, CP, term)	In agreement with the person in charge: Laboratory course (at least 6 CP) At least two advanced lectures in nuclear and particle physics (at least 6 CP) At least one seminar in nuclear and particle physics (at least 2 CP)
Credit points/ Work load	14 – 18 CP / 420 – 540 h (approx. 1/3 in-class, 2/3 self-studies)
Learning targets	Advanced knowledge of the fundamental principles of matter, its interactions and the experimental methods of nuclear and particle physics, familiarisation with current topics of research in the field.
Contents	Experimental techniques of nuclear and particle physics. Theory of the fundamental constituents of matter and their interactions. Aspects of the Standard Model of elementary particle physics.
Requirements to meet	Successful completion of the laboratory course. Successful participation (including talk/presentation) in a seminar in nuclear and particle physics. Depending on the choice of courses: successful completion of written exercises or exams.
Exam	30 – 45 minutes oral exam. The grade of the module counts 1/6 to the overall grade of the MSc.
Prerequisites for attending	None

Module 4	**Physical Specialisation: Materials Physics**
Semester	1st and 2nd semester
Person in charge	Prof. Dr. G. Wilde, Prof. Dr. C. Busse
Components (course, duration, CP, term, time)	**Obligatory parts:** Materials Physics I (lecture with exercises, 2+1 h/w, 4 CP, WS) Materials Physics II (lecture with exercises, 2+1 h/w, 4 CP, SS) Laboratory course in Materials Physics (laboratory course, 5 h/w, 5 CP, SS) **Elective parts:** In agreement with the person in charge: Advanced lectures or seminars in the area of materials physics or experimental and theoretical solid state physics with a total amount of up to 5 CP. Conducting a short research project in a materials physics research group with a total amount of up to 5 CP. Conducting a short research project as an internship in industry under scientific guidance of a university professor of this module with a total amount of up to 5 CP.
Credit points/ Work load	14 – 18 CP / 420 – 540 h (approx. 1/3 in-class, 2/3 self-studies)
Learning targets	Profound knowledge of physical concepts and methods in materials science. Ability to perform active research in current problems of materials physics.
Contents	Laboratory course: Experimental methods and basic physical properties of materials Materials Physics I and II: Structure and lattice defects, thermodynamics and constitution, diffusion and atomic transport, phase transformations and reaction kinetics, mechanical properties, functional materials. Advanced lectures may include: 'Atomic transport', 'Physics of soft matter and biological materials', 'Polymer physics', 'Semiconductor physics', 'Mechanics of materials', 'Nano-structured materials', 'Simulation methods in materials science'
Requirements to meet	Successful completion of the laboratory course. Successful completion of the exercises corresponding to Materials Physics I+II.
Exam	30 – 45 minutes oral exam. The grade of the module counts 1/6 to the overall grade of the MSc.
Prerequisites for attending	None

Module 5	**Physical Specialisation: Nonlinear Physics**
Semester	1st and 2nd semester
Person in charge	Prof. Dr. C. Denz, Prof. Dr. S. Linz
Components (course, duration, CP, term)	In agreement with the person in charge: Basic and advanced lectures in a suitable combination (4-12 CP) At least one seminar in nonlinear physics (2-6 CP) Experimental exercises in nonlinear physics (4-12 CP) More CPs can be obtained according to each student's main focus in experimental or theoretical nonlinear physics chosen from lectures, laboratory classes or seminars. In agreement with the person in charge, CPs in laboratory classes can be achieved in research projects working on a nonlinear physical problem ("Mini-research"), in a project in the interdisciplinary course "Nonlinear modelling in natural sciences" or by carrying out a project with/doing an internship in a company or an external research facility under scientific guidance of a university professor associated to this module (up to 8 CP).
Credit points/ Work load	14 – 18 CP / 420 – 540 h (approx. 1/3 in-class, 2/3 self-studies)
Learning targets	To understand the basic concepts of nonlinear physics, the role of nonlinearities in different physical, chemical or biological systems, to learn the relevant methods of theoretical and/or experimental analysis of nonlinear systems, to be able to apply the gained knowledge to a specific theoretical/experimental problem.
Contents	The module consists of theoretical and experimental courses offering the possibility to focus either on the theoretical or the experimental part. Each combination includes basic principles of nonlinear physics, such as signatures of nonlinear and complex systems, emergence, self-organisation, stability, bifurcations, attractors or pattern formation as well as specific examples of nonlinear systems. Use of typical nonlinear model equations (e.g., Swift-Hohenberg-equation, complex Ginzburg-Landau-equation, nonlinear Schrödinger-equation) and discussion of their generic characteristics and applications to concrete systems.
Requirements to meet	Successful participation in an exercise class. Successful participation (including talk/presentation) in a seminar. Solving experimental and/or theoretical problems, including documentation of the solutions.
Exam	30 – 45 minutes oral exam The grade of the module counts 1/6 to the overall grade of the MSc.
Prerequisites for attending	None

