

Module Catalogue

for the Subject

Mathematical Physics

as a Bachelor's with 1 major with the degree "Bachelor of Science" (180 ECTS credits)

Examination regulations version: 2012 Responsible: Institute of Mathematics Responsible: Faculty of Physics and Astronomy

JMU Würzburg • generated 26-Aug-2024 • exam. reg. data record 82|b55|-|-|H|2012

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The subject is divided into

section / sub-section	ECTS credits	starting page
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Mathematics	69	8
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Compulsory Electives	20	29
Mathematics		30
Physics		40
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Content and Objectives of the Programme

The Bachelor programme in Mathematical Physics is offered by the Department of Mathematics, jointly with the Faculty of Physics and Astronomy, with a total of currently (SS 2010) 9 resp. 13 chairs.

At the end of this course of study, the student should be familiar with the main branches of mathematical physics, taught methods of both mathematical and physical reasoning and working as well as analytical thinking, abstract concepts and the ability to recognize and construct complex structures and interconnections.

Through the course these skills which the students acquire provide the basic knowledge required for analyzing and solving subsequently the various problems they encounter, and in particular for obtaining a consecutive Bachelor-Masters degree. Therefore, the main emphasis is put on the comprehension of fundamental mathematical and physical notions and principles, the knowledge of a variety of methods, the development of analytical reasoning and abstraction, and the capacity of a qualitative understanding of complex structural interconnections, rather than a detailed quantitative knowledge of many facts in mathematics and physics.

For the Bachelor thesis the student should work on a thematic and temporally closely limited frame in order to carry out a special task in mathematical physics, using well-known procedures and scientific criteria under guidance but, to a large extent, independently.

The exam should ascertain whether the candidate overlooks the context of the basics in mathematical physics and possesses the ability to apply the corresponding scientific methods. The exam should lead to an internationally comparable degree in mathematical physics and provides the means for entry into the working world. In the framework of a consecutive Bachelor-Masters degree it may also be used as preparation for further Masters study.

Abbreviations used

Course types: \mathbf{E} = field trip, \mathbf{K} = colloquium, \mathbf{O} = conversatorium, \mathbf{P} = placement/lab course, \mathbf{R} = project, \mathbf{S} = seminar, \mathbf{T} = tutorial, $\ddot{\mathbf{U}}$ = exercise, \mathbf{V} = lecture

Term: **SS** = summer semester, **WS** = winter semester

Methods of grading: **NUM** = numerical grade, **B**/**NB** = (not) successfully completed

Regulations: **(L)ASPO** = general academic and examination regulations (for teaching-degree programmes), **FSB** = subject-specific provisions, **SFB** = list of modules

Other: **A** = thesis, **LV** = course(s), **PL** = assessment(s), **TN** = participants, **VL** = prerequisite(s)

Conventions

Unless otherwise stated, courses and assessments will be held in German, assessments will be offered every semester and modules are not creditable for bonus.

Notes

Should there be the option to choose between several methods of assessment, the lecturer will agree with the module coordinator on the method of assessment to be used in the current semester by two weeks after the start of the course at the latest and will communicate this in the customary manner.

Should the module comprise more than one graded assessment, all assessments will be equally weighted, unless otherwise stated below.

Should the assessment comprise several individual assessments, successful completion of the module will require successful completion of all individual assessments.

In accordance with

the general regulations governing the degree subject described in this module catalogue:

ASP02009

associated official publications (FSB (subject-specific provisions)/SFB (list of modules)):

25-Oct-2012 (2012-170)

This module handbook seeks to render, as accurately as possible, the data that is of statutory relevance according to the examination regulations of the degree subject. However, only the FSB (subject-specific provisions) and SFB (list of modules) in their officially published versions shall be legally binding. In the case of doubt, the provisions on, in particular, module assessments specified in the FSB/SFB shall prevail.



