Westfälische Wilhelms-Universität Münster

Department of Physics

Commented Course Programme in Physics

MSc in Physics

- Dekanat des Fachbereichs Physik -
September 2015

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 and established the modern Netherlands. Therefore, we traditionally have strong ties to our Dutch neighbours. Nearly 60,000 students live in this town that 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, ensuring 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, comprising about 25 independent research groups that cover a broad range of physics. These courses are open to full time, part time, and exchange students. Moreover, they are open to students studying physics, other natural sciences, mathematics and medicine, both at the undergraduate and graduate level.

As a guideline for the selection of appropriate courses, the following list details the contents of lectures 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 mid-October and ending in mid-February, and a Summer Term beginning in mid-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.

Courses in the Master program will be taught in English upon request. In the laboratory courses, experiments are normally conducted in groups of two students under the supervision of an instructor. Here, English is accepted as a working language for the course work and reports.

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 (Akademisches Auslandsamt) and the Foreign Language Centre (Sprachenzentrum).

We look forward to seeing you in Münster.
Gernot Münster
Dean of Studies
Münster, September 2015

CONTACT

Advice for International Students

Mrs Astrid Burgbacher
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D-48149 Münster
Tel.: +49 (0) 251/ 83-2 22 54; Fax: +49 (0) 251 / 83-2 22 26
e-mail: International.applicants@uni-muenster.de
http://www.uni-muenster.de/international/incoming/index.html

Admissions Requirement and Studies

Studierendensekretariat
Schlossplatz 2
D-48149 Münster
Tel. +49 (0) 251 / 83-2 22 37, -2 47 72
e-mail: studierendensekretariat@uni-muenster.de

for International Students (non EU-Citizens):
http://www.uni-muenster.de/Studierendensekretariat/ausl.html

Language Courses

Sprachenzentrum / Language Centre of the University of Münster
Lehrgebiet Deutsch als Fremdsprache/German as a Foreign Language
Hüfferstrasse 27 III
D-48149 Münster
Tel.: +49 (0) 251/83-3 21 08
Fax: +49 (0) 251/83-3 83 49
e-mail: ldafmail@uni-muenster.de
http://spz.uni-muenster.de/ldaf

Accommodation

Student Welfare Organisation - Studentenwerk Münster -
- Wohnraumverwaltung -
Bismarckallee 5
D-48151 Münster
Tel.: +49 (0) 251 / 83-7 95 60
e-mail: wohnen@studentenwerk-muenster.de
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Tel.: +49 (0) 251 / 83-7 96 46
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http://www.studentenwerk-muenster.de/

Information for ERASMUS Students [Incoming and Outgoing]

Westfälische Wilhelms-Universität Münster
International Office – ERASMUS Office
Leonardo Campus 11
D-48149 Münster
http://www.uni-muenster.de/ERASMUS/

Information for students and teachers concerning ERASMUS activities; contact person for ERASMUS partner universities

1.) LLL Institutional Coordinator
Mrs Anke Kohl
Tel.: +49 (0) 251 / 83-2 26 01; Fax: +49 (0) 251 / 83-2 21 13
e-mail: anke.kohl@uni-muenster.de

2.) Exchange Student Service
Tel.: +49 (0) 251 / 83-2 2113; Fax: +49 (0) 251 / 83-2 14 13
e-mail: admin.ess@uni-muenster.de

3.) For Outgoing students
Heike Afhüppe
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e-mail: erasmus.out@uni-muenster.de

For Language Courses and accommodation see above.

Department of Physics

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Description of Modules for the Study Course

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">Physical Elective Studies
6-18 CP (WPM)</td><td rowspan="2">Physical Specialisation I
14 - 18 CP (WPM)</td><td rowspan="2">Physical Specialisation II
14 - 18 CP (WPM)</td><td rowspan="2">Interdisciplinary Studies
12 – 15 (24) CP (WPM)</td></tr>
<tr><td>2. (SS)</td></tr>
<tr><td>3. (WS)</td><td colspan="4">Professional Specialisation and Project Planning
30 CP (WPM)</td></tr>
<tr><td>4. (SS)</td><td colspan="4">Master’s Thesis
30 CP (WPM)</td></tr>
</table>

WS: Winter Term SS: Summer Term PM: Mandatory Module WPM: Elective Module

The total credit of the modules “Physical elective studies”, “Physical Specialisation I and II“ and “Interdisciplinary Studies” must amount to at least 60 CP.

