UNIVERSITÄT OSNABRÜCK

FACHBEREICH PHYSIK

MODULBESCHREIBUNGEN

FÜR DIE LEHREINHEIT

„PHYSIK“

beschlossen in der
291. Sitzung des Fachbereichsrates des Fachbereichs Physik am 17.05.2017
befürwortet in der 139. Sitzung der Ständigen zentralen Kommission für Studium und Lehre und Studienqualitätskommission (ZSK) am 25.10.2017
genehmigt in der 270. Sitzung des Präsidiums am 10.04.2018
AMBl. der Universität Osnabrück Nr. 03/2018 vom 24.05.2018, S. 363

Änderung
beschlossen in der
306. Sitzung des Fachbereichsrates des Fachbereichs Physik am 19.02.2020
befürwortet in der 155. Sitzung der Zentralen Kommission für Studium und Lehre und Studienqualitätsmittel (ZSK) am 27.05.2020
genehmigt in der 333. Sitzung des Präsidiums am 17.06.2021
AMBl. der Universität Osnabrück Nr. 08/2021 vom 21.09.2021, S. 797

Modul PHY-EV-V-y: Complement and deepen the knowledge of physics: y	
Identifier	PHY-EV-V-y
Module title	Complement and deepen the knowledge of physics: y
German module title	Ergänzung und Vertiefung zur Physik: y
Authorised module representative	Dean of Studies
Qualification objectives	• Acquisition of supplementary or in-depth knowledge of physics • Social skills such as the ability to cooperate, advisory skills as well as personal skills such as time and self-management, proactivity, diligence, accuracy, perseverance, etc.
Contents	Selected topics in physics Different module contents are distinguished by different sub-identifiers y∈ {A, B, C, ..., Z}.
Module components including CP (LP) information	Lecture (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	As required in summer or winter semester
Course credits	
Required pre-examination achievements	
Type of examination by continuous assessment	Written examination (90 min) or oral examination (30 min)
Examination requirements	Mastering of all contents of the module
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-EV-S-y: Complement and deepen the knowledge of physics: y	
Identifier	PHY-EV-S-y
Module title	Complement and deepen the knowledge of physics: y
German module title	Ergänzung und Vertiefung zur Physik: y
Authorised module representative	Dean of Studies
Qualification objectives	• Acquisition of supplementary or in-depth knowledge of physics • Social skills such as the ability to cooperate, advisory skills as well as personal skills such as time and self-management, proactivity, diligence, accuracy, perseverance, etc.
Contents	Selected topics in physics Different module contents are distinguished by different sub-identifiers y∈ {A, B, C, ..., Z}.
Module components including CP (LP) information	Seminar (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	As required in summer or winter semester
Course credits	
Required pre-examination achievements	
Type of examination by continuous assessment	Oral examination (30 min) or oral presentation and written report
Examination requirements	Mastering of all contents of the module
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-AFP-15: Applied solid state physics	
Identifier	PHY-AFP-15
Module title	Applied solid state physics
German module title	Angewandte Festkörperphysik
Authorised module representative	Dean of Studies
Qualification objectives	• Consolidation of experimental solid state physics on the basis of further current topics • Acquisition of physical knowledge in English • Exemplary application of numerical methods • Self-competences such as self- and time management, proactivity, motivation, endurance, diligence, accuracy, self-confidence
Contents	The lecture expands on issues of solid-state physics with a focus on electronic transport phenomena and single spin systems. Subjects covered: • Semiconductors and devices (transistor, solar cell) • Quantumtransport (e.g. quantum hall effect) • Spintronics (AMR, GMR, spin injection and spin transistor) • Quantum spintronics and -technologies (e.g. quantum sensing)
Module components including CP (LP) information	Lecture (6 LP)
CP of the module	6 LP
SWS (hours per week during the semester) of the module	4 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually in summer or winter semester
Course credits	
Required pre-examination achievements	
Type of examination by continuous assessment	Written examination (120 min) or oral examination (30 min)
Examination requirements	Mastering of all contents of the module
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics MSc Nanosciences – Materials, Molecules and Cells PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-ACM: Advanced Computer Simulations and Modelling	
Identifier	PHY-ACM
Module title	Advanced Computer Simulations and Modelling
German module title	Fortgeschrittene Computersimulation und Modellierung
Authorised module representative	Dean of Studies
Qualification objectives	• Implementation of advanced computer simulations and modelling • Acquiring physics knowledge from English texts • Self-competences such as self-management, time management, creativity, proactivity, motivation, carefulness, accurateness, endurance, self-confidence, etc.
Contents	The course introduces to implementation of advanced computer simulations and modelling by means of algorithms, programming, and data analysis. Contents include: • Calculus of condensed matter physics • Elements of programming • Quantum mechanics • Statistical physics • Practical exercises
Module components including CP (LP) information	Lecture with exercise classes (6 LP)
CP of the module	6 LP
SWS (hours per week during the semester) of the module	4 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually, either summer or winter term
Course credits	
Required pre-examination achievements	Successful participation in the exercise classes
Type of examination by continuous assessment	Written examination (120 min) or oral examination (30 min) or oral presentation (30 min)
Examination requirements	Mastering of all contents of the module
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-QTD: Quantum Thermodynamics	
Identifier	PHY-QTD
Module title	Quantum Thermodynamics
German module title	Quantenthermodynamik
Authorised module representative	Dean of Studies
Qualification objectives	• Deepened knowledge on selected topics in the context of Quantum Thermodynamics • Acquiring physics knowledge from English texts • Self-competences such as self-management, time management, creativity, proactivity, motivation, carefulness, accurateness, endurance, self-confidence, etc.
Contents	The course deepens knowledge on selected topics in the context of Quantum Thermodynamics. Many contents relate to subjects of theoretical condensed matter physics.
Module components including CP (LP) information	Seminar (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Each semester
Course credits	
Required pre-examination achievements	
Type of examination by continuous assessment	Oral examination (30 min) or oral presentation (30 min) or written report
Examination requirements	Mastering of all contents of the module
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-SP_v1: Statistical Physics	
Identifier	PHY-SP_v1
Module title	Statistical Physics
German module title	Statistische Physik
Authorised module representative	Dean of Studies
Qualification objectives	• Advanced concepts of Statistical Physics • Interdisciplinary applications of Statistical Physics • Understanding of modern research literature in Statistical Physics • Self-competences such as self-management, time management, creativity, proactivity, motivation, carefulness, accurateness, endurance, self-confidence, etc.
Contents	The seminar deepens knowledge in the field of Statistical Physics. Contents are oriented toward current topics at the research front.