Module 6	**Physical Specialisation: Photonics and Magnonics**
Semester	Recommended for 1st and 2nd semester
Person in charge	Prof. Dr. C. Denz, Prof. Dr. S. Demokritov
Components (course, duration, CP, term)	In agreement with person in charge 14-18 CP chosen among:: Basic lectures with exercises and advanced lectures in photonics and magnonics (at least 4 CP) Laboratory course in photonics and magnonics (4 CP) At least one seminar in photonics and magnonics (at least 2 CP) In agreement with the person in charge, CPs in laboratory classes can be achieved in research projects working on a nonlinear physical problem ("Mini-research"), in a project in the interdisciplinary course "Nonlinear modelling in natural sciences" or by carrying out a project with/doing an internship in a company or an external research facility under scientific guidance of a university professor associated to this module (up to 8 CP).
Credit points/ Work load	14 – 18 CP/ 420 – 540 h (approx. 1/3 in-class, 2/3 self-studies)
Learning targets	Learning how to apply basic physical knowledge to application-oriented problems in photonics. Advanced knowledge in optics, photonics and the application of waves; Understanding of the importance for non physical factors (e.g. economic and social)
Contents	Transferring basic physical knowledge to a specific photonic problem. Systematic treatment of a problem either in optics, photonics, magnonics or the application of waves.
Requirements to meet	Successful participation in an exercise class. Successful participation (including talk/presentation) in a seminar. Successful completion of the experimental and application-related problems including the documentation of the solutions.
Exam	30 – 45 minutes oral exam. The grade of the module counts 1/6 to the overall grade of the MSc.
Prerequisites for attending	None

Module 7	**Physical Specialisation: Physics of Low-Dimensional Solids**
Semester	1st and 2nd semester
Person in charge	Prof. Dr. T. Kuhn, Prof. Dr. M. Donath
Components (course, duration, CP, term, time)	Introduction to Solid State Theory (lecture with exercises, 3+1 h/w, 5 CP, WS) Lecture in the field of modern experimental solid state physics (2 CP) Seminar related to current problems in experimental or theoretical solid state physics (2 CP) Laboratory course: Experimental exercises in solid state spectroscopy (4 CP) Choice among: Research-oriented lab course (3 CP) and an advanced course in modern experimental solid state physics (2 CP) Advanced lecture with exercises in Solid State Theory (5 CP)
Credit points/ Work load	18 CP / 540 h (approx. 1/3 in-class, 2/3 self-studies)
Learning targets	Advanced knowledge of physical phenomena in low-dimensional solid state systems. Application of experimental and theoretical techniques for their analysis and description. Understanding of qualitatively new effects resulting from spatial confinement and of their relevance for applications.
Contents	Selected phenomena in solid state physics, in particular regarding low-dimensional systems.
Requirements to meet	Successful participation in the exercises to “Introduction to Solid State Theory”. Successful participation (including talk/presentation) in the seminar. Successful completion of the laboratory course “Experimental exercises in solid state spectroscopy”. Successful completion of the research-oriented lab course or successful participation in the exercises to Advanced Solid State Theory.
Exam	30 – 45 minutes oral exam. The grade of the module counts 1/6 to the overall grade of the MSc.
Prerequisites for attending	None

