

Attachment 2: module descriptions

Module	LP	graded/ not graded	term which is RPT (WS)	term which is RPT (SoSe)	p.
Compulsory modules					
Molecular and Cellular Biophysics	6	graded	1 st term	2 nd term	18
Foundations of Life-Light-Matter Research	6	graded	1 st	2 nd	10
Lab Course on Life, Light and Matter Research	6	graded	2 nd	1 st	14
In-depth knowledge acquisition	12	graded	3 rd	3 rd	32
Method training	12	graded	3 rd	3 rd	29
Master Thesis Physics of Life, Light, and Matter	30	graded	4 th	4 th	15
Compulsory electives: Within the compulsory electives, you have to study modules with together 42 credit points, among them at least three core modules.					
Core modules					
Atoms and Clusters	6	graded	1 st	2 nd	4
Fundamentals of Photonics	9	graded	1 st	2 nd	11
Molecular physics	9	graded	1 st	2 nd	16
Nonlinear Optics and Spectroscopy	9	graded	2 nd	1 st	22
Simulations Methods of Molecular Biophysics	3	graded	1 st	2 nd	28
Surface Science and Nanostructures	9	graded	1 st	2 nd	30
Complementary modules					
Analysis of structure and dynamics of nanostructured materials	6	graded	2 nd	1 st	3
Computational many-particle physics	6	graded	2 nd	1 st	7
Current problems of physics	6	graded	2 nd	2	2
Fundamentals of Quantum Optics	6	graded	2 nd	1 st	12
Nanotechnology in materials´ synthesis	6	graded	1 st	2	20
Physics and technology of optical fibers	6	graded	2 nd	1 st	24
Quantum optics of macroscopic systems	6	graded	2 nd	1 st	27
Semiconductor Optics	6	graded	1 st	2 nd	13
Electives: Within the electives, you have to study one module with at least 6 credit points from the following catalogue or another module of the university.					
German for International Master's Courses A1 CEFR	6	not graded	3 rd	3 rd	8
Internship Physics	6	not graded	3 rd	3 rd	5
Introduction to Atmospheric Physics and Ocean Physics	6	not graded	3 rd	2 nd	9
Biosystems Modeling and Simulation	6	not graded	2 nd	3 rd	6
Nature-Inspired Computing	6	not graded	2 nd	3 rd	21
Plasma Physics and Astrophysics	9	not graded	2 nd	3 rd	25

Explanation:

LP – credit points RPT – regular examination date

WS – begin of study in winter semester

SoSe –begin of study in summer semester

Edited: 9.12.2015

Category	Content										
Name (German)	Aktuelle Probleme der Physik										
Subtitle											
Name (English)	Current Problems of Physics										
Credit points and total work load	6 180 hours										
Contact person	Director of the Institute of Physics										
Language	German or English (to be announced in the second week)										
Admission restriction	none										
Level	Master course - advanced										
Mandatory prerequisites	none										
Recommended prerequisites	none										
Duration	1 semester										
Term	sporadic										
Learning and qualification objectives (competences)	The students become acquainted with experimental and theoretical methods of a special field of modern physics. They acquire basic knowledge in this special field of physics and are aware of important recent developments and open questions. They know relevant advanced models to describe the physical phenomena. The students get familiar with mathematical methods, analytical as well as numerical, to solve typical problems in physics. They know different approximations and are able to assess their advantages and drawbacks. The students are aware of pros and cons of advanced modern experimental techniques and know how these different methods complement each another. The students are able to start experimental or theoretical scientific work.										
Course contents	depends on topic										
Recommended literature	no										
Semester periods per week (SWS) by type of course	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 60%;">Lecture</td> <td style="text-align: right;">3 SWS</td> </tr> <tr> <td>Seminar</td> <td style="text-align: right;">1 SWS</td> </tr> <tr> <td style="border-top: 1px solid black;">Total</td> <td style="text-align: right; border-top: 1px solid black;">4 SWS</td> </tr> </table>	Lecture	3 SWS	Seminar	1 SWS	Total	4 SWS				
Lecture	3 SWS										
Seminar	1 SWS										
Total	4 SWS										
Work load for students	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 60%;">Classes</td> <td style="text-align: right;">56 hrs.</td> </tr> <tr> <td>Preparation of classes, studying</td> <td style="text-align: right;">64 hrs.</td> </tr> <tr> <td>Solving of exercises</td> <td style="text-align: right;">40 hrs.</td> </tr> <tr> <td>Preparation/examination</td> <td style="text-align: right;">20 hrs.</td> </tr> <tr> <td style="border-top: 1px solid black;">Total work load</td> <td style="text-align: right; border-top: 1px solid black;">180 hrs.</td> </tr> </table>	Classes	56 hrs.	Preparation of classes, studying	64 hrs.	Solving of exercises	40 hrs.	Preparation/examination	20 hrs.	Total work load	180 hrs.
Classes	56 hrs.										
Preparation of classes, studying	64 hrs.										
Solving of exercises	40 hrs.										
Preparation/examination	20 hrs.										
Total work load	180 hrs.										
Prerequisites for the final examination (type and extent)	none										
Test performance/ requirements for a successful examination (type and extent)	<p>Written examination (90 minutes) or oral examination (30 minutes)</p> <p><i>To be announced in the second week of the lecture period.</i></p>										
Number	2350270										

Category	Content												
Name (German)	Analyse der Struktur und Dynamik nanostrukturierter Materialien												
Subtitle													
Name (English)	Analysis of Structure and Dynamics of Nanostructured Materials												
Credit points and total work load	6 180 hours												
Contact person	Prof. Burkel												
Language	German or English (to be announced in the second week)												
Admission restriction	none												
Level	Master course - advanced												
Mandatory prerequisites	none												
Recommended prerequisites	none												
Duration	1 semester												
Term	Summer												
Learning and qualification objectives (competences)	The students get acquainted with important research methods to characterize the structure and the dynamics of new materials. A special focus is laid on methods for modern nano-technology in materials and life sciences. The students study selected techniques. The students are able to read up on current topics of modern physics in the literature.												
Course contents	Research with synchrotron radiation and neutrons at Large Scale Facilities: Sources, instrumentation, spectroscopic methods and scattering techniques with X-rays, neutrons, ions and electrons, imaging methods; microscopy methods; calorimetric techniques; magnetic resonance methods												
Recommended literature	no												
Semester periods per week (SWS) by type of course	<table> <tr> <td>Lecture</td> <td>3 SWS</td> </tr> <tr> <td>Seminar</td> <td>1 SWS</td> </tr> <tr> <td><hr/></td> <td></td> </tr> <tr> <td>Total</td> <td>4 SWS</td> </tr> </table>	Lecture	3 SWS	Seminar	1 SWS	<hr/>		Total	4 SWS				
Lecture	3 SWS												
Seminar	1 SWS												
<hr/>													
Total	4 SWS												
Work load for students	<table> <tr> <td>Classes</td> <td>56 hrs.</td> </tr> <tr> <td>Preparation of classes, studying</td> <td>64 hrs.</td> </tr> <tr> <td>Solving of exercises</td> <td>40 hrs.</td> </tr> <tr> <td>Preparation/examination</td> <td>20 hrs.</td> </tr> <tr> <td><hr/></td> <td></td> </tr> <tr> <td>Total work load</td> <td>180 hrs.</td> </tr> </table>	Classes	56 hrs.	Preparation of classes, studying	64 hrs.	Solving of exercises	40 hrs.	Preparation/examination	20 hrs.	<hr/>		Total work load	180 hrs.
Classes	56 hrs.												
Preparation of classes, studying	64 hrs.												
Solving of exercises	40 hrs.												
Preparation/examination	20 hrs.												
<hr/>													
Total work load	180 hrs.												
Prerequisites for the final examination (type and extent)	Presentation												
Test performance/ requirements for a successful examination (type and extent)	Written examination (90 minutes) or oral examination (30 minutes) <i>To be announced in the second week of the lecture period.</i>												
Number	2350300												