Module components including CP (LP) information	Seminar (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Each semester
Course credits	
Required pre-examination achievements	
Type of examination by continuous assessment	Oral examination (30 min) or oral presentation (30 min) or written report
Examination requirements	Mastering of all contents of the module
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-MPP: Many Particle Physics	
Identifier	PHY-MPP
Module title	Many Particle Physics
German module title	Vielteilchenphysik
Authorised module representative	Dean of Studies
Qualification objectives	• Deepened knowledge on selected topics in the context of many particle physics • Acquiring physics knowledge from English texts • Self-competences such as self-management, time management, creativity, proactivity, motivation, carefulness, accurateness, endurance, self-confidence, etc.
Contents	The course deepens knowledge on selected topics in the context of many particle physics. Contents are oriented according to topics of theoretical condensed matter physics.
Module components including CP (LP) information	Seminar (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Each semester
Course credits	
Required pre-examination achievements	
Type of examination by continuous assessment	Oral examination (30 min) or oral presentation (30 min) or written report
Examination requirements	Mastering of all contents of the module
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-PCMS-15: Computational Materials Science	
Identifier	PHY-PCMS-15
Module title	Computational Materials Science
German module title	Computersimulationen in den Materialwissenschaften
Authorised module representative	Dean of Studies
Qualification objectives	• Knowledge of various computer simulation methods, their merits and limits, and their mutual relations • Practical implementation of simulation algorithms • Competence for development of models and respective computer simulation techniques to describe structural and dynamical properties of complex materials • Self-competences such as self-management, time management, creativity, proactivity, motivation, carefulness, accurateness, endurance, self-confidence
Contents	Techniques are conveyed to conduct computer simulations for exploring structural and dynamical properties of materials. Contents include: • Basic methods of computer simulations in condensed matter physics • Applications to structural properties of fluids, soft matter systems as well as crystalline and amorphous solids • Applications to transport and relaxation processes in solids and soft matter systems
Module components including CP (LP) information	Practical course (3LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually in either the summer or winter term
Course credits	Successful participation in the practical course, written report or oral presentation
Required pre-examination achievements	
Type of examination by continuous assessment	
Examination requirements	
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-CTT: Current Topics in Theoretical Physics	
Identifier	PHY-CTT
Module title	Current Topics in Theoretical Physics
German module title	Aktuelle Themen der Theoretischen Physik
Authorised module representative	Dean of Studies
Qualification objectives	• Knowledge about current research topics in Theoretical Physics • Self-competences such as self-management, time management, creativity, proactivity, motivation, carefulness, accurateness, endurance, self-confidence, etc.
Contents	The seminar conveys knowledge about current topics in theoretical physics at the research front. The focus will be on selected studies in the field of condensed matter theory.
Module components including CP (LP) information	Seminar (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Each semester
Course credits	
Required pre-examination achievements	
Type of examination by continuous assessment	Oral examination (30 min) or oral presentation (30 min) or written report
Examination requirements	Mastering of all contents of the module
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-TRQ-15: Transport and Relaxation Dynamics in Quantum Systems	
Identifier	PHY-TRQ-15
Module title	Transport and Relaxation Dynamics in Quantum Systems
German module title	Transport und Relaxationsdynamik in Quantensystemen
Authorised module representative	Dean of Studies
Qualification objectives	• Consolidation of condensed matter theory • Application of the theory to non-equilibrium processes in condensed matter systems • Profound understanding of non-equilibrium pysics in quantum systems • Acquiring physics knowledge from english texts • Self-competences such as self-management, time management, creativity, proactivity, motivation, carefulness, accurateness, endurance, self-confidence, etc.
Contents	The course introduces the non-equilibrium physics of quantum systems. Contents include: • Mapping of quantum dynamics onto master equations • Relaxation of excited states • Introduction to transport theory • Green-Kubo-formalsim • Calculating relaxation times and transport coefficients
Module components including CP (LP) information	Lecture with excercises (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually, either summer or winter term
Course credits	
Required pre-examination achievements	
Type of examination by continuous assessment	Written examination (60 min) or oral examination (20 min) or presentation (20 min)
Examination requirements	Mastering of all contents of the module
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics MSc Nanosciences – Materials, Molecules and Cells PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-NQP-15: Computational Quantum Physics	
Identifier	PHY-NQP-15
Module title	Computational Quantum Physics
German module title	Numerische Quantenphysik
Authorised module representative	Dean of Studies
Qualification objectives	• Deepened knowledge of quantum mechanics • Implementation of advanced numerical methods • Self-competences such as self-management, time management, creativity, proactivity, motivation, carefulness, accurateness, endurance, self-confidence, etc.
Contents	The module applies advanced numerical methods to problems in the context of quantum mechanics. Topics include: • Quantum dynamics • Lattice models of interacting spin, fermions, and bosons • Use of Symmetries • Extension of programming skills • Application to specific problems • Writing of a scientific report
Module components including CP (LP) information	Practical course (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually, either summer or winter term
Course credits	Successful participation in the practical course, written report or oral presentation
Required pre-examination achievements	
Type of examination by continuous assessment	
Examination requirements	
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Nanosciences – Materials, Molecules and Cells MSc Physics PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-TKM-15: Condensed Matter Theory	
Identifier	PHY-TKM-15
Module title	Condensed Matter Theory
German module title	Theorie der Kondensierten Materie
Authorised module representative	Dean of Studies
Qualification objectives	• Introduction to the theoretical concepts of condensed matter physics, application to modern problems • Acquiring physics knowledge from English texts • Self-competences such as self-management, time management, creativity, proactivity, motivation, carefulness, accurateness, endurance, self-confidence, etc.