Compulsory Courses

(130 ECTS credits)



Mathematics

(69 ECTS credits)

Module title			Abbreviation			
Analysis			10-M-ANA-122-m01			
Module coordinator			Module offered by			
Dean o	f Studi	es Mathematik (Mather	natics)	Institute of Mathem	natics	
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)		
20	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
2 seme	ster	undergraduate	By way of exception assessments.	, additional prerequi	isites are listed in th	e section on
Conten	ts					
		and completeness, bas al and integral calculus				
Intende	ed lear	ning outcomes				
mather	natical	nows and masters the e arguments and presen nethods and concepts	t them adequately in w	ritten and oral form.	He/She is acquaint	ed with the
Course	S (type, r	number of weekly contact hours	, language — if other than Ger	rman)		
compo • 1 • 1 • 1 Method module is	nent. o-M-AN o-M-AN o-M-AN d of ass	omprises 3 module con IA-1-122: V + Ü (no infor IA-2-122: V + Ü (no info IA-P-122: M (no informa sessment (type, scope, lang ile for bonus)	mation on SWS (weekl rmation on SWS (week tion on SWS (weekly c uage — if other than German, o	y contact hours) and ly contact hours) and ontact hours) and co examination offered — if no	d course language av d course language av ourse language avail ot every semester, informati	vailable) vailable) able) ion on whether
 Assessment in this module comprises the assessments in the individual module components as specified below. Unless stated otherwise, successful completion of the module will require successful completion of all individual assessments. Assessment in module component 10-M-ANA-1-122: Analysis 1 Analysis 1 8 ECTS, Method of grading: (not) successfully completed written examination (approx. 90 to 180 minutes); if announced by the lecturer, the written examination in groups of 2, approx. 30 minutes). Module will also be considered successfully completed if the module component for assessment purposes (Prüfungsteilmodul)) and this examination was passed. Language of assessment: German, English if agreed upon with the examiner Other prerequisites: Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment at a later date, students will put their registration for admission to assessment anew. Assessment in module component 10-M-ANA-2-122: Analysis 2 8 ECTS, Method of grading: (not) successfully completed written examination for admission to assessment anew. 						
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Other prerequisites: Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.

Assessment in module component 10-M-ANA-P-122: Examination in Analysis

- 4 ECTS, Method of grading: numerical grade
- oral examination of one candidate each (approx. 30 minutes); assessment will have reference to the contents of modules 10-M-ANA-1 and 10-M-ANA-2
- Language of assessment: German, English if agreed upon with the examiner
- Only after successful completion of module components: Successful completion of the written examination in any one of the other two module components is a prerequisite for participation in module component 10-M-ANA-P.

Allocation of places

Additional information

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Workload

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

§ 73 (1) 1. Mathematik Analysis

Module appears in

Bachelor' degree (1 major) Mathematics (2012)

Bachelor' degree (1 major) Mathematics (2013)

Bachelor' degree (1 major) Mathematical Physics (2012)

Bachelor' degree (1 major) Computational Mathematics (2012)

Bachelor' degree (1 major) Computational Mathematics (2013)

Module title			Abbreviation		
Linear Algebra					10-M-LNA-122-m01
Module coordinator				Module offered by	
Dean of Studies Mathematik (Mathematics)			atics)	Institute of Mathematics	
ECTS Method of grading On			Only after succ. con	npl. of module(s)	
20	nume	rical grade			
Duratio	on	n Module level Other prerequisites			
2 semester undergraduate By way of exception, additional prerequisites are listed in the assessments.			isites are listed in the section on		

Contents

Basic notions and structures; vector spaces, linear maps and systems of linear equations; theory of matrices and determinants; eigenvalue theory; bilinear forms and Euclidean/unitary vector spaces; diagonalisability and Jordan normal form.

Intended learning outcomes

The student knows and masters the basic notions and essential methods of linear algebra. He/She is able to perform easy mathematical arguments independently, and can present them adequately in written and oral form. He/She is able to apply the central proof methods and concepts of linear algebra and knows about their algebraic and geometric background.

Courses (type, number of weekly contact hours, language – if other than German)

This module comprises 3 module components. Information on courses will be listed separately for each module component.

- 10-M-LNA-1-122: V + Ü (no information on SWS (weekly contact hours) and course language available)
- 10-M-LNA-2-122: V + Ü (no information on SWS (weekly contact hours) and course language available)
- 10-M-LNA-P-122: M (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus)

Assessment in this module comprises the assessments in the individual module components as specified below. Unless stated otherwise, successful completion of the module will require successful completion of all individual assessments.

Assessment in module component 10-M-LNA-1-122: Linear Algebra 1 Linear Algebra 1

- 8 ECTS, Method of grading: (not) successfully completed
- written examination (approx. 90 to 180 minutes); if announced by the lecturer, the written examination can be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups (groups of 2, approx. 30 minutes). Module will also be considered successfully completed if the module component was selected as subject of the oral examination covering several modules (separate module component for assessment purposes (Prüfungsteilmodul)) and this examination was passed.
- Language of assessment: German, English if agreed upon with the examiner
- Other prerequisites: Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.