Module 8	**Physical Specialisation**
Semester	1st and 2nd semester
Person in charge	Supervisor of the module as selected by the Dean of Studies
Components (course, duration, CP, term)	In agreement with the person in charge selected by the Dean of Studies the module can be assembled from thematically coherent courses offered by the Department of Physics amounting to 14-18 CP. Normally the person responsible for the lecture/lab/seminar indicates the workload in terms of CP. If this is not the case, the CP are calculated using the following scheme: Lectures (1 h/w, corresponds to roughly 1 CP) Exercises to lectures (1 h/w, corresponds to roughly 2 CP) Experimental exercises/practical course (1 h/w, corresponds to roughly 1.5 CP) Seminars (1 h/w, corresponds to roughly 1 CP)
Credit points/ Work load	14 – 18 CP / 420 – 540 h
Learning targets	In agreement with person in charge of the module.
Contents	In agreement with person in charge of the module.
Exam	30 – 45 minutes oral exam. The grade of the module counts 1/6 to the overall grade of the MSc.
Prerequisites for attending	Individually arranged modules need to be approved by the Dean of Studies.

Module 9	**General studies: Business Administration**
Semester	1st and 2nd Semester
Person in charge	Depending on Module (Faculty in charge: Faculty of Business Administration and Economics)
Components (course, duration, CP, term)	Business Administration (BA) I (lecture and exercises, 4 h/w, 6 CP, 120 h self-studies) BA II (lecture and exercises, 4 h/w, 120 h self-studies, 6 CP) BA III (lecture and exercises, 4 h/w, 120 h self-studies, 6 CP) BA IV (lecture and exercises, 4 h/w, 120 h self-studies, 6 CP)
Credit points/ Work load	24 CP / 720 h
Learning targets	Enhanced insight into Business Administration is gained.
Contents	Students must participate in exactly 1 of the following 4 specialisations (Minor): 1. Minor Accounting: *compulsory:* Financial Accounting and Taxation (6 CP) (from Bachelor's Business Administration) *elective:* (3 out of 4 modules (6 CP) from Master's Business Administration) - Concepts and Tools of Management Accounting - International Financial Reporting - International Taxation - International Management Accounting and Control 2. Minor Finance: *compulsory:* Corporate Finance (6 CP) (from Bachelor's Business Administration) *elective:* (3 out of 4 modules (6 CP) from Master's Business Administration) - Introduction to Finance - Behavioral Finance - Derivatives I - Financial Intermediation I 3. Minor Management: *compulsory:* Management and Governance (6 CP) (from Bachelor's Business Administration) *elective:* (3 out of 4 modules (6 CP) from Master's Business Administration) - Organization - Strategic Management - Human Resources - Management 4. Minor Marketing: *compulsory:* Foundations of Marketing (6 CP) (from Bachelor's Business Administration) *elective:* (3 out of 4 modules (6 CP) from Master's Business Administration) - Advanced Market Research - Advanced Industrial Marketing - Consumer Marketing - Media Marketing For students who attended only BA I and microeconomics I in their bachelor's degree, it is recommended to attend Minor Management.
Exam	Depending on chosen Minor see: http://www.wiwi.uni-muenster.de/bachelor_bwl/studieninformationen/PO2010/wichtige_dokumente/Modulhandbuch_PO_2010.pdf (for bachelor's Business Administration) http://www.wiwi.uni-muenster.de/mas ter_bwl/pdf/Master-BWL_Modulhandbuch-PO-2010.pdf (for Master's Business Administration) The grade of the module counts 1/6 to the overall grade of the MSc.
Prerequisites for attending	Documented economic knowledge (lectures) amounting to 18 CP (e.g. from bachelor's degree)..

Module 10	**General studies: German as a Foreign Language**
Semester	1st and 2nd semester
Person in charge	Coordinator of the language centre
Components (course, duration, CP, term)	In the course of this module lectures from the course program “German as a Foreign Language” offered at the language center of the University are studied. Depending on the German entrance level individual courses will be chosen in agreement with the coordinator of the language center that lead at least to the qualification level A2.
Credit points/ Work load	12 – 15 CP / 360 – 450 h
Learning targets	Ability to deal with study-oriented communication and everyday-life situations.
Contents	The specific content depends on the choice of the courses.
Exam	Every lecture chosen for this module must be completed with an exam. Depending on the lectures this can be a written or oral exam, a homework assignment or an oral presentation. The form of the exam is announced at the beginning of each lecture. The grade of the module is given by the mean grade of the individual lectures weighted by the respective number of credits. The grade of the module counts 1/6 to the overall grade of the MSc.
Prerequisites for attending	Only for foreign students with a limited language competence in German (below DSH-2 level).