Contents	The course introduces to basic concepts of condensed matter theory. Contents include: • Basic solid state theory • Elements of theory of electronic structure and many-particle physics • Elements of soft condensed matter theory • Mean field theory
Module components including CP (LP) information	Lecture with exercise classes (6 LP)
CP of the module	6 LP
SWS (hours per week during the semester) of the module	4 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually, either summer or winter-term
Course credits	
Required pre-examination achievements	Successful participation in the exercise classes
Type of examination by continuous assessment	Written examination (120 min) or oral examination (30 min) or oral presentation (30 min)
Examination requirements	Mastering of all contents of the module
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Nanosciences – Materials, Molecules and Cells MSc Physics PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-SDS-15: Stochastic Dynamical Systems	
Identifier	PHY-SDS-15
Module title	Stochastic Dynamical Systems
German module title	Stochastische Dynamische Systeme
Authorised module representative	Dean of Studies
Qualification objectives	• Consolidation of condensed matter theory • Knowledge of stochastic methods for the description and modelling of systems whose dynamics is influenced by random forces • Application of stochastic methods with focus on current research in materials science, biophysics and further interdisciplinary research areas (e.g. physiology, finance) • Self-competences such as self-management, time-management, creativity, proactivity, motivation, carefulness, accurateness, endurance, self-confidence
Contents	Concepts and methods are conveyed to describe stochastic dynamical systems, which occur in many areas of physics as well as many other scientific fields. Contents particularly include: • Basic principles of probability theory, central limit theorem and generalisations, extreme value statistics • Theory of stochastic processes; Markov processes; Gaussian, Poissonian and shot noise processes • Correlation functions, cumulants, stationary processes, spectral decomposition, Wiener-Khinchin theorem • Linear response theory and fluctuation-dissipation theorem • Langevin- and Fokker-Planck equations; master equation • Stochastic thermodynamics: microscopic description of work and heat, detailed and integral fluctuation theorems
Module components including CP (LP) information	Lecture with exercises (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually in either the summer or winter term
Course credits	
Required pre-examination achievements	
Type of examination by continuous assessment	Written examination (60 min) or oral examination (20 min) or oral presentation (20 min)
Examination requirements	Mastering of all contents of the module
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Nanosciences – Materials, Molecules and Cells MSc Physics PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-BMMP-15: Biomacromolecular Physics	
Identifier	PHY-BMMP-15
Module title	Biomacromolecular Physics
German module title	Biomakromolekülphysik
Authorised module representative	Dean of Studies
Qualification objectives	• Introduction into theoretical and experimental fundamentals of biophysics (structure, dynamics and function of biomolecules, thermodynamics of biomolecular processes, etc.) • Acquisition of biophysical knowledge in English • Self-competences such as self- and time management, proactivity, motivation, endurance, diligence, accuracy, self-confidence
Contents	The module introduces into the basics of biophysics. Contents include in particular: • Structure and function of proteins, nucleic acids and membranes • Thermodynamics of biomolecular processes • Protein dynamics • Protein reactions
Module components including CP (LP) information	Lectures with exercises (6 LP)
CP of the module	6 LP
SWS (hours per week during the semester) of the module	4 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually in winter or summer term
Course credits	
Required pre-examination achievements	Successful completion of exercise tasks
Type of examination by continuous assessment	Written examination (120 min) or oral examination (30 min)
Examination requirements	Mastering of all contents of the module
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Nanosciences – Materials, Molecules and Cells MSc Physics PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-BMMP-M-15: Methods of Biomacromolecular Physics	
Identifier	PHY-BMMP-M-15
Module title	Methods of Biomacromolecular Physics
German module title	Methoden der Biomakromolekülphysik
Authorised module representative	Dean of Studies
Qualification objectives	• Experimental and theoretical fundamentals of biophysical methods (spectroscopy, modeling, etc.) • Self-competences such as self- and time management, proactivity, motivation, diligence, care, accuracy, endurance, self-confidence
Contents	The course introduces the methods of biophysics. Contents include: • Spectroscopy: Mössbauer spectroscopy, X-ray spectroscopy, UV-Vis-, IR-, Raman-spectroscopy, NMR, ESR spectroscopy • Modelling, molecular dynamics simulations
Module components including CP (LP) information	Lectures with exercises (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually in winter or summer term
Course credits	
Required pre-examination achievements	
Type of examination by continuous assessment	Written examination (60 min) or oral examination (20 min) and a homework
Examination requirements	Mastering of all contents of the module
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Nanosciences – Materials, Molecules and Cells MSc Physics PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-BMMP-P-15: Practical Course: Biomacromolecular Physics	
Identifier	PHY-BMMP-P-15
Module title	Practical Course: Biomacromolecular Physics
German module title	Praktikum zur Biomakromolekülphysik
Authorised module representative	Dean of Studies
Qualification objectives	• Acquisition of in-depth knowledge and experimental skills in a specific area of biophysics • Self-competences such as self- and time management, proactivity, motivation, diligence, accuracy, endurance, self-confidence
Contents	Independent training in special topics of biophysics and practical implementation of the skills obtained in experimental work. Contents include: • Introduction into a special topic in biophysics • Practical implementation of the experimental concepts • Conducting experiments in the field of biophysics • Writing an internship report
Module components including CP (LP) information	Practical course (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually during the winter or summer term
Course credits	Successful participation in the practical course; evaluation and processing of special experimental problems; written internship report or oral presentation
Required pre-examination achievements	
Type of examination by continuous assessment	
Examination requirements	
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Nanosciences – Materials, Molecules and Cells MSc Physics PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-BMMP-S-15: Seminar: Biomacromolecular Physics	
Identifier	PHY-BMMP-S-15
Module title	Seminar: Biomacromolecular Physics
German module title	Seminar zur Biomakromolekülphysik
Authorised module representative	Dean of Studies
Qualification objectives	• Independent preparation and delivery of talks in the field of biophysics • Self-competences such as self- and time management, proactivity, motivation, deligence, accuracy, endurance, self-confidence
Contents	The course deals with selected questions of biophysics. Contents include: • Structure, dynamics and function of proteins, nucleic acids and membranes • Thermodynamics of biomolecular processes • Spectroscopy in biophysics • molecular dynamics simulations
Module components including CP (LP) information	Seminar (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually during the winter or summer term
Course credits	A successful delivery of a lecture and compulsory regular attendance of all seminars, participation in the discussions
Required pre-examination achievements	
Type of examination by continuous assessment	
Examination requirements	
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Nanosciences – Materials, Molecules and Cells MSc Physics PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-BPHBI-15: Biophysical and Applied Bioinformatics	
Identifier	PHY-BPHBI-15
Module title	Biophysical and Applied Bioinformatics
German module title	Biophysikalische und Angewandte Aspekte der Bioinformatik
Authorised module representative	Dean of Studies
Qualification objectives	• Knowledge of biophysical properties of proteins, DNA and RNA • Knowledge of principles and basic algorithms of Computational Biology • Knowledge of databases and servers that contain sequence and structural information together with software for their analyses • English language skills in the field of Bioinformatics • Self-competences such as self-management, time management, creativity, proactivity, motivation, carefulness, accurateness, endurance, self-confidence etc.
Contents	The module provides an introduction to the fundamentals of Bioinformatics. Specifically it includes: • Physical aspects of Bioinformatics • Proteins as physical systems • RNA and DNA as physical systems • Molekular dynamics simulations • Evolution, Homology, Orthology, Paralogy • Sequence analyses, Alignments (Needleman-Wunsch, BLAST, psi-BLAST), Substitution matrices, • Prediction of protein and RNA structures.