Module Descriptions

Module 1	**Elective studies in Physics (elective)**
Semester	1st and 2nd semester
Person in charge	Dean of Studies
Components (course, duration, CP, term)	Courses of free choice 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 presence and 2/3 self studies)
Learning targets	This module permits students to obtain knowledge of free choice. With the chosen courses the students are able to integrate new knowledge and decide further specialisation of physical elective modules I and II well-grounded.
Contents	Consultation of person in charge of each course
Exam	To obtain the CPs for a single course, it may be obligatory to submit a project. One has to absolve at least one exam relevant course, e.g. a seminar, to get the CPs allocated. The module grade does not count to the overall grade.
Prerequisites for attending	Consultation of person in charge of each course

Module 2	**Functional Nanosystems (elective)**
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-study)
Learning targets	Advanced knowledge in 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 minute oral-exam The module grade counts 1/6 to the overall grade.
Prerequisites for attending	None

Module 3	**Nuclear and Particle Physics (elective)**
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 – 450 h (approx. 1/3 in-class, 2/3 self-study)
Learning targets	Advanced knowledge and methods of nuclear and particle physics, familiarisation with current topics of research.
Contents	Experimental techniques of nuclear and particle physics Advanced knowledge about 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 Possibly: successful completion of marked written exercises or exams.
Exam	30 – 45 minute oral-exam The module grade counts 1/6 to the overall grade.
Prerequisites for attending	None

Module 4	**Material Physics (elective)**
Semester	1st and 2nd semester
Person in charge	Prof. Dr. Wilde
Components (course, duration, CP, term, time)	**Obligatory parts:** Lecture with exercises: 'Material Physics I' (4 CP), *Fri: 10:15-11:45, IG1 619* *Exercises: Wed: 2:15-3:00, IG1 619* Lecture with exercises: 'Material Physics II' (4 CP), *Fri: 10:15-11:45, IG1 619* *Exercises: Wed: 5:15-6:00, IG1 619* Laboratory course: 'Practical exercises in Material Physics' (5 CP) **Alternative parts:** In agreement with person in charge: Advanced lectures or seminars in the area of material physics or experimental and theoretical solid state physics with a total amount of up to 5 CP Conducting a short research project in a material physics research group with a total amount of up to 5 CP Conducting a short research project as an internship in the industry under scientific guidance of an 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-study)
Learning targets	The module teaches profound knowledge of physical concepts and methods in material science. Courses should enable students to perform active research in current problems of material physics.
Contents	Laboratory course: Experimental methods and basic physical properties of materials Material 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', 'Semi-conductor physics', 'Mechanics of materials', 'Nano-structured materials', 'Simulation methods in material science'
Requirements to meet	- Successful completion of the laboratory course - Successful participation in validated courses
Exam	30 – 45 minute oral-exam The module grade counts 1/6 to the overall grade.
Prerequisites for attending	None

Module 5	**Non-linear Physics (elective)**
Semester	1st and 2nd semester
Person in charge	Prof. Dr. Cornelia Denz, Prof. Dr. S. Linz
Components (course, duration, CP, term)	In agreement with the person in charge: Basic and advanced lectures in 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 making a project participating in a practical course in an enterprise or an external research facility under scientific guidance of an university professor of this module (up to 8 CP).
Credit points/ Work load	14 - 18 CP/ 480 - 540 h (approx. 1/3 in-class, 2/3 self-study)
Learning targets	Understanding of basic concepts of nonlinear physics, the role of nonlinearities in different physical, chemical or biological systems, learning of relevant methods for theoretical and/or experimental analysis of nonlinear systems, obtain ability of application to concrete theoretical and experimental physical problems.
Contents	The module offers theoretical and experimental contents. 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 (i.e. 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 one-hour-exercise Successful participation (including talk/presentation) in a seminar Solving experimental and theoretical problems, including documentation of the solutions
Exam	30 – 45 minute oral exam Counts 1/6 to overall grade.
Prerequisites for attending	None