Assessment in module component 10-M-LNA-2-122: Linear Algebra 2 Linear Algebra 2

- 8 ECTS, Method of grading: (not) successfully completed
- written examination (approx. 90 to 180 minutes); if announced by the lecturer, the written examination can be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups (groups of 2, approx. 30 minutes). Module will also be considered successfully completed if the

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module component was selected as subject of the oral examination covering several modules (separate module component for assessment purposes (Prüfungsteilmodul)) and this examination was passed.

- Language of assessment: German, English if agreed upon with the examiner
- Other prerequisites: Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.

Assessment in module component 10-M-LNA-P-122: Examination in Linear Algebra

- 4 ECTS, Method of grading: numerical grade
- oral examination of one candidate each (approx. 30 minutes); assessment will have reference to the contents of modules 10-M-LNA-1 and 10-M-LNA-2
- Language of assessment: German, English if agreed upon with the examiner
- Only after successful completion of module components: Successful completion of the written examination in any one of the other two module components is a prerequisite for participation in module component 10-M-LNA-P.

Allocation of places

UNIVERSITÄT

WÜRZBURG

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Additional information

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Workload

Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

§ 73 (1) 2. Mathematik Lineare Algebra, Algebra und Elemente der Zahlentheorie

Module appears in

Bachelor' degree (1 major) Mathematics (2012)

Bachelor' degree (1 major) Mathematics (2013)

Bachelor' degree (1 major) Mathematical Physics (2012)

Bachelor' degree (1 major) Computational Mathematics (2012)

Bachelor' degree (1 major) Computational Mathematics (2013)

Module title				Abbreviation	
Mathematics in Mathematical Physics					10-M-MMP-122-m01
Module coordinator Module offered by			Module offered by		
Dean of Studies Mathematik (Mathematics) Ins			Institute of Mathematics		
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)	
20	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
2 seme	ester	undergraduate	By way of exception, additional prerequisites are listed in the section on assessments.		
Conten	Contents				

Basics in ordinary and partial differential equations, complex analysis, functional analysis and Fourier analysis with a special focus on applications in physics.

Intended learning outcomes

The student is acquainted with advanced methods in mathematics, which are needed in theoretical and experimental physics.

Courses (type, number of weekly contact hours, language – if other than German)

This module comprises 3 module components. Information on courses will be listed separately for each module component.

- 10-M-MMP-2-122: V + Ü (no information on SWS (weekly contact hours) and course language available)
- 10-M-MMP-1-122: V + Ü (no information on SWS (weekly contact hours) and course language available)
- 10-M-MMP-P-122: M (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language - if other than German, examination offered - if not every semester, information on whether module is creditable for bonus)

Assessment in this module comprises the assessments in the individual module components as specified below. Unless stated otherwise, successful completion of the module will require successful completion of all individual assessments.

Assessment in module component 10-M-MMP-2-122: Mathematical Methods in Physics 2 Mathematical Methods in Physics 2

- 8 ECTS, Method of grading: (not) successfully completed
- written examination (approx. 90 to 180 minutes); if announced by the lecturer, the written examination can be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups (groups of 2, approx. 30 minutes). Module will also be considered successfully completed if the module component was selected as subject of the oral examination covering several modules (separate module component for assessment purposes (Prüfungsteilmodul)) and this examination was passed.
- Language of assessment: German, English if agreed upon with the examiner
- Other prerequisites: Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.

Assessment in module component 10-M-MMP-1-122: Mathematics in Mathematical Physics 1 Mathematics in Mathematical Physics 1

- 8 ECTS, Method of grading: (not) successfully completed
- written examination (approx. 90 to 180 minutes); if announced by the lecturer, the written examination can be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups (groups of 2, approx. 30 minutes). Module will also be considered successfully completed if the module component was selected as subject of the oral examination covering several modules (separate module component for assessment purposes (Prüfungsteilmodul)) and this examination was passed.

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- Language of assessment: German, English if agreed upon with the examiner
- Other prerequisites: Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.

Assessment in module component 10-M-MMP-P-122: Examination in Mathematics in Mathematical Physics

- 4 ECTS, Method of grading: numerical grade
- oral examination of one candidate each (approx. 30 minutes); assessment will have reference to the contents of modules 10-M-MMP-1 and 10-M-MMP-2
- Language of assessment: German, English if agreed upon with the examiner
- Only after successful completion of module components: Successful completion of the written examination in any one of the other two module components is a prerequisite for participation in module component 10-M-MMP-P.