Module components including CP (LP) information	Lectures with practicals (6 LP)
CP of the module	6 LP
SWS (hours per week during the semester) of the module	4 SWS
Duration of the module	One semester
Duration of the module	Annually during the winter term
Course credits	
Required pre-examination achievements	Successful participation in the practicals
Type of examination by continuous assessment	Written examination (120 min)
Examination requirements	Complete contents of module and qualification objectives
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Nanosciences – Materials, Molecules and Cells MSc Physics PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-BPHBI-M-15: Methods of applied Bioinformatics	
Identifier	PHY-BPHBI-M-15
Module title	Methods of applied Bioinformatics
German module title	Methoden der angewandten Bioinformatik
Authorised module representative	Dean of Studies
Qualification objectives	• Experimental and theoretical basics of bioinformatic methods (analysis of operons, genome analysis, functional predictions, structural analysis of substrate-binding sites) • English language skills in the field of bioinformatic methods • Self-competences such as self-management, time management, creativity, proactivity, motivation, carefulness, accurateness, endurance, self-confidence etc.
Contents	The module provides an introduction to the fundamentals of bioinfomatic methods. Specifically, it includes: • Databases and servers (e.g. EBI, NCBI, DDBJ) • Multiple alignments (e.g. Clustal, T-Coffee, MUSCLE) und phylogenetic analysis • Comparison of protein folds and their classification (e.g. SCOP, CATH), • Methods of structure prediction • Methods of molecular dynamics simulations
Module components including CP (LP) information	Lectures and a seminar paper (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Duration of the module	Annually during the summer term
Course credits	
Required pre-examination achievements	Successful completion of the seminar paper
Type of examination by continuous assessment	Written examination (120 min) and seminar paper
Examination requirements	Complete contents of module and qualification objectives
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of Module	MSc Nanosciences – Materials, Molecules and Cells MSc Physics PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-BPHBI-P-15: Practical Course in applied bioinformatics and evolutionary biophysics	
Identifier	PHY-BPHBI-P-15
Module title	Practical Course in applied bioinformatics and evolutionary biophysics
German module title	Praktikum zur angewandten Bioinformatik und evolutionären Biophysik
Authorised module representative	Dean of Studies
Qualification objectives	• Acquisition of in-depth knowledge and experimental skills in a specific area of computational biology or evolutionary biophysics • Self-management, time management, creativity, proactivity, motivation, carefulness, accurateness, endurance, self-confidence etc.
Contents	Independent training in special topics of computational biology or evolutionary biophysics and practical implementation of the skills obtained in experimental work. Contents include: • Introduction into a special topic of computational biology or evolutionary biophysics • Practical implementation of the experimental concepts • Conducting computer-based analysis in the field of computational biology or evolutionary biophysics • Writing an internship report
Module components including CP (LP) information	Practical course (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Duration of the module	Annually during the summer semester
Course credits	Successful participation in the practical course; evaluation and processing of special experimental problems; written internship report or oral presentation
Required pre-examination achievements	
Type of examination by continuous assessment	
Examination requirements	
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Nanosciences – Materials, Molecules and Cells MSc Physics PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-BPHBI-S-15: Seminar in applied bioinformatics and evolutionary biophysics	
Identifier	PHY-BPHBI-S-15
Module title	Seminar in applied bioinformatics and evolutionary biophysics
German module title	Seminar zur angewandten Bioinformatik und evolutionären Biophysik
Authorised module representative	Dean of Studies
Qualification objectives	• Independent preparation and submission of talks in the fields of Bioinformatics, Computational Biology and evolutionary Biophysics • English language skills in the field of bioinformatic methods • Self-competences such as self-management, time management, creativity, proactivity, motivation, carefulness, accurateness, endurance, self-confidence etc.
Contents	The course deals with selected questions of evolution of biophysical processes. Contents include: • Evolution of enzyme mechanisms • Biophysics of protein evolution • Biophysics of RNA- and DNA-evolution • Evolution of prokaryotes • Basics of comparative genomics • Structure prediction
Module components including CP (LP) information	Seminar (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Duration of the module	Annually during the summer term
Course credits	
Required pre-examination achievements	A successful submission of a talk and compulsory regular attendance of all seminars, participation in the discussions
Type of examination by continuous assessment	
Examination requirements	
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Nanosciences – Materials, Molecules and Cells MSc Physics PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-FPR-12: Advanced Laboratory Course Physics (12 LP)	
Identifier	PHY-FPR-12
Module title	Advanced Laboratory Course Physics (12 LP)
German module title	Fortgeschrittenen-Praktikum Physik (12 LP)
Authorised module representative	Dean of Studies
Qualification objectives	• Conducting complex experimental studies • Independent preparation and evaluation • Self-competencies such as self- and time management, proactivity, willingness to perform, motivation, diligence, accuracy, persistence, self-confidence
Contents	Carrying out laborious laboratory tests in the fields of advanced experimental physics
Module components including CP (LP) information	Laboratory course (12 LP)
CP of the module	12 LP
SWS (hours per week during the semester) of the module	8 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually in summer term
Course credits	
Required pre-examination achievements	
Type of examination by continuous assessment	6 evaluated experimental protocols
Examination requirements	Basics, implementation and logging of all laboratory tests
Calculation of module grade	Arithmetic mean of all assessments
Regulations on how to pass the module	Successful processing of all laboratory tests
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-FPR-6_v1: Advanced Laboratory Course Physics (6 LP)	
Identifier	PHY-FPR-6_v1
Module title	Advanced Laboratory Course Physics (6 LP)
German module title	Fortgeschrittenen-Praktikum Physik (6 LP)
Authorised module representative	Dean of Studies
Qualification objectives	• Conducting complex experimental studies • Independant preparation and evaluation • Self-competencies such as self and time management, proactivity, willingness to perform, motivation, diligence, accuracy, persistence, self-confidence
Contents	Carrying out laborious laboratory tests in the fields of advanced experimental physics
Module components including CP (LP) information	Laboratory course (6 LP)
CP of the module	6 LP
SWS (hours per week during the semester) of the module	4 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually in summer term
Course credits	
Required pre-examination achievements	
Type of examination by continuous assessment	3 evaluated experimental protocols
Examination requirements	Basics, implementation and logging of all laboratory tests
Calculation of module grade	Arithmetic mean of all assessments
Regulations on how to pass the module	Successful processing of all laboratory tests
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-OFP-15: Surface Science	
Identifier	PHY-OFP-15
Module title	Surface Science
German module title	Oberflächenphysik
Authorised module representative	Dean of Studies
Qualification objectives	• Introduction to experimental and theoretical concepts of surface science and exemplary applications of the concepts for different materials and experimental techniques • Learning of physics using english language • Self-competences such as self-management, time management, creativity, proactivity, motivation, carefulness, accurateness, endurance, self-confidence etc.