Category	Content
Name (German)	Atoms and Clusters
Subtitle	
Name (English)	Atoms and Clusters
Credit points and total work load	6 180 hours
Contact person	Prof. Meiwes-Broer, Prof. Fennel
Language	English
Admission restriction	none
Level	Master course - basic
Mandatory prerequisites	none
Recommended prerequisites	none
Duration	1 semester
Term	Winter
Learning and qualification objectives (competences)	The students become acquainted with experimental and theoretical methods of atomic and cluster physics. They acquire basic knowledge in this special field of physics and are aware of important recent developments and open questions. They know relevant advanced models to describe the physical phenomena. The students get familiar with mathematical methods, analytical as well as numerical, to solve typical problems in atomic and cluster physics. They know different approximations and are able to assess their advantages and drawbacks. The students are aware of pros and cons of advanced modern experimental techniques and know how these different methods complement each another. The students are able to start experimental or theoretical scientific work in a group working in this field.
Course contents	Atoms: electronic structure, atom-field interactions, QED effects (spontaneous emission), higher-order perturbation theory, magnetic and optical traps, Bose-Einstein condensates, cold fermions, atoms in strong fields, photoionization, generation of high harmonics, inner shell effects, electron correlations Clusters: bonding types, cluster generation, shell models, jellium approximation, electronic structure, fullerenes, nonmetal-metal transition, density-functional theory, polarizability, linear response, sum rules, collective resonances, spectroscopy, optical properties, spin effects, clusters in Helium droplets, on surfaces, in strong fields; nanoplasmas
Recommended literature	none
Semester periods per week (SWS) by type of course	Lecture 4 SWS Seminar 1 SWS Total 5 SWS
Work load for students	Classes 70 hrs. Preparation of classes, studying 60 hrs. Solving of exercises 30 hrs. Preparation/examination 20 hrs. Total work load 180 hrs.
Prerequisites for the final examination (type and extent)	50 % of achievable points solving exercises
Test performance (type and extent)	Written examination (90 minutes) or oral examination (30 minutes) <i>To be announced in the second week of the lecture period.</i>
Number	2350310

Category	Content								
Name (German)	Berufspraktikum Physik								
Subtitle									
Name (English)	Internship Physics								
Credit points and total work load	6 180 hours								
Contact person	Head of examination board								
Language	German or English (to be announced in the second week)								
Admission restriction	none								
Level	Master course - basic								
Mandatory prerequisites	none								
Recommended prerequisites	none								
Duration	1 semester								
Term	Every semester								
Learning and qualification objectives (competences)	The students work in an enterprise or institute with the job profile of a physicist. They gain first experience in a real working environment and get confronted with practical project-oriented, organizational, and social situations. The students get experience to prepare for a job application.								
Course contents									
Recommended literature	no								
Semester periods per week (SWS) by type of course	_____								
	Total 0 SWS								
Work load for students	<table> <tr> <td>Internship</td> <td>160 hrs.</td> </tr> <tr> <td>Preparation/examination</td> <td>20 hrs.</td> </tr> <tr> <td><hr/></td> <td></td> </tr> <tr> <td>Total work load</td> <td>180 hrs.</td> </tr> </table>	Internship	160 hrs.	Preparation/examination	20 hrs.	<hr/>		Total work load	180 hrs.
Internship	160 hrs.								
Preparation/examination	20 hrs.								
<hr/>									
Total work load	180 hrs.								
Prerequisites for the final examination (type and extent)	none								
Test performance/ requirements for a successful examination (type and extent)	Report (2-3 pages)								
Number	2350320								

Category	Content
Name (German)	Biosystems Modeling and Simulation
Subtitle	
Name (English)	Biosystems Modeling and Simulation
Credit points and total work load	6 180 hours
Contact person	Lehrstuhl für Systembiologie und Bioinformatik
Language	English
Admission restriction	none

Level	Master course - advanced
Mandatory prerequisites	no
Recommended prerequisites	While this course is an introduction, a basic understanding of mathematical modelling (e.g. Markov processes, differential equations) is recommended. No prior knowledge of biological topics is necessary. The biological and biochemical background is introduced in the lectures.

Duration	1 semester
Term	Summer

Learning and qualification objectives (competences)	<p>This course is an introduction to the interdisciplinary research field of systems biology; combining systems theory with applications to biological systems. Using experimental data and information from biological databases, systems biology investigates networks of biochemical reactions that are underlying the functioning of living cells and disease mechanisms. This course introduces basic techniques for mathematical modelling and computational simulations of nonlinear dynamic systems. While the mathematics is of a general nature, dealing with basic stochastic and differential equation models of dynamic systems, we introduce applications and case studies from modern life sciences. The course enables to:</p> <ul style="list-style-type: none"> • formulate models of nonlinear dynamic systems • formulate models of stochastic processes • translate a given (biological) problem into a mathematical representation • analyze the dynamical system properties with various mathematical methods
Course contents	<ul style="list-style-type: none"> - Biochemical reaction networks - Systems theory - Experimental data generation - Modelling biochemical reactions - Stochastic modeling and simulation - Nonlinear dynamics - Pathway modelling - Dynamic motifs and modules - Feedback, regulation and control - Tools and databases
Recommended literature	none

Semester periods per week (SWS) by type of course	Lecture	3 SWS
	Exercise	1 SWS
	Total	4 SWS
Work load for students	Classes	55 hrs.
	Preparation of classes, studying	45 hrs.
	Solving of exercises	30 hrs.
	Preparation/examination	50 hrs.
	Total work load	180 hrs.

Course specific examination and study rules for M.Sc. Physics of Life, Light, and Matter

Attachment 2: module descriptions [refers to Anlage 2 of „Studiengangsspezifische Prüfungs- und Studienordnung für den Masterstudiengang Physics of Life, Light and Matter an der Universität Rostock vom 12. Mai 2015 (SPSO)“]

Prerequisites for the final examination (type and extent)	none
Test performance/ requirements for a successful examination (type and extent)	Written examination (90 minutes)
Number	1150170