Module 6	**Photonics and Magnonics (elective)**
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 among the following: - basic lectures with exercises and advanced lectures in photonics and magnonics (at least 4 CP) - Experimental exercises in photonics and magnonics (4 CP) - At least one seminar in photonics and magnonics (at least 2 CP) Alternatively in agreement with person in charge CPs in experimental excercises can be obtained by participating in a research project to an application relevant problem ("Mini-research") or by doing a practical course in an enterprise or an external research facility under scientific guidance of an university professor of this module (up to 8 CP).
Credit points/ Work load	14 - 18 CP/ 480 - 540 h (approx. 1/3 in-class, 2/3 self-study)
Learning targets	Exemplary learning about transmission of basic physical knowledge to application oriented problems at the example of 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	Applied problems on the basis of certain examples; Systematic and advanced treatment of a problem either in optics, photonics, magnonics or the application of waves.
Requirements to meet	Successful completion of exercises for any course in the modulus Successful participation (including talk/presentation) in a seminar in photonics and applied physics of waves Successful completion of an applied problem, including a documentation of the solution for "Experimental exercises on photonics and applied physics of waves" or in one of the above-mentioned projects.
Exam	30 – 45 minute oral-exam Counts 1/6 to overall grade.
Prerequisites for attending	None

Module 7	**Physics of Low-Dimensional Solids (elective)**
Semester	1st and 2nd semester
Person in charge	Prof. Dr. T. Kuhn, Prof. Dr. M. Donath
Components (course, duration, CP, term, time)	In agreement with person in charge 18 CP among the following: Lecture “Introduction to Solid State Theory” with exercises (3+2 CP) *Tue: 10:15-11:45, IG1 718, Thu: 10:15-11:45, IG1 718* At least one advanced lecture in the field of modern experimental solid state physics (at least 2 CP) At least one seminar related to current problems in experimental or theoretical solid state physics (2 CP) Experimental exercises in solid state spectroscopy (4 CP) Optionally additional advanced courses in experimental or theoretical solid state physics (5 CP)
Credit points/ Work load	18 CP / 540 h (approx. 1/3 in-class, 2/3 self-study)
Learning targets	Advanced knowledge of physical phenomena in low-dimensional solid state systems Application of experimental and theoretical techniques for 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 for „Introduction to Solid State Theory“ Successful participation (including talk/presentation) in a seminar related to current problems in experimental or theoretical solid state physics Successful participation in the “Experimental Exercises for solid state spectroscopy” or a successful participation in the exercises for an advanced lecture in solid state theory
Exam	30 – 45 minute oral-exam Counts 1/6 to overall grade.
Prerequisites for attending	None

Module 8	**Physical Specialisation I or II**
Semester	1st and 2nd semester
Person in charge	Supervisors of the modules
Components (course, duration, CP, term)	In agreement with person in charge 14-18 CP in the field of physics. The person in charge normally indicates workload by 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) (At least 8 CP through experimental exercises/practical courses and at least 5 CP of theoretical physics in one of the modules.)
Credit points/ Work load	14-18 CP/ 420-540 h
Learning targets	Consultation of person in charge of each course
Contents	Consultation of person in charge of each course
Exam	In each specialisation: 30 – 45 minute oral-exam Each counts 1/6 to overall grade.
Prerequisites for attending	Consultation of person in charge of each course

Module 9	**Interdisciplinary studies: Business Administration (elective)**
Semester	1st and 2nd Semester
Person in charge	Depending on Module
Components (course, duration, CP, term)	- Business Administration (BA) I (lecture and exercises, 4 h/w, 6 CP, 120 h self-study) - BA II (lecture and exercises, 4 h/w, 120 h self-study, 6 CP) - BA III (lecture and exercises, 4 h/w, 120 h self-study, 6 CP) - BA IV (lecture and exercises, 4 h/w, 120 h self-study, 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 specializations (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 - Adcanced 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:

	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) counts 1/6 to overall grade.
Prerequisites for attending	Documented economic knowledge (lectures) totalling 18 CP (e.g. from bachelor's degree)

Module 10	**Interdisciplinary studies: German as a Foreign Language (elective)**
Semester	1st and 2nd semester
Person in charge	Coordinator of the language centre
Components (course, duration, CP, term)	Choose among the following exercises: German for beginners (A1) (elective, 8 CP, 8 h/w) Advanced German (A2) (elective, 4 CP, 4 h/w) Conversation exercises (elective, 3 CP, 2 h/w) Exercises for reading comprehension (A2.1) (elective, WS, 3 CP, 2 h/w) German phonetics (A2.1) (elective, 3 CP, 2 h/w) Conversation exercises (B1) (elective, WS, 6 CP, 4 h/w) Exercises for reading comprehension (B1) (elective, 3 CP, 2 h/w) Exercises for writing (B1) (elective, 3 CP, 2 h/w) Grammar communicative (B1) (elective, 3 CP, 2 h/w) Conversation exercises and exercises forlistening comprehension (B2) (elective, WS, 6 CP, 4 h/w) Exercises for reading comprehension (B2) (elective, 3 CP, 2 h/w) Exercises for writing (B2) (elective, 3 CP, 2 h/w) Conversation exercises (C1) (elective, 6 CP, 4 h/w) Technical language: science (C1) (elective, SS, 3 CP, 2 h/w) Learning of technical language in a tandem (elective, SS, 6 CP, 4 h/w)
Credit points/ Work load	12-15 CP / 360-450 h
Learning targets	Ability to deal with study-oriented communication and everyday-life situations.
Contents	1. This course is addressed to students without or with a littleprior knowledge in erman 2. Consolidation and extension of prior knowledge 3. Treatment of texts, interviews about different subjects, exercises listening comprehension 4. Improvement in reading comprehension through different reading-techniques 5. Improvement in pronunciation and intonation 6. Preparation of rules and norms of the written language in comparison to the spoken language 7. Preparation of the fundamental grammatical structure 8. Treatment of everyday life- texts and specialized texts with help of reading strategies 9. Improvement in writtenability of expression in an academic context 10. Conversations and discussions about social and study-relevant topics 11. Treatment of authentic specialized texts from different areas of sciences 12. Learning of technical language in a tandem with the aim to create a project (suitable for the subject); the students get language-learning advice and supervision
Exam	Exam (at least A2.1) Counts 1/6 to overall grade
Prerequisites for attending	Only foreign students with a limited language competence in German

Module 11	**Interdisciplinary studies: Geophysics (elective)**
Semester	1st and 2nd semester
Person in charge	Prof. Dr. U. Hansen, Prof. Dr. C. Thomas
Components (course, duration, CP, term, time)	Advanced Geophysics II (lecture and exercises, 6 CP, 4 h/w) *Mon: 2:15-3:45, IG1 88h* *Exercises: Wed: 3:15-4:00,IG1 88h* Choose among the following: Geophysical Fluid Mechanics (lecture and exercises, elective, 4 CP, 3 h/w) Geophysical Basics I (lecture and exercises, elective, 4 CP, 3 h/w) *Mon: 12:30-2:00, IG1 HS1* *Exercises: Wed: 10:15-11:00, 11:15-12:00, GEO 315 or 12:15-1:00, IG1 88h* Advanced Seismology (lecture and exercises, elective, 5 CP, 3 h/w) Geophysical Basics II (lecture and exercises, elective, 4 CP, 3 h/w) *Thu: 12:15-1:45, GEO 315* *Exercises: Thu: 8:15-9:00 or 9:15-10:00, GEO 315* (A 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	*Advanced Geophysics II:* Concepts for describing geophysical continua; Mechanical and thermodynamic conservation laws for describing processes in geophysical continuum mechanics; Material 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 non-linear dynamics and application to the analysis of fluid dynamics phenomena; Stability theory; Flow in rotating systems. *Geophysical Basics I:* Foundation and knowledge of seismology, wave propagation and seismometry; Overview of seismic sources and travel time equation; Introduction to exploration seismic and digital signal processing. Application of concepts to practical examples including processing. *Advanced seismology:* Advanced signal processing of seismic data and arraymethods 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* *Geophysical Basics II:* 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	30 – 45 minute oral-exam Counts 1/6 to overall grade
Prerequisites for attending	None