Contents	The module comprises basic concepts and experimental techniques of surface science. Contents particularly include: • Basics of experimental and vacuum techniques • Geometric and electronic structure of surfaces • Structural properties and kinetics of adsorbates • Elementary processes on surfaces
Module components including CP (LP) information	Lecture with excercises (6 LP)
CP of the module	6 LP
SWS (hours per week during the semester) of the module	4 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually in either winter or summer term
Course credits	
Required pre-examination achievements	Successful working on excercises
Type of examination by continuous assessment	Written examination (120 min) or oral examination (30 min)
Examination requirements	Mastering of all contents of the module
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics MSc Nanosciences – Materials, Molecules and Cells PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-UKP-15: Ultrafast Physics	
Identifier	PHY-UKP-15
Module title	Ultrafast Physics
German module title	Ultrakurzzeitphysik
Authorised module representative	Dean of Studies
Qualification objectives	• Role of ultrafast physics in different disciplines of science • Application of ultrafast physics in spectroscopy • Quantum optics • Application to modern examples of the fields of (nano-)photonics, solid state- and bio-physics. • Knowledge about industrial applications, development of ultrafast laser systems, material processing, sensors. • English language skills in the field of ultrafast physics • Self-competences such as self-management, time management, creativity, proactivity, motivation, carefulness, accurateness, endurance, self-confidence etc
Contents	The module provides an insight into the relevant research topics of ultrafast physics. In particular it includes: • Analysis of ultrafast dynamics of vibration and rotation in molecular systems • Ultrafast control of quantum states • Fs-pulse injection of quasi-particles: excitons, polarons, magnons • Ultrafast transport phenomena in (nonlinear) optical (nanoscopic) materials: excited carriers, electron-phonon-relaxation, luminescence, hopping, ballistic transport
Module components including CP (LP) information	Lecture with exercises (6 LP)
CP of the module	6 LP
SWS (hours per week during the semester) of the module	4 SWS
Duration of the module	One semester
Frequency with which the course is offered	Bi-annually in summer or winter term
Course credits	
Required pre-examination achievements	Successful completion of exercise tasks
Type of examination by continuous assessment	Written examination (120 min) or oral examination (30 min)
Examination requirements	Mastering of all contents of the module
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics MSc Nanosciences – Materials, Molecules and Cells PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-UKP-E-15: Introduction: Ultrafast Physics	
Identifier	PHY-UKP-E-15
Module title	Introduction: Ultrafast Physics
German module title	Einführung in die Ultrakurzzeitphysik
Authorised module representative	Dean of Studies
Qualification objectives	• Knowledge about physics and mathematical description of ultrashort laser pulses • Understanding of the properties of ultrashort laser pulses and their interaction with matter, applications • Understanding of the propagation of ultrashort laser pulses • Nonlinear optical phenomena and phase matching conditions • Ultrashort pulse laser systems • English language skills in the field of ultrafast physics • Self-competences such as self-management, time management, creativity, proactivity, motivation, carefulness, accurateness, endurance, self-confidence etc
Contents	The module provides an insight into the fundamentals of ultrafast physics. In particular it includes: • Physics of ultrashort laser pulses • Propagation, correlation and interaction phenomena, i.e. chirp and self-phase modulation • Optical nonlinearities: Two-Photon Absorption, nonlinear index of refraction • Frequency conversion, optical parametric processes • Laser system resonators, Kerr lens design, Pockels cells
Module components including CP (LP) information	Lecture (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Bi-annually in summer or winter term
Course credits	
Required pre-examination achievements	
Type of examination by continuous assessment	Written examination (60 min) or oral examination (20 min)
Examination requirements	
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics MSc Nanosciences – Materials, Molecules and Cells PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-UKP-F: Advanced Ultrafast Physics	
Identifier	PHY-UKP-F
Module title	Advanced Ultrafast Physics
German module title	Fortgeschrittene Ultrakurzzeitphysik
Authorised module representative	Dean of Studies
Qualification objectives	• In-depth presentation of selected topics from ultrafast physics • Self-competencies such as self- and time management, proactivity, motivation, diligence, willingness to perform, accuracy, endurance, self-confidence
Contents	The lecture provides in-depth knowledge on a topic of ultrafast physics on a high level. Typically, it involves: • The physical background of current research results • The discussion of research results in an interdisciplinary context • The physical background of new fields of research
Module components including CP (LP) information	Lecture with exercises (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually in summer or winter term
Course credits	
Required pre-examination achievements	Successful completion of exercise tasks
Type of examination by continuous assessment	Written examination (60 min) or oral examination (20 min)
Examination requirements	Mastering of all contents of the module
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-AFM: Non-contact atomic force microscopy	
Identifier	PHY-AFM
Module title	Non-contact atomic force microscopy
German module title	Nichtkontakt-Raster-Kraftmikroskopie
Authorised module representative	Dean of Studies
Qualification objectives	• Introduction to non-contact atomic force microscopy • Self-competencies such as self- and time management, proactivity, willingness to perform, motivation, diligence, accuracy, persistence, self-confidence
Contents	The lecture provides a survey over physical foundations, technologies and methods in non-contact atomic force microscopy. Topics covered include: • Physics of the tip-sample interaction • Dynamic probes and the physics of their oscillation • Frequency demodulation and phase locked loop techniques • Technology for scanning and moving the probe • Analysis of scanning force images and force maps • Applications of non-contact atomic force microscopy
Module components including CP (LP) information	Lecture (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually in summer term
Course credits	
Required pre-examination achievements	
Type of examination by continuous assessment	Written examination (60 min) or oral examination (20 min)
Examination requirements	Mastering of all contents of the module
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics PhD Program Nanosciences
Prerequisites for participation in this module	Successful completion of the lectures Experimental Physics 1-5 or equiv.

Modul PHY-AFM-P: Lab course non-contact atomic force microscopy	
Identifier	PHY-AFM-P
Module title	Lab course non-contact atomic force microscopy
German module title	Praktikum Nichtkontakt-Raster-Kraftmikroskopie
Authorised module representative	Dean of Studies
Qualification objectives	• Practice in non-contact atomic force microscopy • Self-competencies such as self- and time management, proactivity, willingness to perform, motivation, diligence, accuracy, persistence, self-confidence
Contents	The lab course is a practical introduction into techniques of non-contact atomic force microscopy. Typical topics are: • Characterisation of NC-AFM probes • Calibration of the probe oscillation • Optimisation of filter and loop settings for experiment control • Study of phase locked loop and lock-in techniques • Development of software or hardware for the NC-AFM • Processing of NC-AFM data
Module components including CP (LP) information	Practical course (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Biannually in summer term or winter tem
Course credits	Participation in the lab course, completion of experiments, data analysis, written report
Required pre-examination achievements	
Type of examination by continuous assessment	
Examination requirements	
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics PhD Program Nanosciences
Prerequisites for participation in this module	Successful completion of the lectures Experimental Physics 1-5 or equiv.