Category	Content								
Name (German)	Deutsch für internationale Masterstudiengänge A1 GER								
Subtitle									
Name (English)	German for International Master's Courses A1 CEFR								
Credit points and total work load	6 180 hours								
Contact person	Language Centre								
Language	German								
Admission restriction	none								
Level	Language level A1 GER								
Mandatory prerequisites	none								
Recommended prerequisites	Entry-level test								
Duration	1 semester								
Term	Every semester								
Learning and qualification objectives (competences)	<p>The course enables students to</p> <ul style="list-style-type: none"> • cope with familiar everyday situations in their university environment appropriately; • reply to questions and ask for/ provide simple information • read simple texts written in standard language and dealing with topics they are familiar with • write simple texts and speak about topics of personal interest they are familiar with and to express their own impressions and opinions <p>Students learn and practise communication strategies such as paraphrasing, inferring the meaning of unknown vocabulary from the context, and learning strategies, such as using a dictionary.</p>								
Course contents	Students learn and practise communication strategies such as paraphrasing, inferring the meaning of unknown vocabulary from the context, and learning strategies, such as using a dictionary.								
Recommended literature	none								
Semester periods per week (SWS) by type of course	<table> <tr> <td>Excercise course</td> <td>8 SWS</td> </tr> <tr> <td>Total</td> <td>8 SWS</td> </tr> </table>	Excercise course	8 SWS	Total	8 SWS				
Excercise course	8 SWS								
Total	8 SWS								
Work load for students	<table> <tr> <td>Classes</td> <td>118 hrs.</td> </tr> <tr> <td>Preparation of classes, studying</td> <td>56 hrs.</td> </tr> <tr> <td>Preparation/examination</td> <td>6 hrs.</td> </tr> <tr> <td>Total work load</td> <td>180 hrs.</td> </tr> </table>	Classes	118 hrs.	Preparation of classes, studying	56 hrs.	Preparation/examination	6 hrs.	Total work load	180 hrs.
Classes	118 hrs.								
Preparation of classes, studying	56 hrs.								
Preparation/examination	6 hrs.								
Total work load	180 hrs.								
Prerequisites for the final examination (type and extent)	Regular attendance (at least 80 % - documented by attendance list)								
Test performance/ requirements for a successful examination (type and extent)	<table> <tr> <td>1st Exam:</td> <td>Written examination (60 - 90 minutes)</td> </tr> <tr> <td>2nd Exam:</td> <td>Oral examination (15 minutes)</td> </tr> </table>	1st Exam:	Written examination (60 - 90 minutes)	2nd Exam:	Oral examination (15 minutes)				
1st Exam:	Written examination (60 - 90 minutes)								
2nd Exam:	Oral examination (15 minutes)								
Number	9109090								

Category	Content
Name (German)	Einführung in die Atmosphärenphysik und in die Physik des Ozeans
Subtitle	
Name (English)	Introduction to Atmospheric Physics and Ocean Physics
Credit points and total work load	6 180 hours
Contact person	Prof. Dr. F.-J. Lübken (Atmosphärenphysik/ Atmospheric Physics) Dr. V. Mohrholz (Physik des Ozeans/ Ocean Physics)
Language	German or English (to be announced in the second week)
Admission restriction	none
Level	Master course - basic
Mandatory prerequisites	none
Recommended prerequisites	none
Duration	1 semester
Term	Winter
Learning and qualification objectives (competences)	The students become acquainted with concepts and phenomena in Atmospheric Physics and Ocean Physics. On this basis, they are able to start experimental or theoretical work in a scientific working group in this field. They have an overview of the relevant knowledge in these fields. They are aware of important recent developments. They acquire a basic experimental and theoretical knowledge in these fields, and have therefore the fundament for a profound specialisation.
Course contents	Fundamental physical processes in the atmosphere: Structure of the atmosphere, basic physical concepts and equations, energy balance, creation of layers, depth of penetration of solar radiation, ozone layer, equations of motion. Fundamental physical processes in the ocean: basic concepts, vertical structure Principles of ocean dynamics: equation of motion, reaction to forcing, waves, tides, thermohaline circulation, observational methods.
Recommended literature	none
Semester periods per week (SWS) by type of course	Lecture 4 SWS Excercise course 1 SWS Total 5 SWS
Work load for students	Classes 70 hrs. Preparation of classes, studying 60 hrs. Solving of excercises 30 hrs. Preparation/examination 20 hrs. Total work load 180 hrs.
Prerequisites for the final examination (type and extent)	Solution of 50 % of the requested exercises
Test performance/ requirements for a successful examination (type and extent)	Written examination (90 minutes) or oral examination (30 minutes) <i>To be announced in the second week of the lecture period.</i>
Number	2350190

Category	Content
Name (German)	Foundations of Life, Light and Matter Research
Subtitle	
Name (English)	Foundations of Life, Light and Matter Research
Credit points and total work load	6 180 hours
Contact person	Prof. Dr. S. Speller, Prof. S. Lochbrunner
Language	English
Admission restriction	none
Level	Master course - basic
Mandatory prerequisites	none
Recommended prerequisites	none
Duration	1 semester
Term	Winter
Learning and qualification objectives (competences)	The students become acquainted with the basics of quantum mechanics in atomic, molecular and solid state physics. They know relevant models and approximations for the description of physical phenomena in these fields, and they can apply them. They know important experimental techniques for different physical quantities. They are able to familiarize themselves with advanced topics by using the literature.
Course contents	Quantum physics: wave particle dualism, wave function, Schrödinger equation Atomic physics: hydrogen atom, spin, shell model, periodic system, absorption and emission of light Molekular physics: bindung, rotation, vibration Solid state physics: crystal structure, band model, phonons
Recommended literature	no
Semester periods per week (SWS) by type of course	Lecture 3 SWS Excercise course 2 SWS Total 5 SWS
Work load for students	Classes 70 hrs. Preparation of classes, studying 50 hrs. Solving of excercises 40 hrs. Preparation/examination 20 hrs. Total work load 180 hrs.
Prerequisites for the final examination (type and extent)	Solution of 50 % of the requested exercises
Test performance/ requirements for a successful examination (type and extent)	Written examination (120 minutes) or oral examination (30 minutes) <i>To be announced in the second week of the lecture period.</i>
Number	2350560

Category	Content										
Name (German)	Fundamentals of Photonics										
Subtitle											
Name (English)	Fundamentals of Photonics										
Credit points and total work load	9 270 hours										
Contact person	Prof. Scheel, Prof. Hage										
Language	English										
Admission restriction	none										
Level	Master course - advanced										
Mandatory prerequisites	none										
Recommended prerequisites	none										
Duration	1 semester										
Term	Winter										
Learning and qualification objectives (competences)	<p>The students have an overview of the relevant knowledge in the field. They are aware of important recent developments and open questions. The students become acquainted with experimental and theoretical methods of the field and their usefulness for particular physical problems. The students are familiar with mathematical techniques necessary to understand these methods.</p> <p>The students know pros and cons of different experimental methods, and how these different methods complement one another.</p> <p>They know relevant models and approximations to describe the physical phenomena. They are aware of the limits of the models.</p>										
Course contents	Geometric optics, refraction, reflection, Electromagnetic waves, diffraction, interference, polarisation, coherence, Nonlinear optics, 2nd order and 3rd order nonlinear effects, Field quantisation, quantum states and their properties Transformation optics, metamaterials, Laser physics, Photodetection										
Recommended literature	no										
Semester periods per week (SWS) by type of course	<table> <tr> <td>Lecture</td> <td>4 SWS</td> </tr> <tr> <td>Excercise course</td> <td>2 SWS</td> </tr> <tr> <td><u>Total</u></td> <td><u>6 SWS</u></td> </tr> </table>	Lecture	4 SWS	Excercise course	2 SWS	<u>Total</u>	<u>6 SWS</u>				
Lecture	4 SWS										
Excercise course	2 SWS										
<u>Total</u>	<u>6 SWS</u>										
Work load for students	<table> <tr> <td>Classes</td> <td>84 hrs.</td> </tr> <tr> <td>Preparation of classes, studying</td> <td>96 hrs.</td> </tr> <tr> <td>Solving of excercises</td> <td>60 hrs.</td> </tr> <tr> <td><u>Preparation/examination</u></td> <td><u>30 hrs.</u></td> </tr> <tr> <td><u>Total work load</u></td> <td><u>270 hrs.</u></td> </tr> </table>	Classes	84 hrs.	Preparation of classes, studying	96 hrs.	Solving of excercises	60 hrs.	<u>Preparation/examination</u>	<u>30 hrs.</u>	<u>Total work load</u>	<u>270 hrs.</u>
Classes	84 hrs.										
Preparation of classes, studying	96 hrs.										
Solving of excercises	60 hrs.										
<u>Preparation/examination</u>	<u>30 hrs.</u>										
<u>Total work load</u>	<u>270 hrs.</u>										
Prerequisites for the final examination (type and extent)	Solution of 50 % of the requested exercises										
Test performance/ requirements for a successful examination (type and extent)	<p>Written examination (120 minutes) or oral examination (30 minutes)</p> <p><i>To be announced in the second week of the lecture period.</i></p>										
Number	2350350										