Module 11	**General studies: Geophysics**
Semester	1st and 2nd semester
Person in charge	Prof. Dr. U. Hansen, Prof. Dr. C. Thomas
Components (course, duration, CP, term, time)	Geophysics for Advanced Students II (lecture and exercises, 6 CP, 4 h/w, WS) Choice of two courses among the following three: Geophysical Fluid Mechanics (lecture and exercises, 4 CP, 3 h/w, WS Fundamentals of Geophysics II (lecture and exercises, 4 CP, 3 h/w, WS) Advanced Seismology (lecture and exercises, 5 CP, 4 h/w, WS) (Basic knowledge in seismology is required to choose Advanced Seismology)
Credit points/ Work load	14 – 15 CP / 420 – 450 h
Learning targets	Introduction into the mathematical/physical description of the dynamics of geophysical systems. Acquirement of special knowledge in a field of research (e.g. geodynamics, seismology, applied geophysics)
Contents	*Geophysics for Advanced Students II:* Concepts for describing geophysical continua; Mechanical and thermodynamic conservation laws for describing processes in geophysical continuum mechanics; Materials laws and Rheology; Basic equations for describing dynamics of atmosphere, ocean, cryosphere and Earth's mantle. *Geophysical Fluid Mechanics:* Foundation of geophysical fluid mechanics; Examples for geophysical flow phenomena: mantle convection, plate tectonics, dynamics in the Earth's core, dynamics in porous media, groundwater dynamics; Convection processes; Methods and concepts from nonlinear dynamics and application to the analysis of fluid dynamics phenomena; Stability theory; Flow in rotating systems. *Advanced seismology:* Advanced signal processing of seismic data and array methods for detailed evaluation of the seismic wave field, calculation of radiation characteristics, modelling of the seismic wave field, quake localisation, anisotropy calculations, *scattering of the seismic wave field* *Fundamentals of Geophysics:* Gravity and shape of the Earth, Earth's magnetic field and magnetic measurements, electrical and electromagnetical methods for Earth exploration and investigation of the Earth.
Exam	40 – 45 minutes oral exam. The grade of the module counts 1/6 to the overall grade of the MSc.
Prerequisites for attending	None

Module 12	**General studies: Molecular Biophysics**
Semester	1st and 2nd semester
Person in charge	Prof. Dr. Dreisewerd, Dr. Mormann (Faculty of Medicine)
Components (course, duration, CP, term, time)	Molecular biophysics of cells and tissues I (lecture,compulsory, 2 CP, 2 h/w, WS) Molecular biophysics of cells and tissues II (lecture,compulsory, 2 CP, 2 h/w, SS) Biophysical methods of molecular biology, cell biology and physiology (lab, compulsory, 5 CP, 3 h/w, SS) Biophysical methods of molecular biology, cell biology and physiology (lecture, compulsory, 2 CP, 2 h/w, SS) Selected topics of molecular biophysics (seminar, compulsory, 1 CP, 1 h/w, WS/SS) Choice among the following: **Mass spectroscopy:** Fundamentals and applications of biomedical mass spectrometry I and II (lecture, 2 CP, 1 h/w in WS and SS), Basics, techniques and applications of laser- and electrospray mass spectrometry (seminar, 1 CP, 1 h/w, WS/SS) **Fluorescence microscopy:** basics and newest developments I and II (lecture, 2 CP, 1 h/w in WS and SS), basics, techniques and cell biological applications of high-resolution fluorescence microscopy (seminar, 1 CP, 1 h/w, WS/SS) **Noninvasive imaging:** magnetic resonance tomography and other techniques of noninvasive imaging I and II (lecture, 2 CP, 1 h/w in WS and SS), techniques and applications of molecular imaging (seminar, 1 CP, 1 h/w, WS/SS)
Credit points/ Work load	15 CP / 450 h
Learning targets	Knowledge of molecular biophysics and ability to use biophysical standard methods
Contents	Molecular biophysics of cells and tissues, biophysical methods of molecular biology, cell biology and physiology. Choice of: Mass spectroscopy, Fluorescence microscopy or Noninvasive imaging (particularly NMR/MRT).
Exam	30 – 45 minutes oral exam. The grade of the module counts 1/6 to the overall grade of the MSc.
Prerequisites for attending	None