Modul PHY-AFM-S: Seminar non-contact atomic force microscopy	
Identifier	PHY-AFM-S
Module title	Seminar non-contact atomic force microscopy
German module title	Seminar Nichtkontakt-Raster-Kraftmikroskopie
Authorised module representative	Dean of Studies
Qualification objectives	• Preparation and presentation of a subject related to NC-AFM • Self-competencies such as self- and time management, proactivity, willingness to perform, motivation, diligence, accuracy, persistence, self-confidence
Contents	The seminar covers intellectual work in the context of non-contact atomic force microscopy. Typically, the presentation covers one of the items: • Recent advances in NC-AFM techniques and data evaluation • Recent success in NC-AFM imaging or force mapping • Research into publications on a specific aspect of NC-AFM research • Report on construction work related to NC-AFM • Plan for NC-AFM studies • Plan for NC-AFM technical developments
Module components including CP (LP) information	Seminar (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Biannually in summer term or winter tem
Course credits	Oral presentation, regular participation in the seminar
Required pre-examination achievements	
Type of examination by continuous assessment	
Examination requirements	
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics PhD Program Nanosciences
Prerequisites for participation in this module	Successful completion of the lectures Experimental Physics 1-5 or equiv.

Modul PHY-AS1_v1: Astronomy 1	
Identifier	PHY-AS1_v1
Module title	Astronomy 1
German module title	Astronomie 1
Authorised module representative	Dean of Studies
Qualification objectives	• Introduction to classical astronomy • Basic knowledge of observational instruments and methods • Self-competencies such as self- and time management, proactivity, willingness to perform, motivation, diligence, accuracy, persistence, self-confidence
Contents	• Classical astronomy (astrometry) and observational methods • Orientation in the sky and astronomical coordinate systems • Course of sun, moon and planets (in the planetarium) • Time, calender systems, eclipses • Planets • Observing instruments: light collectors, -analyzers and -detectors • Observations over the whole electromagnetic spectrum • Reduction methods
Module components including CP (LP) information	Lecture with exercises (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually in summer term
Course credits	
Required pre-examination achievements	
Type of examination by continuous assessment	Written examination (90 min), oral examination (30 min) or presentation
Examination requirements	Entire content and qualification objectives of the module
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-AS2_v1: Astronomy 2	
Identifier	PHY-AS2_v1
Module title	Astronomy 2
German module title	Astronomie 2
Authorised module representative	Dean of Studies
Qualification objectives	• Astrophysics of stars and galaxies • Self-competencies such as self- and time management, proactivity, willingness to perform, motivation, diligence, accuracy, persistence, self-confidence
Contents	• Stars and stellar systems (star clusters) • Radiation and properties of stars • Sun, peculiar stars, stellar structure and evolution • The Galaxy, interstellar medium • Structure and kinematics of the Galaxy • Galaxies, clusters of galaxies • Observational cosmology
Module components including CP (LP) information	Lecture with exercises (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually in winter term
Course credits	
Required pre-examination achievements	
Type of examination by continuous assessment	Written examination (90 min), oral examination (30 min) or presentation
Examination requirements	Entire content and qualification objectives of the module
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-ASN: Advanced surface physics and nanoscience	
Identifier	PHY-ASN
Module title	Advanced surface physics and nanoscience
German module title	Fortgeschrittene Oberflächen- und Nanophysik
Authorised module representative	Dean of Studies
Qualification objectives	• In-depth knowledge of a special topic in advanced surface physics or nanoscience • Self-competencies such as self- and time management, proactivity, willingness to perform, motivation, diligence, accuracy, persistence, self-confidence
Contents	The lecture provides an in-depth discussion of a special topic in advanced surface physics or nanoscience on a high level Typically, the lecture covers one of the items: • Physical background of recent research results • Physical background of current research in the working group • Discussion of research in an interdisciplinary context • Scientific background for the development of a new field of research
Module components including CP (LP) information	Lecture (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually in summer term
Course credits	
Required pre-examination achievements	
Type of examination by continuous assessment	Written examination (60 min) or oral examination (20 min)
Examination requirements	Entire content and qualification targets of the module
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics PhD Program Nanosciences
Prerequisites for participation in this module	Successful completion of the lectures Experimental Physics 1-5 or equiv.

Modul PHY-DDD: Diamond and defects in diamond	
Identifier	PHY-DDD
Module title	Diamond and defects in diamond
German module title	Diamant und Defekte in Diamant
Authorised module representative	Dean of Studies
Qualification objectives	• Introduction to diamond, diamond surfaces and defects in diamond • Self-competences such as self-management, time management, creativity, proactivity, motivation, carefulness, accurateness, endurance, self-confidence etc.
Contents	The lecture provides a survey over diamond materials properties and physical phenomena governing diamond. Topics covered include: • Physical properties and classification of diamond • Atomic and electronic structure of diamond surfaces • Physical description of defects in diamond • Methods of diamond synthesis • Methods of characterising defects in diamond • Applications of diamond and defects in diamond
Module components including CP (LP) information	Lecture (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually in summer term
Course credits	
Required pre-examination achievements	
Type of examination by continuous assessment	Written examination (60 min) or oral examination (20 min)
Examination requirements	Entire content and qualification targets of the module
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics PhD Program Nanoscience
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-OFP-P-15: Laboratory Course: Surface Sciences	
Identifier	PHY-OFP-P-15
Module title	Laboratory Course: Surface Sciences
German module title	Praktikum zur Oberflächenphysik
Authorised module representative	Dean of Studies
Qualification objectives	• Learning of advanced knowledge and experimental abilities of special fields of surface science • Self-competences such as self-management, time management, creativity, proactivity, motivation, carefulness, accurateness, endurance, self-confidence etc.
Contents	The student has to deepen his knowledge on a special subject in the field of surface science and to apply this to practical exercises. Contents are: • Settling into a special subject of surface science • Practical application of theoretical concepts • Final report
Module components including CP (LP) information	Laboratory course (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually in either winter or summer term
Course credits	Successful participation on laboratory course, analysis of distinct experiments, written report or oral presentations
Required pre-examination achievements	
Type of examination by continuous assessment	
Examination requirements	
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics MSc Nanosciences – Materials, Molecules and Cells PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-OFP-S-15: Seminar: Surface Science	
Identifier	PHY-OFP-S-15
Module title	Seminar: Surface Science
German module title	Seminar zur Oberflächenphysik
Authorised module representative	Dean of Studies
Qualification objectives	• Gathering knowledge on a special subject of surface science and presenting this to an auditorium • Self-competences such as self-management, time management, creativity, proactivity, motivation, carefulness, accurateness, endurance, self-confidence etc.