Category	Content
Name (German)	Grundlagen der Quantenoptik
Subtitle	
Name (English)	Fundamentals of Quantum Optics
Credit points and total work load	6 180 hours
Contact person	Prof. Dr. Vogel, Prof. Dr. Hage
Language	German or English (to be announced in the second week)
Admission restriction	none
Level	Master course - basic
Mandatory prerequisites	none
Recommended prerequisites	none
Duration	1 semester
Term	Summer
Learning and qualification objectives (competences)	The students have an overview of the relevant knowledge in the field. They are aware of important recent developments and open questions. The students become acquainted with experimental and theoretical methods of the field and their usefulness for particular physical problems. The students are familiar with mathematical techniques necessary to understand these methods. The students know pros and cons of different experimental methods, and how these different methods complement one another. The students become acquainted with a special field of modern physics. On this basis, they are able to start experimental or theoretical work in a scientific working group in this field.
Course contents	quantum optical measurement schemes, phase-space distributions, reconstruction of quantum states; nonclassical properties of light and matter; verification of quantum entanglement and general nonclassical features; probing quantum physics (Bell inequality), quantum cryptography; nonclassical interferometry, quantum optomechanics.
Recommended literature	none
Semester periods per week (SWS) by type of course	Lecture 3 SWS Seminar 1 SWS Total 4 SWS
Work load for students	Classes 56 hrs. Preparation of classes, studying 64 hrs. Solving of exercises 40 hrs. Preparation/examination 20 hrs. Total work load 180 hrs.
Prerequisites for the final examination (type and extent)	Solution of 50% of the requested exercises
Test performance/ requirements for a successful examination (type and extent)	Written examination (90 minutes) or oral examination (30 minutes) <i>To be announced in the second week of the lecture period.</i>
Number	2350360

Category	Content
Name (German)	Halbleiteroptik
Subtitle	
Name (English)	Semiconductor Optics
Credit points and total work load	6 180 hours
Contact person	Prof. Dr. Stolz
Language	German or English (to be announced in the second week)
Admission restriction	none
Level	Master course - advanced
Mandatory prerequisites	none
Recommended prerequisites	none
Duration	1 semester
Term	Winter
Learning and qualification objectives (competences)	The students acquire a deepened understanding of semiconductor physics and optical processes in semiconductors. They know the relevant processes. They are able to solve particular problems in semiconductor optics. The students are able to read up on current topics of modern physics in the literature. The students are able to give a good-quality talk (presentation) on a complex topic of modern physics. They can conduct a scientific discussion.
Course contents	band model; application of group theory in semiconductor physics; phonons, electron-phonon interaction; transport processes; optical processes, excitons, dense electron-hole plasmas, Bose-Einstein condensation; nanostructures, quantum wells, quantum dots; microcavities, polaritons; semiconductor laser
Recommended literature	none
Semester periods per week (SWS) by type of course	Lecture 2 SWS Seminar 2 SWS Total 4 SWS
Work load for students	Classes 56 hrs. Preparation of classes, studying 64 hrs. Solving of exercises 40 hrs. Preparation/examination 20 hrs. Total work load 180 hrs.
Prerequisites for the final examination (type and extent)	none
Test performance/ requirements for a successful examination (type and extent)	Colloquium (40 minutes)
Number	2350090

Category	Content								
Name (German)	Masterarbeit Physics of Life, Light and Matter								
Subtitle									
Name (English)	Master Thesis Physics of Life, Light and Matter								
Credit points and total work load	30 900 hours								
Contact person	Prof. Dr. H. Stolz								
Language	English								
Admission restriction	none								
Level	Master course - specializing								
Mandatory prerequisites	Record of at least 72 credit points in the study program.								
Recommended prerequisites	none								
Duration	1 semester								
Term	Every semester								
Learning and qualification objectives (competences)	<p>The students get acquainted to a new area of research, they are able to read up on this subject in the literature. They familiarize themselves with measurement methods and are able to master the operation of complex measuring equipment. Or they get acquainted with theoretical concepts and learn to apply scientific computer codes to solve problems numerically.</p> <p>The students work well with others in a team.</p> <p>They are able to discuss complex physical facts and own results referring to the current state of research. They can present this in a scientific work as well as in a talk. In a scientific discussion, they can deal with critical questions and properly present their own results.</p> <p>The students follow the rules of good scientific practice.</p>								
Course contents									
Recommended literature	no								
Semester periods per week (SWS) by type of course	<table border="0"> <tr> <td>Consultation</td> <td>1 SWS</td> </tr> <tr> <td><hr/></td> <td></td> </tr> <tr> <td>Total</td> <td>1 SWS</td> </tr> </table>	Consultation	1 SWS	<hr/>		Total	1 SWS		
Consultation	1 SWS								
<hr/>									
Total	1 SWS								
Work load for students	<table border="0"> <tr> <td>Classes</td> <td>14 hrs.</td> </tr> <tr> <td>Preparation/examination</td> <td>886 hrs.</td> </tr> <tr> <td><hr/></td> <td></td> </tr> <tr> <td>Total work load</td> <td>900 hrs.</td> </tr> </table>	Classes	14 hrs.	Preparation/examination	886 hrs.	<hr/>		Total work load	900 hrs.
Classes	14 hrs.								
Preparation/examination	886 hrs.								
<hr/>									
Total work load	900 hrs.								
Prerequisites for the final examination (type and extent)	none								
Test performance/ requirements for a successful examination (type and extent)	<p>1st Exam: thesis (20 weeks)</p> <p>2nd Exam: colloquium (40 minutes)</p>								
Number	2350580								

Category	Content
Name (German)	Molecular Physics
Subtitle	
Name (English)	Molecular Physics
Credit points and total work load	9 270 hours
Contact person	Prof. Lochbrunner, Prof. Kühn
Language	English
Admission restriction	none

Level	Master course - advanced
Mandatory prerequisites	none
Recommended prerequisites	none

Duration	1 semester
Term	Winter

Learning and qualification objectives (competences)	<p>The students have an overview of the relevant knowledge in molecular physics. The students become acquainted with experimental and theoretical methods of the field. On this basis, they are able to start experimental or theoretical work in a scientific working group in this field. They are aware of important recent developments in the field and of open questions.</p> <p>The students become acquainted with experimental and theoretical methods of the field and their usefulness for particular physical problems. The students are familiar with mathematical techniques necessary to understand these methods.</p> <p>The students know pros and cons of different experimental methods, and how these different methods complement one another.</p> <p>The students are able to read up on current topics of modern physics in the literature.</p>
Course contents	<p>Fundamentals: Molecular Schrödinger equation, Born-Oppenheimer approximation, potential energy surfaces, non-adiabatic transitions, conical intersections, electron structure theory, bond types, and structure of molecules.</p> <p>Dynamics: Rotation, libration, vibration, normal modes, anharmonicities, wave packet dynamics, system-bath coupling, dissipative dynamics, and rate theories.</p> <p>Elementary processes: Optical excitation, relaxation, dephasing, solvation, chemical reactions, charge transfer, and energy transfer.</p> <p>Systems: Isolated molecules and molecules in solution, biomolecules, supramolecular complexes and aggregates, molecular materials and organic electronics.</p> <p>Experimental techniques: Stationary and time-resolved absorption spectroscopy, fluorescence, infrared and THz spectroscopy, and Raman scattering.</p>
Recommended literature	no

Semester periods per week (SWS) by type of course	Lecture	4 SWS
	Seminar	1 SWS
	Excercise course	1 SWS
	<hr/> Total	6 SWS
Work load for students	Classes	84 hrs.
	Preparation of classes, studying	116 hrs.
	Solving of excercises	40 hrs.
	Preparation/examination	30 hrs.
	<hr/> Total work load	270 hrs.