Module 12	**Interdisciplinary studies: Molecular Biophysics (elective)**
Semester	1st and 2nd semester
Person in charge	Priv.-Doz. Dr. Dreisewerd, Dr. Mormann (medicine)
Components (course, duration, CP, term, time)	Molecular biophysics of cells and tissues I (lecture, 2 CP, 2 h/w, WS) *Mon: 5:15-6:45, Robert-Koch-Straße 31* Molecular biophysics of cells and tissues II (lecture, 2 CP, 2 h/w, SS) *Mon: 5:15-6:45, Robert-Koch-Straße 31* Biophysical methods of molecular biology, cell biology and physiology (lab, 5 CP, 3 h/w, SS) Biophysical methods of molecular biology, cell biology and physiology (lecture, 2 CP, 2 h/w, SS) Selected topics of molecular biophysics (seminar, 1 CP, 1 h/w, WS/SS) Choose among the following: **Mass spectroscopy:** Basics 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), *Lecture: Tue: 4:15-5:00, Albert-Schweizer-Haus* **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) *Lecture: Wed: 4:15-5:00, Robert-Koch-Straße 31* **Noninvasively 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)**,** *Lecture: Tue: 4:15-5:00, Robert-Koch-Straße 31*
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 minute oral-exam Counts 1/6 to overall grade
Prerequisites for attending	None

Module 13	**Interdisciplinary studies: Economics (elective)**
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/exercieses) 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/exercieses) 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/exercieses) 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/exercieses) 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 B achelor'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 chosen module: http://www.wiwi.uni-muenster.de/master_vwl/Studium/po_2012/download/Modulhandbuch_Master_VWL-PO-2012.pdf
Prerequisites for attending	Economic knowledge from bachelor's degree must be present

Module 14	**Interdisciplinary studies**
Semester	1st and 2nd semester
Person in charge	Supervisors of modules
Components (course, duration, CP, term)	In agreement with person in charge 12-15 CP among different fields of study. A high percentage of lectures/labs/seminar needs to be out of the advanced range of master studies. The person in charge normally indicates workload by 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	Consultation of person in charge of each course
Contents	Consultation of person in charge of each course
Exam	30 – 45 minute oral-exam Counts 1/6 to overall grade
Prerequisites for attending	The individual arranged module needs to be approved by the dean of the faculty.

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-study)
Learning targets	Basics of independent academic work taught through advanced research oriented courses. Introduction to academic work and to scientific and methodical basics required for master's thesis Independent acquisition of information, data and literature. Learning of the specific technical and numerical or mathematical skills required for the master's thesis. The student is able to control the experimental facilities and is able to choose required devices and to purchase them commercially. The student is able to evaluate measurements to make sure that the results are reliable. Practice of cooperation with technical equipment of the workshops and institutions. This module integrates the student with a working group to encourage teamwork and optimal use of information
Contents	Independently gathering information and background knowledge and gaining familiarization with the topic of the master's thesis
Exam	30 to 45 minute oral exam The module grade does not count to overall grade.
Prerequisites for attending	At least 45 CP obtained in master studies

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 scientific education. It demonstrates that the student is capable of independent research work applying state of the art methodology. The goal to perform a research project in a current field of physical research under guidance of the scientific supervisor. Acquisition of scientific key skills: ability to communicate, literature research, assessment of published data, accuracy in experimental work, endurance.
Contents	Every student has to work on a current scientific problem in the field of her/his choice under guidance of the supervisor.
Exam	Prepare master's thesis 30 minute concluding presentation of the master's thesis, in which both examiners participate The thesis grade determines the module grade. Counts ½ to overall grade.
Prerequisites for attending	At least 60 CP obtained in master studies