Contents	The student has to deepen his knowledge on a special subject in the field of surface science and to present his knowledge to an auditorium. Contents are: • Physical concept of distinct phenomena in surface science • Physical concept of experimental techniques in surface science
Module components including CP (LP) information	Seminar (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually in either winter or summer term
Course credits	Oral presentation and regular participation in the seminar
Required pre-examination achievements	
Type of examination by continuous assessment	
Examination requirements	
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics MSc Nanosciences – Materials, Molecules and Cells PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-PCN-15: Physics of Carbon Nanostructures (lecture)	
Identifier	PHY-PCN-15
Module title	Physics of Carbon Nanostructures (lecture)
German module title	Physik der Kohlenstoff-Nanostrukturen
Authorised module representative	Dean of Studies
Qualification objectives	• Specific knowledge in the physics of carbon nanostructures • Personal competences such as time and self-mamagement, proactivity, motivation, diligence, rigor, persistence, confidence
Contents	Introduction to basic concepts and application-relevant methods of physics of carbon nanostructures Exemplary contents: • Carbon nanostructures – classification and general properties • Fullerenes: chem. modification, quantum and solar applications • Nanotubes and graphene: electronic transport and sensing • Diamond: defects, electronics, sensing and quantum application
Module components including CP (LP) information	Lecture (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually
Course credits	Regular attendance
Required pre-examination achievements	Open to regular participants
Type of examination by continuous assessment	Written examination (60 min) or oral examination (20 min)
Examination requirements	Complete contents of module and qualification objectives
Calculation of module grade	Grade of final examination
Regulations on how to pass the module	Grade ≤ 4.0 ('sufficient' or better) and regular attendance
Retaking to improve grades	Not allowed
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics MSc Nanosciences – Materials, Molecules and Cells PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-PCN-P-15: Physics of Carbon Nanostructures (lab course)	
Identifier	PHY-PCN-P-15
Module title	Physics of Carbon Nanostructures (lab course)
German module title	Praktikum zur Physik der Kohlenstoff-Nanostrukturen
Authorised module representative	Dean of Studies
Qualification objectives	The students • gain hands-on experience in experimental physics, • learn about good laboratory practices, • hone team work skills, • acquire personal competences such as time and self-management, proactivity, motivation, diligence, rigor, persistence, confidence.
Contents	Project-based work in the physics of carbon nanostructures. Exemplary topics / areas: • CVD synthesis of carbon materials (nanotubes, diamond) • Physical modification by ion implantation • Chemical modification (simple one-pot reactions) • Preparative work (purification, surface treatments) • Microelectronics methods (metallisation, lithography) • Analysis and characterization (structural, optical, electronic, spin)
Module components including CP (LP) information	Lab course (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Each semester
Course credits	Participation in lab course + treatment of specific experimental problem + written lab protocol + short oral presentation
Required pre-examination achievements	Lab protocol deemed sufficient
Type of examination by continuous assessment	Oral presentation (20 min)
Examination requirements	Complete contents of module and qualification objectives
Calculation of module grade	Grade of presentation (25%) and grade of lab protocol (75%)
Regulations on how to pass the module	Grade ≤ 4.0 ('sufficient' or better)
Retaking to improve grades	Not allowed
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics MSc Nanosciences – Materials, Molecules and Cells PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-PCN-S-15: Physics of Carbon Nanostructures (seminar)	
Identifier	PHY-PCN-S-15
Module title	Physics of Carbon Nanostructures (seminar)
German module title	Seminar zur Physik der Kohlenstoff-Nanostrukturen
Authorised module representative	Dean of Studies
Qualification objectives	• (self-)acquisition of experimental und theoretical concepts in the physics of carbon nanostructures • communication and presentation skills • personal competences such as time and self-mamagement, proactivity, motivation, diligence, rigor, persistence, confidence
Contents	Detailed discussions of basic topics in the area of applied methods, esp. in the context of carbon nanostrucure physics Exemplary topics: • Electronic transport in 1D und 2D materials • Electronic bio-sensing with carbon nanotube transistors • Methods and concepts of electron spin resonance • Optical bio-sensing with nano-diamonds • Spin-based quantum sensing and quantum computing
Module components including CP (LP) information	Seminar (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually, alternating with lecture PHY-PCN-15
Course credits	Participation in seminar and own presentation
Required pre-examination achievements	Independent preparation of a technical topic
Type of examination by continuous assessment	Seminar presentation with discussion
Examination requirements	Complete contents of module and qualification objectives
Calculation of module grade	Grade of presentation
Regulations on how to pass the module	Grade ≤ 4.0 ('sufficient' or better)
Retaking to improve grades	Not allowed
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics MSc Nanosciences – Materials, Molecules and Cells PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-PFM-15: Physics of Functional Materials	
Identifier	PHY-PFM-15
Module title	Physics of Functional Materials
German module title	Physik funktionaler Materialien
Authorised module representative	Dean of Studies
Qualification objectives	• Learning of experimental and theoretical concepts of the physics of functional materials • Self-competences such as self-management, time management, creativity, proactivity, motivation, carefulness, accurateness, endurance, self-confidence etc.
Contents	The module comprises basic concepts and experimental techniques of the physics of functional materials. Contents particularly include: • Modification of physical properties due lower dimension • Impact of defects and material properties • Application in the fields of electronic and magnetic materials
Module components including CP (LP) information	Lecture with excercises (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually in either winter or summer term
Course credits	
Required pre-examination achievements	
Type of examination by continuous assessment	Written examination (60 min) or oral examination (20 min)
Examination requirements	Mastering of all contents of the module
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics MSc Nanosciences – Materials, Molecules and Cells PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-PSY-15: Physics with Synchrotron Radiation	
Identifier	PHY-PSY-15
Module title	Physics with Synchrotron Radiation
German module title	Physik mit Synchrotronstrahlung
Authorised module representative	Dean of Studies
Qualification objectives	• Learning of experimental and theoretical concepts of the physics using synchrotron radiation • Self-competencies such as self- and time management, proactivity, willingness to perform, motivation, diligence, accuracy, persistence, self-confidence
Contents	The module comprises basic concepts and experimental techniques of the physics using synchrotron radiation. Contents particularly include: • Interaction of x-rays with matter • Sources of synchrotron radiation – generation and instruments • Techniques and applications of spectroscopy • Diffraction techniques and their application • Imaging techniques (x-ray microscopy)
Module components including CP (LP) information	Lecture with excercises (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually in either winter or summer term
Course credits	
Required pre-examination achievements	
Type of examination by continuous assessment	Written examination (60 min) or oral examination (20 min)
Examination requirements	Mastering of all contents of the module
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics MSc Nanosciences – Materials, Molecules and Cells PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-PUDS-15: Physics of Ultrathin Films	
Identifier	PHY-PUDS-15
Module title	Physics of Ultrathin Films
German module title	Physik ultradünner Schichten
Authorised module representative	Dean of Studies
Qualification objectives	• Learning of experimental and theoretical concepts of the physics of thin and ultrathin films • Self-competences such as self-management, time management, creativity, proactivity, motivation, carefulness, accurateness, endurance, self-confidence etc.