Module 13	**General studies: Economics**
Semester	1st and 2nd semester
Person in charge	Depending on Module
Components (course, duration, CP, term)	Economics Module I (lecture, exercises, or seminar, 6 CP, 30 h seminar, 60 h lecture/exercises, 150 h (seminar) and 120 h (lecture/exercises) self-study) Economics Module II (lecture, exercises, or seminar, 6 CP, 30 h seminar, 60 h lecture/exercises, 150 h (seminar) and 120 h (lecture/exercises) self-study) Economics Module III (lecture, exercises, or seminar, 6 CP, 30 h seminar, 60 h lecture/exercises, 150 h (seminar) and 120 h (lecture/exercises) self-study) Economics Module IV (lecture, exercises, or seminar, 6 CP, 30 h seminar, 60 h lecture/exercises, 150 h (seminar) and 120 h (lecture/exercises) self-study)
Credit points/ Work load	24 CP / 720 h
Learning targets	Enhanced insight into Economics is gained.
Contents	Modules can be chosen freely from the master's degree of economics. Descriptions of the modules: http://www.wiwi.uni-muenster.de/master_vwl/Studium/po_2012/download/Modulhandbuch_Master_VWL-PO-2012.pdf "Projektstudium" (Project studies) cannot be chosen. The following combinations are recommended: - Economic Policy, Energy Economics I (from Bachelor's degree of Economics); Advanced Energy Econonmics I, Advanced Energy Economics II - Economic Policy, Business Cooperation: Governance or Business Cooperation: Management (from the Bachelor's degree of Economics, only one out of the two modules can be chosen), Business Cooperation: Mergers and Acquisition, Current cases of Mergers & Acquisitions - Economic Theory of the State, History of Economics, Public Economics, Empirical Public Economics - Economic Policy, Economics of Regulation, Principles of Transport Economics or Transport Economics and Logistics (from the Bachelor's degree of Economics, only one out of the two modules can be chosen), Advanced Transport Economics - Advanced Statistics (from the bachelor's degree of Economics), Time Series Analysis, Selected Topics in Econometrics, Statistics, Empirical Economic Research I, Selected Topics in Econometrics, Statistics, Empirical Economic Research II - Economic Policy, Economics of Regulation, Regional Economics: Fundamentals (from the Bachelor's degree of Economics), Advanced Regional Economics - Advanced Microeconomics, Advanced Microeconomics II, Applied Microeconometrics, Economic theory (only for theoretically based students!)
Exam	Exam or thesis and presentation, depending on the chosen module, see: http://www.wiwi.uni-muenster.de/master_vwl/Studium/po_2012/download/Modulhandbuch_Master_VWL-PO-2012.pdf The grade of the module counts 1/6 to the overall grade of the MSc.
Prerequisites for attending	Economic knowledge from bachelor's degree is required.

Module 17	**General studies: Psychology**
Semester	1st and 2nd semester
Person in charge	Prof. Dr. M. Lappe
Components (course, duration, CP, term)	Neural structures, functions and defects (lecture, 6 CP, 2 h/w), Experimental methods of neural and behavioural research (lecture, 6 CP, 2 h/w)
Credit points/ Work load	12 CP / 360 h
Learning targets	Extended knowledge of current research in the field of cognitive neurosciences. Knowing about common methods and their range of application. Being able to evaluate critically the prevailing scientific opinion and to see connections between different displines of cognitive neuroscience.
Contents	The lecures cover the neurocognitive basics of behaviour as well as methods used in neuroscientific behavioural research. Neuropsychological and psychological theories of cognitive functions will be part of the curriculum as well as functional-neuroanatomic basics. Scientific problems of cognitive neuroscience will be presented by means of impaired and unimpaired neurocognitive capabilites
Exam	Written or oral exam for each lecture, 60 minutes written/30 minutes oral exam, weighting 50% each. The grade of the module counts 1/6 to the overall grade of the MSc.
Requirements to meet	There may be exercises or/and short tests (10min/test) in the course of the module.
Prerequisites for attending	Successful participation in the module “Interdisciplinary Studies: Theoretical Basics of Psychology” during the bachelor course in physics.