Course specific examination and study rules for M.Sc. Physics of Life, Light, and Matter

Attachment 2: module descriptions [refers to Anlage 2 of „Studiengangsspezifische Prüfungs- und Studienordnung für den Masterstudiengang Physics of Life, Light and Matter an der Universität Rostock vom 12. Mai 2015 (SPSO)“]

Prerequisites for the final examination (type and extent)	Presentation
Test performance/ requirements for a successful examination (type and extent)	Written examination (120 minutes) or oral examination (30 minutes) <i>To be announced in the second week of the lecture period.</i>
Number	2350380

Category	Content								
Name (German)	Molecular and Cellular Biophysics								
Subtitle									
Name (English)	Molecular and Cellular Biophysics								
Credit points and total work load	6 180 hours								
Contact person	Prof. Dr. J. Kolb (INP Greifswald), Prof. Dr. S. Speller, Prof. Dr. S. Lochbrunner								
Language	English								
Admission restriction	none								
Level	Master course - basic								
Mandatory prerequisites	none								
Recommended prerequisites	none								
Duration	1 semester								
Term	Winter								
Learning and qualification objectives (competences)	<p>The students have an overview of the relevant knowledge in biophysics on a molecular and cellular level. The students become acquainted with concepts, methodical aspects and basics models of the field. On this basis, they are able to start an experimental or theoretical master thesis in a scientific working group in this field.</p> <p>They are aware of important recent developments in the field and of open questions. They know relevant models and approximations to describe the physical phenomena in this field. The students become acquainted with experimental techniques of the field and their usefulness for particular physical quantities. The students are able to read up on current topics of modern physics in the literature.</p>								
Course contents	<p>Introduction to Biomolecules and Cells</p> <ul style="list-style-type: none"> - Biomolecules, structure and function: amino acids, proteins, enzymes, nucleic acids, DNA - Central dogma: biosynthesis, transcription, translation - Membranes and transport channels - Structure and organelles of cells - Cellular programs: division, differentiation, repair, apoptosis, cancer - Transport and traffic <p>Electric Properties and Fields</p> <ul style="list-style-type: none"> - Electrical properties of cell membranes: resting potential, Nernst equation, Goldman-Hodgkin-Katz equation, excitable vs non-excitable cells, Hodgkin-Huxley membrane model - Manipulation of cellular properties and functions by pulsed electric fields, electromagnetic exposures, and non-thermal plasmas, and their application towards diagnostic and treatment of disease <p>Nanoprobing and Biophysical Interactions</p> <ul style="list-style-type: none"> - NanoProbing methods for biology - Protein layers and specific binding - Aspects of cell-surface contacts <p>Optical Techniques in Biophysics</p> <ul style="list-style-type: none"> - Microscopy: principles, confocal, multi-photon, super resolution, Raman - Fluorescence and Förster transfer 								
Recommended literature	none								
Semester periods per week (SWS) by type of course	<table border="0"> <tr> <td>Lecture</td> <td>3 SWS</td> </tr> <tr> <td>Seminar</td> <td>1 SWS</td> </tr> <tr> <td><hr/></td> <td></td> </tr> <tr> <td>Total</td> <td>4 SWS</td> </tr> </table>	Lecture	3 SWS	Seminar	1 SWS	<hr/>		Total	4 SWS
Lecture	3 SWS								
Seminar	1 SWS								
<hr/>									
Total	4 SWS								

Work load for students	Classes	56 hrs.
	Preparation of classes, studying	64 hrs.
	Solving of exercises	40 hrs.
	Preparation/examination	20 hrs.
	Total work load	180 hrs.
Prerequisites for the final examination (type and extent)	Presentation	
Test performance/ requirements for a successful examination (type and extent)	Written examination (120 minutes) or oral examination (30 minutes) <i>To be announced in the second week of the lecture period.</i>	
Number	2350390	

Category	Content
Name (German)	Nanotechnologie in der Materialsynthese
Subtitle	
Name (English)	Nanotechnology in Materials Synthesis
Credit points and total work load	6 180 hours
Contact person	Prof. Burkel
Language	German or English (to be announced in the second week)
Admission restriction	none
Level	Master course - basic
Mandatory prerequisites	none
Recommended prerequisites	none
Duration	1 semester
Term	Winter
Learning and qualification objectives (competences)	The students acquire a deepened knowledge in solid state physics with focus on material science problems. They know relevant nano-techniques to produce new materials. New material's properties are discussed for important applications by the students themselves in seminar contributions. The students know the recent developments and open questions in the field.
Course contents	Material science basics: Phase diagrams, diffusion, mechanical properties, equilibrium and nonequilibrium synthesis methods; Physical and chemical synthesis and structuring methods for new (nano) materials: Layers and layer systems, nanoparticles and nanostructured materials, cluster, lithography, atomic and molecular manipulation; Properties and application of new materials for biomedical and construction technology, regenerative energy economy, Molecular electronics, magnetic materials, materials for fuel cells, heterogenous catalysis and sensors.
Recommended literature	no
Semester periods per week (SWS) by type of course	Lecture 3 SWS Seminar 1 SWS Total 4 SWS
Work load for students	Classes 56 hrs. Preparation of classes, studying 64 hrs. Solving of excercises 40 hrs. Preparation/examination 20 hrs. Total work load 180 hrs.
Prerequisites for the final examination (type and extent)	Presentation
Test performance/ requirements for a successful examination (type and extent)	Written examination (90 minutes) or oral examination (30 minutes)
Number	2350140