Contents	The module comprises basic concepts and applied techniques of the physics of ultrathin films. Contents particularly include: • Deposition techniques • Experimental techniques to characterize ultrathin films • Morphology and defects • Elektronic, optical and magnetic properties of ultrathin films • Transport in ultrathin films
Module components including CP (LP) information	Lecture with excercises (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually in either winter or summer term
Course credits	
Required pre-examination achievements	
Type of examination by continuous assessment	Written examination (60 min) or oral examination (20 min)
Examination requirements	Mastering of all contents of the module
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics MSc Nanosciences – Materials, Molecules and Cells PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-UKP-P-15: Laboratory Course: Ultrafast Physics	
Identifier	PHY-UKP-P-15
Module title	Laboratory Course: Ultrafast Physics
German module title	Praktikum zur Ultrakurzzeitphysik
Authorised module representative	Dean of Studies
Qualification objectives	• Experience with experimental techniques in the laboratory for ultrafast physics and with ultrashort laser pulses • Application to modern research topics • Self-competences such as self-management, time management, creativity, proactivity, motivation, carefulness, accurateness, endurance, self-confidence, etc.
Contents	The module shows and imparts skills in the context of ultrafast physics. Contents in particular include: • Generation of ultrashort laser pulses • Detection of ultrashort laser pulses via detectors and autocorrelation techniques • Temporal control of ultrashort laser pulses • Nonlinear optical fs-spectroscopy, holographic ultrafast spectroscopy, UV/VIS/MIR fs-spektroscopie • Application to modern research topics in the field of (nano-)photonics, solid state- and bio-physics
Module components including CP (LP) information	Practicalum course (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Bi-anually in either summer or winter term
Course credits	Successful participation, analysis and study of specific experimental questions, written report or oral presentation
Required pre-examination achievements	
Type of examination by continuous assessment	
Examination requirements	
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics MSc Nanosciences – Materials, Molecules and Cells PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-UKP-S-15: Seminar: Ultrafast Physics	
Identifier	PHY-UKP-S-15
Module title	Seminar: Ultrafast Physics
German module title	Seminar zur Ultrakurzzeitphysik
Authorised module representative	Dean of Studies
Qualification objectives	• Competence in techniques and giving of professional talks and presentation • Application to modern research topics in the field of ultrafasts physics • Self-competences such as self-management, time management, creativity, proactivity, motivation, carefulness, accurateness, endurance, self-confidence, etc.
Contents	The module introduces into the techniques and the giving of talks and presentations with modern research topics in the field of ultrafast physics as an example. Content particularly includes: • Selection and finding of topics, outline and search • Time management and planning of the preparation phase • Techniques of presentation (i.e. with power point or prezi) • Creative elements of presentations, implementation of media • Speech techniques, rhetoric, voice control • Self reflection and critical discussion with seminar participants • Detailed study of modern research topics in the field of ultrafast physics
Module components including CP (LP) information	Seminar (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Bi-anually in either summer or winter term
Course credits	Successful presentation of a talk and regular participation at the seminar. Presence at talk and discussion
Required pre-examination achievements	
Type of examination by continuous assessment	
Examination requirements	
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics MSc Nanosciences – Materials, Molecules and Cells PhD Program Nanosciences
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Module PHY-FS_v1: Professional Specialization	
Identifier	PHY-FS_v1
Module title	Professional Specialization
German module title	Fachliche Spezialisierung
Authorised module representative	Dean of Studies
Qualification objectives	• Independent specialization in a specific topic of physics • Understanding of essential topics • Summarizing results by oral or written presentation • Self-competencies such as self- and time management, proactivity, willingness to perform, motivation, diligence, accuracy, persistence, self-confidence
Contents	Guided by a lecturer, the module serves to work independently and deeply on a current research project in experimental and/or theoretical physics. Contents are fixed individually. Examples are: • Reading current literature to acquire survey knowledge • Reproducing basic elements by studying literature or lab work • Evaluating various arguments • Writing or presenting the central aspects of the research topic
Module components including CP (LP) information	Professional Specialization (12 LP)
CP of the module	12 LP
SWS (hours per week during the semester) of the module	8 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually in winter and summer term
Course credits	Oral examination (30min)
Required pre-examination achievements	
Type of examination by continuous assessment	
Examination requirements	Complete contents of module and qualification objectives
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	-
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics MSc Nanosciences – Materials, Molecules and Cells
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-FP_v1: Research Project	
Identifier	PHY-FP_v1
Module title	Research Project
German module title	Forschungsprojekt
Authorised module representative	Dean of Studies
Qualification objectives	• Familiarisation with current (experimental or theoretical) research techniques • Tracking prototypical results • Development of exemplary new results • Summary by oral presentation or written elaboration • Self-competencies such as self- and time management, proactivity, willingness to perform, motivation, diligence, accuracy, persistence, self-confidence
Contents	The module serves as an autonomous in-depth introduction to experimental or theoretical physics techniques in a current field of research under the guidance of a physics lecturer. Contents of the module are determined individually. Examples are: • Understanding of the mechanisms and techniques used • Tracking of known and established results on prototypical systems • Developing your own results by means of suitable tests • Presentation of the techniques in the form of a written summary or a presentation
Module components including CP (LP) information	Research Project (15 LP)
CP of the module	15 LP
SWS (hours per week during the semester) of the module	10 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually in winter and summer term
Course credits	Oral examination (30 min)
Required pre-examination achievements	
Type of examination by continuous assessment	
Examination requirements	
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations

Modul PHY-KMA: Colloquium of the Master Thesis	
Identifier	PHY-KMA
Module title	Colloquium of the Master Thesis
German module title	Kolloquium zur Masterarbeit
Authorised module representative	Dean of Studies
Qualification objectives	• Autonomous presentation of the results of the master thesis • Self-competencies such as self- and time management, proactivity, willingness to perform, motivation, diligence, accuracy, persistence, self-confidence
Contents	The main results of the Master's thesis are presented and discussed.
Module components including CP (LP) information	Colloquium (3 LP)
CP of the module	3 LP
SWS (hours per week during the semester) of the module	2 SWS
Duration of the module	One semester
Frequency with which the course is offered	Annually in winter and summer term
Course credits	Oral examination (30 min)
Required pre-examination achievements	
Type of examination by continuous assessment	
Examination requirements	
Calculation of module grade	
Regulations on how to pass the module	
Retaking to improve grades	
Decision-making body for the module	Fachbereichsrat Physik
Use of module	MSc Physics
Prerequisites for participation in this module	Possible prerequisites see respective examination regulations