Allocation of places

Additional information

Additional information will be listed separately for each module component.

- 10-M-MMP-2-122: Additional information on module duration: 1 to 2 semesters.
- 10-M-MMP-1-122: --
- 10-M-MMP-P-122:--

Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Mathematical Physics (2012)

Module	e title				Abbreviation
Advanced Analysis					10-M-VAN-122-m01
Module coordinator				Module offered by	
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
9		rical grade			
Duratio		Module level	Other prerequisites		
1 semesterundergraduateCertain prerequisites must be met to qualify for adr sessment. The lecturer will inform students about t at the beginning of the course. Registration for the sidered a declaration of will to seek admission to a dents have obtained the qualification for admission the course of the semester, the lecturer will put the sessment into effect. Students who meet all prereq ted to assessment in the current or in the subseque sessment at a later date, students will have to obta admission to assessment anew.			nts about the respective details ion for the course will be con- nission to assessment. If stu- or admission to assessment over will put their registration for as- et all prerequisites will be admit- e subsequent semester. For as-		
Conten	ts				
Continu	uation	of analysis in several vari	ables, integration the	eorems.	
Intende	ed lear	ning outcomes			
she is a	able to	understand the construc	tion of a complex ma	thematical concept.	e of the Lesbegue integral, he or
		umber of weekly contact hours, l			
		mation on SWS (weekly	-		
		essment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	ot every semester, information on whether
if anno each (a	unced pprox.	nation (approx. 90 to 180 by the lecturer, the writte 20 minutes) or an oral ex ssessment: German, Eng	n examination can be xamination in groups	(groups of 2, approx	l examination of one candidate ĸ. ȝo minutes)
Allocat	ion of p	olaces			
Additio	onal inf	ormation			
 Worklo	ad				
Teachi	ng cycl	e			
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module appears in					
Bachelor' degree (1 major) Mathematics (2012)					
Bachelor' degree (1 major) Mathematics (2013)					
Bachelor' degree (1 major) Mathematical Physics (2012)					
	Bachelor' degree (1 major) Computational Mathematics (2012)				
Bachel	or' deg	ree (1 major) Computatio	nal Mathematics (20:	13)	
		or Mathematical Physics		gonorated at Aug 2024 • ex	



Physics (61 ECTS credits)

For students interested in participating in the FOKUS programme, module 11-TQM-F will replace module 11-TQM. Module component 11-TQM-F-2, which will prepare students for studying in the Master's programme FOKUS Physik (FOKUS Physics), will be offered in the form of a block course between the lecture periods of the winter and summer semesters (for students who took up studies in winter semester, block course will be offered between third and fourth subject semester).