Module 14	**General studies**
Semester	1st and 2nd semester
Person in charge	Supervisor of the module chosen in agreement with the Dean of Studies.
Components (course, duration, CP, term)	In agreement with person in charge the module can be self assembled amounting to 12-15 CP in the chosen field of study. A significant part of lectures/labs/seminars has to be taken from course programmes on the master level or advanced bachelor level (3rd year). Normally the person responsible for the lecture/lab/seminar indicates the workload in terms of CP. If this is not the case, the CP are calculated using the following scheme: Lectures (1 h/w, corresponds to roughly 1 CP) Exercises to lectures (1 h/w, corresponds to roughly 2 CP) Experimental exercises/practical course (1 h/w, corresponds to roughly 1.5 CP) Seminars (1 h/w, corresponds to roughly 1 CP)
Credit points/ Work load	12 – 15 CP / 360 – 450 h
Learning targets	In agreement with the person in charge of the module.
Contents	In agreement with the person in charge of the module.
Exam	30 – 45 minutes oral exam. The grade of the module counts 1/6 to the overall grade of the MSc.
Prerequisites for attending	Individually arranged modules need to be approved by the Dean of Studies.

Module 15	**Professional Specialisation and Project Design**
Semester	3rd semester
Person in charge	Master's thesis supervisor
Components (course, duration, CP, term)	Advanced Lectures (1 h/w corresponds to 1 CP) Exercises for Advanced Lectures (1 h/w corresponds to 2 CP) Laboratory Course / Internship (1 h/w corresponds to 1.5 CP) Computational Physics, Course Research and Group Seminars (1 h/w corresponds to 1 CP) Approximately 5 h/w in total self-studies
Credit points/ Work load	30 CP / 900 h (approx. 1/3 in-class, 2/3 self-studies)
Learning targets	During this module the student joins a research group. This should encourage teamwork and optimal use of informal information Learning to perform of independent academic work taught through advanced research-oriented courses. Introduction to academic work and to scientific and methodological basics required for the master's thesis. Independent acquisition of information, data and literature. Learning the specific technical, numerical or mathematical skills required for the master's thesis. Being able to control the experimental facilities and being able to select required devices and if necessary to purchase them commercially. Being able to evaluate measurements and to make sure that the results are reliable. Practicing the cooperation with the staff of the workshops and institutions.
Contents	Gathering information and background knowledge independently and becoming familiar with the topic of the master's thesis.
Exam	30 – 45 minutes presentation on the topic of the planned master's thesis. The grade of the module does not contribute to the overall grade of the MSc.
Prerequisites for attending	At least 30 CP obtained in the master's programme.

Module 16	**Master's Thesis**
Semester	4th semester
Person in charge	Master's thesis supervisor
Components (course, duration, CP, term)	Independent work on master's thesis (30 CP)
Credit points/ Work load	30 CP / 900 h
Learning targets	The master's thesis completes the scientific education. The goal is to perform a research project in a current field of physical research under the guidance of a scientific supervisor. With the thesis the student demonstrates that she/he is capable of performing independent research work by applying state-of-the-art methodology. Acquisition of scientific key skills: ability to communicate, literature research, assessment of published data, accuracy in experimental work, endurance.
Contents	The student has to work on a current scientific problem in the field of her/his choice under guidance of the supervisor.
Exam	Delivery of the master's thesis. 30 minute concluding presentation of the master's thesis, in which both examiners participate The thesis grade determines the module grade. The grade of the module counts 1/2 to the overall grade of the MSc.
Prerequisites for attending	At least 60 CP obtained in the master's programme.