Category	Content												
Name (German)	Nature-Inspired Computing												
Subtitle													
Name (English)	Nature-Inspired Computing												
Credit points and total work load	6 180 hours												
Contact person	Prof. Dr. Salomon												
Language	German or English (to be announced in the second week)												
Admission restriction	none												
Level	Master course - advanced												
Mandatory prerequisites	none												
Recommended prerequisites	none												
Duration	1 semester												
Term	Summer												
Learning and qualification objectives (competences)	The students get an overview of common learning and optimization concepts in nature and biology which are relevant for the development and optimization of technical systems. Thus it is an interesting complement to the classic study course of engineering. Repetition, understanding, application: Realization and application of biologically inspired learning techniques, usage of neuronal networks in technology. Analysis, synthesis: design and functional principles of mobile agents. Evaluation: technical utilization of basic principles of evolutionary optimization. Personal and social skills: autonomy and personal responsibility, project management, cooperation and ability to work in a team, interdisciplinary thinking.												
Course contents	design and development of technical systems, particularly their self-X features, may significantly benefit from the incorporation of nature-inspired methods, since they have evolved numerous optimal solutions in nature. This module describes a selection of these methods, and shows how they can be adapted to technical problems. The chosen content will be announced at the beginning of the class as it is influenced by current trends in research and development.												
Recommended literature	no												
Semester periods per week (SWS) by type of course	<table> <tr> <td>Lecture</td> <td>2 SWS</td> </tr> <tr> <td>Seminar</td> <td>1 SWS</td> </tr> <tr> <td>Excercise course</td> <td>2 SWS</td> </tr> <tr> <td><hr/></td> <td></td> </tr> <tr> <td>Total</td> <td>5 SWS</td> </tr> </table>	Lecture	2 SWS	Seminar	1 SWS	Excercise course	2 SWS	<hr/>		Total	5 SWS		
Lecture	2 SWS												
Seminar	1 SWS												
Excercise course	2 SWS												
<hr/>													
Total	5 SWS												
Work load for students	<table> <tr> <td>Classes</td> <td>70 hrs.</td> </tr> <tr> <td>Preparation of classes, studying</td> <td>20 hrs.</td> </tr> <tr> <td>Self-study</td> <td>40 hrs.</td> </tr> <tr> <td>Preparation/examination</td> <td>50 hrs.</td> </tr> <tr> <td><hr/></td> <td></td> </tr> <tr> <td>Total work load</td> <td>180 hrs.</td> </tr> </table>	Classes	70 hrs.	Preparation of classes, studying	20 hrs.	Self-study	40 hrs.	Preparation/examination	50 hrs.	<hr/>		Total work load	180 hrs.
Classes	70 hrs.												
Preparation of classes, studying	20 hrs.												
Self-study	40 hrs.												
Preparation/examination	50 hrs.												
<hr/>													
Total work load	180 hrs.												
Prerequisites for the final examination (type and extent)	none												
Test performance/ requirements for a successful examination (type and extent)	<table> <tr> <td>1st Exam:</td> <td>Oral examination (15 minutes)</td> </tr> <tr> <td>2nd Exam:</td> <td>Project work (40 Stunden)</td> </tr> </table>	1st Exam:	Oral examination (15 minutes)	2nd Exam:	Project work (40 Stunden)								
1st Exam:	Oral examination (15 minutes)												
2nd Exam:	Project work (40 Stunden)												
Number	1351080												

Category	Content										
Name (German)	Nonlinear Optics and Spectroscopy										
Subtitle											
Name (English)	Nonlinear Optics and Spectroscopy										
Credit points and total work load	9 270 hours										
Contact person	Prof. Lochbrunner, Prof. Kühn, Prof. Meiwes-Broer										
Language	English										
Admission restriction	none										
Level	Master course - advanced										
Mandatory prerequisites	none										
Recommended prerequisites	none										
Duration	1 semester										
Term	Summer										
Learning and qualification objectives (competences)	<p>The students have an overview of the relevant knowledge in Nonlinear Optics and Spectroscopy. The students become acquainted with experimental and theoretical methods of the field. On this basis, they are able to start experimental or theoretical work in a scientific working group in this field. They are aware of important recent developments in the field and of open questions.</p> <p>The students know relevant models and approximations to describe physical phenomena in the field. The students become acquainted with experimental and theoretical methods of the field and their usefulness for particular physical problems. The students are familiar with mathematical techniques necessary to understand these methods. The students know pros and cons of different experimental methods, and how these different methods complement one another.</p> <p>The students are able to read up on current topics of modern physics in the literature. The students are able to give a good-quality talk (presentation) on a complex topic of modern physics.</p>										
Course contents	<p>Fundamentals: Propagation of light in matter, the concept of polarization, electromagnetic transitions, line width, symmetry and selection rules, correlation function, Brownian oscillator model, relaxation and dephasing.</p> <p>Linear Spectroscopy: Absorption, fluorescence, Franck-Condon factors, FTIR spectroscopy, Rayleigh, Raman, and resonance-Raman scattering, photoelectron and mass spectroscopy, molecular beams, and ion traps.</p> <p>Nonlinear light-matter-interaction: Nonlinear polarization, nonlinear susceptibilities, frequency mixing in nonlinear crystals, Kerr effect, self-phase modulation, multiphoton ionization, laser plasma, Coulomb explosion, attosecond pulses, and free electron laser.</p> <p>Nonlinear Spectroscopy: multiphoton, Doppler free, and saturation spectroscopy, response function, four wave mixing, pump-probe spectroscopy, photon-echo and multidimensional spectroscopy, and coherent control.</p>										
Recommended literature	none										
Semester periods per week (SWS) by type of course	<table border="0"> <tr> <td>Lecture</td> <td>4 SWS</td> </tr> <tr> <td>Seminar</td> <td>1 SWS</td> </tr> <tr> <td>Excercise course</td> <td>1 SWS</td> </tr> <tr> <td><hr/></td> <td></td> </tr> <tr> <td>Total</td> <td>6 SWS</td> </tr> </table>	Lecture	4 SWS	Seminar	1 SWS	Excercise course	1 SWS	<hr/>		Total	6 SWS
Lecture	4 SWS										
Seminar	1 SWS										
Excercise course	1 SWS										
<hr/>											
Total	6 SWS										
Work load for students	<table border="0"> <tr> <td>Classes</td> <td>84 hrs.</td> </tr> <tr> <td>Preparation of classes, studying</td> <td>116 hrs.</td> </tr> <tr> <td>Solving of excercises</td> <td>40 hrs.</td> </tr> <tr> <td>Preparation/examination</td> <td>30 hrs.</td> </tr> </table>	Classes	84 hrs.	Preparation of classes, studying	116 hrs.	Solving of excercises	40 hrs.	Preparation/examination	30 hrs.		
Classes	84 hrs.										
Preparation of classes, studying	116 hrs.										
Solving of excercises	40 hrs.										
Preparation/examination	30 hrs.										

Course specific examination and study rules for M.Sc. Physics of Life, Light, and Matter

Attachment 2: module descriptions [refers to Anlage 2 of „Studiengangsspezifische Prüfungs- und Studienordnung für den Masterstudiengang Physics of Life, Light and Matter an der Universität Rostock vom 12. Mai 2015 (SPSO)“]

	Total work load	270 hrs.
Prerequisites for the final examination (type and extent)	50 % of achievable points solving exercises or presentation	
Test performance/ requirements for a successful examination (type and extent)	Written examination (90 minutes) or oral examination (30 minutes) <i>To be announced in the second week of the lecture period.</i>	
Number	2350400	

Category		Content	
Name (German)	Physik und Technologie der Glasfasern		
Subtitle			
Name (English)	Physics and Technology of Optical Fibers		
Credit points and total work load	6 180 hours		
Contact person	Prof. Dr. Mitschke		
Language	German or English (to be announced in the second week)		
Admission restriction	none		
Level	Master course - advanced		
Mandatory prerequisites	none		
Recommended prerequisites	none		
Duration	1 semester		
Term	summer		
Learning and qualification objectives (competences)	Students become acquainted with a selected topic from experimental physics. In the process they acquire profound knowledge in the applications of optical fibers in optics, laser physics, and communication technology. This enables them to analyze current problems from research and application of this field, and to start their own research in an experimentally working team.		
Course contents	Guiding of light and the concept of modes. Dispersion and mechanisms of loss. Optical components for fiber technology. Nonlinear optical processes in fibers; solitons. Technical applications of optical fibers for telecommunications and for data acquisition.		
Recommended literature	none		
Semester periods per week (SWS) by type of course	Lecture	2	SWS
	Excercise course	2	SWS
	Total	4	SWS
Work load for students	Classes	56	hrs.
	Preparation of classes, studying	64	hrs.
	Solving of excercises	40	hrs.
	Preparation/examination	20	hrs.
	Total work load	180	hrs.
Prerequisites for the final examination (type and extent)	none		
Test performance/ requirements for a successful examination (type and extent)	Written examination (90 minutes) or oral examination (30 minutes) <i>To be announced in the second week of the lecture period</i>		
Number	2350450		