Module title				Abbreviation		
Classic	Classical Physics (Mechanics, Thermodynamics, Waves, Oscillations, Electrici- 11-KP-092-mo1					
ty, Magnetism and Optics)						
Module	coord	inator		Module offered by		
Managi	ng Dire	ector of the Institute of A	pplied Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)		
16	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
2 seme	ster	undergraduate	-	ematische Rechenme sics) for first-semeste	ethoden der Physik (N er students.	∕lathemati-
Conten	ts					
gnetic v tion. Int Non-lin rent. Me	vibratio teractic earity a echanis	of mechanics, thermody ons and waves, radiation ons and central forces. G and chaos. Mechanics o sms of conduction. Mag ent. Electromagnetic way	and wave optics. Tim eneral relativity. Mecl f non-rigid bodies. Ga netostatics. Electroma	e, room and motion hanics of rigid bodie sses. Thermodynami agnetic induction. Ma	. Physical values. Forces. Friction. Vibration a ics. Electrostatics. Electrostatics. Electrostatics.	ce and mo- and waves. ectric cur-
Intende	ed learn	ning outcomes				
ves, sci are able	ence o e to ap	understand the basic pri f electricity, magnetism, ply mathematical metho the solution of mathema	electromagnetic vibra ds to the formulation	ations and waves, ra	diation and wave opt	ics. They
Course	S (type, n	umber of weekly contact hours,	language — if other than Ger	rman)		
tact hou Klassis	urs) + Ü che Phy	ysik 1 (Mechanik, Weller İ (2 weekly contact hour ysik 2 (Elektromagnetisr) + Ü (2 weekly contact h	s), once a year (winter nus, Optik) (Classical	r semester) Physics 2 (Electroma		
		s essment (type, scope, langu le for bonus)	age — if other than German, e	examination offered — if no	t every semester, informatio	n on whether
 This module has the following assessment components 1. Topics covered in lectures and exercises in part 1 (Klassische Physik 1 (Classical Physics 1)): written examination (approx. 120 minutes). 2. Topics covered in lectures and exercises in part 2 (Klassische Physik 2 (Classical Physics 2)): written examination (approx. 120 minutes). 3. Topics covered in lectures and exercises in parts 1 and 2: oral examination of one candidate each (approx. 30 minutes, usually chosen) or written examination (approx. 120 minutes). 						
Assessment component 3 will be offered in German; English if agreed upon with examiner(s). Successful completion of approx. 50% of practice work each is a prerequisite for admission to assessment com- ponents 1 and 2. To qualify for admission to assessment component 3, students must pass assessment component 1 and/or 2. Students are highly recommended to attend both courses Klassische Physik 1 (Classical Physics 1) and Klassi- sche Physik 2 (Classical Physics 2). The topics discussed in these two courses will be covered in assessment component 3. Students must register for assessment components 1 through 3 online (details to be announced). To pass this module, students must first pass assessment component 1 or 2 and must then pass assessment component 3. The grade achieved in assessment component 1 or 2 (whichever is better) and the grade achieved in assessment component 3 will each count 50% towards the overall grade awarded for the module.						
Allocation of places						
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dditional information				
orkload				
eaching cycle				
eferred to in LPO I (examination regulations for teaching-degree programmes)				
odule appears in				
achelor' degree (1 major) Mathematics (2012)				
achelor' degree (1 major) Mathematics (2013)				
achelor' degree (1 major) Physics (2010)				
achelor' degree (1 major) Physics (2012)				
achelor' degree (1 major) Nanostructure Technology (2010)				
achelor' degree (1 major) Nanostructure Technology (2012)				
achelor' degree (1 major) Mathematical Physics (2009)				
achelor' degree (1 major) Mathematical Physics (2012)				
achelor' degree (1 major) Computational Mathematics (2012)				
Bachelor' degree (1 major) Computational Mathematics (2013)				
achelor's degree (1 major, 1 minor) Physics (Minor, 2010)				
o final examination Special study offering (2010)				

Module title				Abbreviation	
Lab Course A					11-P-PA-112-m01
Module coordinator				Module offered by	
Managi	ng Dire	ector of the Institute of Ap	plied Physics	Faculty of Physics a	and Astronomy
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	(not) s	successfully completed			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
pagatio tests, w	on, grap /riting (ohs, linear regression, av of lab reports and publica	erage values and sta		or, error approximation and pro- tribution functions, significance
Intende	ed learı	ning outcomes			
le to inc measur	depenc ring pro	lently plan and conduct e	experiments, to cooperation of the cooperation of the measuring the measuring the measuring the measuring the measuring the cooperation of the measuring the measure of the	erate with others, an g results on the basi	menting techniques. They are ab- d to document the results in a s of error propagation and of the
Course	S (type, n	number of weekly contact hours, l	anguage — if other than Ger	man)	
Ü (1 we Beispie	ekly co ele aus	ntact hour), once a year	(winter semester)		ysis): V (1 weekly contact hour) + hermodynamics and Electricity,
Method	d of ass	sessment (type, scope, langua	ge — if other than German, e	examination offered — if no	ot every semester, information on whether
module is	creditab	le for bonus)			
1. Topic 2. Lab c ted if	cs cove course: f a Test		ises: written examina and evaluating the e alk (with discussion)	experiments will be c	inutes) considered successfully comple- ' understanding of the physics-re-
	sful co	mpletion of approx. 50%	of practice work is a	prerequisite for adm	iission to assessment component
To pass portuni Studen Studen	 To pass assessment component 2, students must pass both elements a) and b). Students will be offered one opportunity to retake element a) and/or element b). Students must register for assessment components 1 and 2 online (details to be announced). Students must attend Auswertung von Messungen und Fehlerrechnung (Measurements and Data Analysis) befo- 				
Electric		eispiele aus Mechanik, v	varmelenre und Elekt	TR (Examples from r	Mechanics, Thermodynamics and
		odule, students must pa	ss both assessment	component 1 and as	sessment component 2.
Allocation of places					
Additional information					
Workload					
Teaching cycle					



Referred to in LPO I (examination regulations for teaching-degree programmes)

§ 53 (1) 1. a) Physik Mechanik, Wärmelehre, Elektrizitätslehre, Optik, der speziellen Relativitätstheorie

§ 53 (1) 1. c) Physik physikalische Grundpraktika

§ 77 (1) 1. a) Physik "Grundlagen der Experimentalphysik"