List of regularly offered courses in the Modules Physical Specialisation

Functional Nanosystems

Seminar on Topics in Nanophysics (seminar, 2 h/w, 2 CP, WS+SS)
Thu 12:15-13:45, IG1 HS3

Nuclear and Particle Physics

Nuclear- and Particle Physics II (lecture, 3 h/w, 3 CP, WS)
Tue 13:15-14:00, Thu 14:15-15:45, KP 104

Introduction to Quantum Field Theory (lecture with exercises, 4+2 h/w, 7 CP, WS)
Tue 12:15-13:45, Fri: 10:15-11:45, KP 404 (lecture); Fri 8:15-9:45 or 15:15-16:45 (exercises)

Introduction to the Standard Model of Particle Physics (lecture with exercises, 4+2 h/w, 6 CP, SS), *Mon 16:00-17:30, Wed 8:30-10:00, KP 304 (lecture); Fri 14.00-15:30 (exercises)*

Introduction to General Relativity and Cosmology (lecture, 4 h/w, 4 CP, SS)
Tue 12:15-13:45, Thu 14:15-15:45, KP 404

Seminar on Nuclear and Particle Physics (seminar, 2 h/w, 2 CP, WS+SS)
Tue 10:15-11:45, KP 104

Seminar on the Theory of Particles and Fields (seminar, 2 h/w, 2 CP, WS+SS)
Wed 10:15-11:45, KP 304

Materials Physics

Materials Physics I (lecture with exercises, 2+1 h/w, 4 CP, WS)
Fri 10:15-13:00, IG1 619 (lecture); Fri 12:15-13:00, IG1 619 (exercises)

Materials Physics II (lecture with exercises, 2+1 h/w, 4 CP, SS)
Fri 10:15-14:00, IG1 619 (lecture); Fri 12:15-13:45, IG1 619 (exercises)

Laboratory Course in Materials Physics (5 h/w, 5 CP, SS)
Wed 13:00-17:00, IG1 619

Nonlinear Physics

Introduction to Nonlinear Physics (lecture with exercises, 2+1 h/w, 4 CP, WS)
Tue 8:15-9:45, AP 222 (lecture); Thu 8:15-9:45 (exercises)

Theoretical Nonlinear Physics I (lecture with exercises, 2+1 h/w, 4 CP, WS)
Tue 14:15-15:45, KP 304 (lecture); Wed 8:15-9:45, KP 303 (exercises)

Theoretical Nonlinear Physics II (lecture with exercises, 2+1 h/w, 4 CP, SS)
Tue 14:15-15:45, KP 304 (lecture); Wed 8:15-9:45, KP 303 (exercises)

Numerical Methods for Complex Systems (lecture with exercises, 2 h/w, 2 CP, WS+SS)
Thu 12:00-14:00, KP 304

Seminar:Theory of Complex Systems (seminar, 2 h/w, 2 CP, WS+SS)
Wed 16:15-17:45, KP 404

Seminar: Nonlinearities in optical and magnetic systems (seminar, 2 h/w, 2 CP, WS+SS)
Thu 10:15-11:45, AP 222

Photonics and Magnonics

Introduction to Photonics (lecture with exercises, 2+1 h/w, 4 CP, WS)
Fri 8:15-9:45, AP HS (lecture); Wed 10:15-11:00, AP 222 (exercises)

Dynamics of Thin Magnetic Layers and Nanostructures (lecture, 2 h/w, 2 CP, WS)
Tue 12:15-13:45, AP 222

Introduction to the Ultrashort Pulse Optics (lecture, 2 h/w, 2 CP, WS)
Tue 14:15-15:45

Aspects of Modern Ultrashort Pulse Optics (lecture and practical course, 2 h/w, 2 CP, WS)
Fri 10:15-11:45

Seminar: Photonics and Data Communication (seminar, 2 h/w, 2 CP, WS+SS)
Wed 8:30-10:00, AP 222

Physics of Low-Dimensional Solids

Introduction to Solid State Theory (lecture with exercises, 3+1 h/w, 5 CP, WS)
Tue,Thu 10:15-11:45, IG1 718

Solid State Theory II (lecture with exercises, 3+1 h/w, 5 CP, SS)
Tue,Thu 10:15-11:45, IG1 718

Integrated Seminar on Current Topics of Low-Dimensional Solids (seminar, 2 h/w, 2 CP, WS+SS) *Wed 10:15-11:45, IG1 718*