Category	Content
Name (German)	Plasma- und Astrophysik
Subtitle	
Name (English)	Plasma Physics and Astrophysics
Credit points and total work load	9 270 hours
Contact person	Prof. Dr. Redmer
Language	German or English (to be announced in the second week)
Admission restriction	none

Level	Master course - advanced
Mandatory prerequisites	none
Recommended prerequisites	none

Duration	1 semester
Term	Summer

Learning and qualification objectives (competences)	<p>The students become acquainted with the basics of plasma physics and astrophysics. On this basis, they are able to start theoretical work in a scientific working group in these fields.</p> <p>The students have an overview of the relevant knowledge and current topics of interest. They know relevant theoretical methods as well as mathematical techniques and numerical procedures to solve problems in these fields. The students can evaluate the numerical effort of different methods, they know the limits of current computer power. They know different approximations and their pros and cons. The students are able to read up on current topics of modern physics in the literature and to give a survey on that.</p>
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Course contents	<ul style="list-style-type: none"> - plasma parameter: charged particle systems, fusion plasmas, astrophysical plasmas, warm dense matter, shock waves, high pressure physics - theory of dense plasmas: plasmas as Fermi systems, screening and correlation effects, effective Schrödinger equation, equation of state, mass action laws for dissociation and ionization - kinetic theory: Boltzmann equation, H theorem, relaxation time approximation, Chapman-Enskog method, transport coefficients, electrical conductivity - basics of density functional theory: Kohn-Sham theory, Hellmann-Feynman theorem, quantum molecular dynamics simulations, equation of state, pair distribution function, Kubo-Greenwood formula, application to warm dense matter - plasma diagnostics and laser-plasma interaction: ionization and scattering processes, dielectric function, dynamic structure factor, Landau damping, free electron lasers, x-ray Thomson scattering, inertial confinement fusion - physics of stars, brown dwarfs and planets: mass-radius relation and Lane-Emden equation, formation scenarios, thermal evolution of planets, gravity data and planetary interiors, extrasolar planets (detection methods and properties)
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Recommended literature	none
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Semester periods per week (SWS) by type of course	Lecture	4 SWS
	Seminar	1 SWS
	Excercise course	1 SWS
	Total	6 SWS
Work load for students	Classes	84 hrs.
	Preparation of classes, studying	116 hrs.

Category	Content												
Name (German)	Quantenoptik makroskopischer Systeme												
Subtitle													
Name (English)	Quantum Optics of Macroscopic Systems												
Credit points and total work load	6 180 hours												
Contact person	Prof. Scheel, Prof. Hage												
Language	German or English (to be announced in the second week)												
Admission restriction	none												
Level	Master course - advanced												
Mandatory prerequisites	none												
Recommended prerequisites	none												
Duration	1 semester												
Term	Summer												
Learning and qualification objectives (competences)	The students have an overview of the relevant knowledge in this special field. They are aware of important recent developments in the field and of open questions. The students become acquainted with experimental and theoretical methods of the field. The students know relevant models and approximations to describe physical phenomena in the field. The students become acquainted with experimental and theoretical methods of the field and their usefulness for particular physical problems. The students are familiar with mathematical techniques necessary to understand these methods. The students know pros and cons of different experimental methods, and how these different methods complement one another. On this basis, they are able to start experimental or theoretical work in a scientific working group in this field.												
Course contents	<ul style="list-style-type: none"> - Electromagnetic field quantisation in linear dielectric media, linear response theory - Propagation of nonclassical light through dielectric media, heat transfer - Coupling of atoms and molecules to medium-assisted fields - Modified spontaneous decay and spinflip lifetimes, Purcell effect, resonators - Quantum optomechanics - Decoherence processes - Dispersion forces (Casimir / Casimir-Polder force, van der Waals interactions) - Quantum reflection 												
Recommended literature	no												
Semester periods per week (SWS) by type of course	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Lecture</td> <td style="width: 50%;">3 SWS</td> </tr> <tr> <td>Seminar</td> <td>1 SWS</td> </tr> <tr> <td colspan="2" style="border-top: 1px solid black;">Total</td> </tr> <tr> <td></td> <td>4 SWS</td> </tr> </table>	Lecture	3 SWS	Seminar	1 SWS	Total			4 SWS				
Lecture	3 SWS												
Seminar	1 SWS												
Total													
	4 SWS												
Work load for students	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 70%;">Classes</td> <td style="width: 30%;">56 hrs.</td> </tr> <tr> <td>Preparation of classes, studying</td> <td>64 hrs.</td> </tr> <tr> <td>Solving of exercises</td> <td>40 hrs.</td> </tr> <tr> <td>Preparation/examination</td> <td>20 hrs.</td> </tr> <tr> <td colspan="2" style="border-top: 1px solid black;">Total work load</td> </tr> <tr> <td></td> <td>180 hrs..</td> </tr> </table>	Classes	56 hrs.	Preparation of classes, studying	64 hrs.	Solving of exercises	40 hrs.	Preparation/examination	20 hrs.	Total work load			180 hrs..
Classes	56 hrs.												
Preparation of classes, studying	64 hrs.												
Solving of exercises	40 hrs.												
Preparation/examination	20 hrs.												
Total work load													
	180 hrs..												
Prerequisites for the final examination (type and extent)	none												
Test performance (type and extent)	Written examination (90 minutes) or al examination (30 minutes) <i>To be announced in the second week of the lecture period.</i>												
Number	2350480												

Category	Content										
Name (German)	Simulation Methods of Molecular Biophysics										
Subtitle											
Name (English)	Simulation Methods of Molecular Biophysics										
Credit points and total work load	3 90 hours										
Contact person	Prof. Dr. O. Kühn										
Language	English										
Admission restriction	none										
Level	Master course - basic										
Mandatory prerequisites	none										
Recommended prerequisites	none										
Duration	1 semester										
Term	Winter										
Learning and qualification objectives (competences)	<p>The students become acquainted with numerical simulations of biological systems on a molecular level. On this basis, they are able to evaluate theoretical models and their results or even to start theoretical work themselves in a scientific working group in this field. The students have an overview of this special field.</p> <p>The students know relevant models and approximations to describe physical phenomena in the field. The students are familiar with mathematical techniques necessary to understand these methods. The students know pros and cons of different numerical techniques, and how these different methods complement one another. The students are able to read up on current topics of modern physics in the literature.</p>										
Course contents	<p>Fundamentals: motivation for simulations in the framework of classical mechanics from the Schrödinger equation, potential energy surfaces and force fields, hybrid quantum mechanics/molecular mechanics (QM/MM) methods, equations of motion in statistical ensembles, statistical analysis of simulation data, free energy calculations, reaction mechanisms, path integral and semi-classical approaches for nuclear quantum effects, stochastic techniques. Numerical techniques: integrating equations of motion, data analysis, approaches for efficient treatment of solvated bio-systems, acceleration of rare events, error analysis. Applications: structure and dynamics of proteins, binding energies, transport in membrane proteins.</p>										
Recommended literature	no										
Semester periods per week (SWS) by type of course	<table> <tr> <td>Lecture</td> <td>2 SWS</td> </tr> <tr> <td>Seminar</td> <td>1 SWS</td> </tr> <tr> <td><hr/></td> <td></td> </tr> <tr> <td>Total</td> <td>3 SWS</td> </tr> </table>	Lecture	2 SWS	Seminar	1 SWS	<hr/>		Total	3 SWS		
Lecture	2 SWS										
Seminar	1 SWS										
<hr/>											
Total	3 SWS										
Work load for students	<table> <tr> <td>Classes</td> <td>42 hrs.</td> </tr> <tr> <td>Preparation of classes, studying</td> <td>28 hrs.</td> </tr> <tr> <td>Preparation/examination</td> <td>20 hrs.</td> </tr> <tr> <td><hr/></td> <td></td> </tr> <tr> <td>Total work load</td> <td>90 hrs.</td> </tr> </table>	Classes	42 hrs.	Preparation of classes, studying	28 hrs.	Preparation/examination	20 hrs.	<hr/>		Total work load	90 hrs.
Classes	42 hrs.										
Preparation of classes, studying	28 hrs.										
Preparation/examination	20 hrs.										
<hr/>											
Total work load	90 hrs.										
Prerequisites for the final examination (type and extent)	none										
Number	2350490										

Category	Content												
Name (German)	Spezialisierungsmodul												
Subtitle													
Name (English)	Method Training												
Credit points and total work load	12 360 hours												
Contact person	Prof. Dr. H. Stolz												
Language	German or English (to be announced in the second week)												
Admission restriction	none												
Level	Master course - specializing												
Mandatory prerequisites	none												
Recommended prerequisites	none												
Duration	1 semester												
Term	Every semester												
Learning and qualification objectives (competences)	<p>The students are able to familiarize themselves with a new field, especially with relevant methods for measurements, their analysis or theoretical methods and numerical techniques. They are able to read up on this subject matter in the literature. They acquire necessary skills of experimental or theoretical/mathematical practice in this special research area what is a prerequisite for a successful work on the master thesis in the subsequent semester.</p> <p>The students are able to prepare a presentation on a complex topic of modern physics. They can lead a scientific discussion. They are able to manage a research project and to set up milestones. The students work well with others in a team.</p>												
Course contents	Study project on a physics topic of the chosen specialization: research of current publications, literature, theoretical basics, measuring and evaluation methods with respect to master thesis, project planning, presentation												
Recommended literature	no												
Semester periods per week (SWS) by type of course	<table border="0"> <tr> <td>Consultation</td> <td>0,5 SWS</td> </tr> <tr> <td><hr/></td> <td></td> </tr> <tr> <td>Total</td> <td>0,5 SWS</td> </tr> </table>	Consultation	0,5 SWS	<hr/>		Total	0,5 SWS						
Consultation	0,5 SWS												
<hr/>													
Total	0,5 SWS												
Work load for students	<table border="0"> <tr> <td>Consultation</td> <td>7 hrs.</td> </tr> <tr> <td>Self-study</td> <td>160 hrs.</td> </tr> <tr> <td>Research</td> <td>163 hrs.</td> </tr> <tr> <td>Preparation/examination</td> <td>30 hrs.</td> </tr> <tr> <td><hr/></td> <td></td> </tr> <tr> <td>Total work load</td> <td>360 hrs..</td> </tr> </table>	Consultation	7 hrs.	Self-study	160 hrs.	Research	163 hrs.	Preparation/examination	30 hrs.	<hr/>		Total work load	360 hrs..
Consultation	7 hrs.												
Self-study	160 hrs.												
Research	163 hrs.												
Preparation/examination	30 hrs.												
<hr/>													
Total work load	360 hrs..												
Prerequisites for the final examination (type and extent)	none												
Test performance/ requirements for a successful examination (type and extent)	Presentation (Oral or Poster presentation, 20 minutes)												
Number	2350040												

Category	Content
Name (German)	Surface Science and Nanostructures
Subtitle	
Name (English)	Surface Science and Nanostructures
Credit points and total work load	9 270 hours
Contact person	Prof. Speller, Dr. Barke
Language	English
Admission restriction	no

Level	Master course - advanced
Mandatory prerequisites	none
Recommended prerequisites	none

Duration	1 semester
Term	Winter

Learning and qualification objectives (competences)	<p>The students get acquainted with concepts and methods of surface and nano science. They know basic structural, electronic, magnetic and optical properties of low-dimensional systems.</p> <p>They have an overview of experimental techniques to prepare, analyze and manipulate surfaces and nano-structures. The students can draw physical conclusions from experimental data of different techniques or a combination of techniques.</p>
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Course contents	<p>1) Surfaces Overview and applications in surface science Structure and morphology Formalisms in real and reciprocal space Electron diffraction Introduction to vacuum physics Preparation of surfaces Diffusion, nucleation and growth Electronic structure Spectroscopy: ensemble methods Surface phonons Magnetism in low dimensions Adsorption of atoms and molecules</p> <p>2) Nanoprobes Principles of scanning probe microscopy Instruments Tunneling current and scanning tunneling microscopy Topographic and spectroscopic imaging STM: advanced methods Atomic force microscopy and spectroscopy Nano-optical methods</p> <p>3) Nanoscale objects and lithography Molecular electronics Physical properties of nanosystems Particle sources Lithography Electron-beam methods</p>
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Recommended literature	no
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Semester periods per week (SWS) by type of course	Lecture	4 SWS
	Seminar	1 SWS
	Excercise course	1 SWS
	<hr/> Total	6 SWS
Work load for students	Classes	84 hrs.
	Preparation of classes, studying	116 hrs.
	Solving of excercises	40 hrs.
	Preparation/examination	30 hrs.
	<hr/> Total work load	270 hrs.
Prerequisites for the final examination (type and extent)	50 % of achievable points solving exercises or Presentation	
Test performance/ requirements for a successful examination (type and extent)	Written examination (120 minutes) or oral examination (30 minutes) <i>To be announced in the second week of the lecture period.</i>	
Number	2350520	

Category	Content												
Name (German)	Vertiefungsmodul												
Subtitle													
Name (English)	In-depth Knowledge Acquisition												
Credit points and total work load	12 360 hours												
Contact person	Prof. Dr. H. Stolz												
Language	German or English (to be announced in the second week)												
Admission restriction	no												
Level	Master course - specializing												
Mandatory prerequisites	none												
Recommended prerequisites	none												
Duration	1 semester												
Term	Every semester												
Learning and qualification objectives (competences)	The students are able to familiarize themselves with a new area of knowledge, they are able to read up on this subject matter in the literature. They acquire a deepened knowledge in this special field of research as required for a successful work on the master thesis in the subsequent semester. The students are able to prepare a presentation on a complex topic of modern physics. They can lead a scientific discussion.												
Course contents	Study project on a given topic of the chosen specialization: current research topics, current publications, literature, theoretical basics, presentation												
Recommended literature	no												
Semester periods per week (SWS) by type of course	<table border="0"> <tr> <td>Consultation</td> <td>0,5 SWS</td> </tr> <tr> <td>Total</td> <td>0,5 SWS</td> </tr> </table>	Consultation	0,5 SWS	Total	0,5 SWS								
Consultation	0,5 SWS												
Total	0,5 SWS												
Work load for students	<table border="0"> <tr> <td>Classes</td> <td>7 hrs.</td> </tr> <tr> <td>Self-study</td> <td>160 hrs.</td> </tr> <tr> <td>Research</td> <td>163 hrs.</td> </tr> <tr> <td>Preparation/examination</td> <td>30 hrs.</td> </tr> <tr> <td><hr/></td> <td></td> </tr> <tr> <td>Total work load</td> <td>360 hrs.</td> </tr> </table>	Classes	7 hrs.	Self-study	160 hrs.	Research	163 hrs.	Preparation/examination	30 hrs.	<hr/>		Total work load	360 hrs.
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Self-study	160 hrs.												
Research	163 hrs.												
Preparation/examination	30 hrs.												
<hr/>													
Total work load	360 hrs.												
Prerequisites for the final examination (type and extent)	none												
Test performance/ requirements for a successful examination (type and extent)	Presentation (Oral or Poster presentation, 20 minutes)												
Number	2350030												