§ 77 (1) 1. d) Physik "physikalische Praktika"

Module appears in

Bachelor' degree (1 major) Mathematics (2012)

Bachelor' degree (1 major) Mathematics (2013)

Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Nanostructure Technology (2012)

Bachelor' degree (1 major) Mathematical Physics (2012)

Bachelor' degree (1 major) Computational Mathematics (2012)

Bachelor' degree (1 major) Computational Mathematics (2013)

First state examination for the teaching degree Grundschule Physics (2009)

First state examination for the teaching degree Hauptschule Physics (2009)

First state examination for the teaching degree Realschule Physics (2009)

First state examination for the teaching degree Gymnasium Physics (2009)

First state examination for the teaching degree Mittelschule Physics (2013)

Module	title				Abbreviation
Laborat	tory Co	ourse Mathematical Phys	ics B		11-P-MPB-122-m01
Module	coord	inator		Module offered by	
Managi	ng Dire	ector of the Institute of Ap	plied Physics	Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
4	(not) s	successfully completed			
Duratio	n	Module level	Other prerequisites		
1 semes	ster	undergraduate			
Conten	ts				
Physica	ıl laws	of optics, vibrations and	waves, science of ele	ectricity and circuits	with electric components.
Intende	ed lear	ning outcomes			
le to inc measur	depeno ring pro	lently plan and conduct e	experiments, to coop valuate the measurin	erate with others, an g results on the basi	menting techniques. They are ab- d to document the results in a s of error propagation and of the
Courses	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)	
P (no in	Iformat	tion on SWS (weekly cont	act hours) and cours	e language available	e)
		Sessment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
if a Test (with di the mod	tat (exa iscussi dule co	am) is passed. Experimen on; approx. 30 minutes) 1	its that were not succ to test the candidate e not successfully co	essfully completed of sunderstanding of t	sidered successfully completed can be repeated once. And b) talk he physics-related contents of ated once. Both components of
Allocati			<u> </u>		
Additio	nal inf	ormation			
Additio	nal inf	ormation on module dura	ition: 1 to 2 semester	s.	
Worklo	ad				
Teachir	ıg cycl	e			
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	
		-	_ · · •		
Module	appea	ars in			
		ree (1 major) Mathematic	al Physics (2012)		
					

Module	e title				Abbreviation
Advanc	ed Lab	oratory Course Mathema	itical Physics C		11-P-MPC-122-m01
Module	e coord	inator		Module offered by	
Manag	ing Dire	ector of the Institute of Ap	oplied Physics	Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)	
4	(not) s	successfully completed			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
		of wave optics, Molecula ised devices with exampl			n measuring methods using spe-
Intende	ed lear	ning outcomes			
le to in measu	depeno ring pro	lently plan and conduct e	experiments, to coop valuate the measurin	erate with others, an g results on the basi	menting techniques. They are ab- d to document the results in a s of error propagation and of the
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Gei	man)	
P (no ir	format	ion on SWS (weekly cont	act hours) and cours	e language available	2)
		sessment (type, scope, langua le for bonus)	ge — if other than German,	examination offered — if no	t every semester, information on whether
if a Tes (with d the mo	tat (exa iscussi dule co	am) is passed. Experimer on; approx. 30 minutes)	its that were not succ to test the candidate e not successfully co	essfully completed of the standard sector of the sector of	sidered successfully completed can be repeated once. And b) talk the physics-related contents of ated once. Both components of
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Additio	nal info	ormation on module dura	ition: 1 to 2 semester	S.	
Worklo	ad				
Teachi	ng cycl	e			
Referre	d to in	LPO I (examination regulation	s for teaching-degree progra	mmes)	
Module	e appea	ars in			
Bachel	or' deg	ree (1 major) Mathematic	al Physics (2012)		

Module	e title				Abbreviation	
Statist	ical Me	chanics, Thermodyna	mics and Electrodynam	ics	11-STE-092-m01	
Module	e coord	inator		Module offered by	I	
Manag and As		ector of the Institute of sics	Theoretical Physics	Faculty of Physics a	and Astronomy	
ECTS	1	od of grading	Only after succ. co	npl. of module(s)		
16	nume	rical grade		-		
Duratio	on	Module level	Other prerequisites	5		
2 seme	ester	undergraduate	10-M1-PHY and 10-I	M2-PHY or 10-M1-NST	and 10-M2-NST	
Conten	ts					
ticles,	critical		al systems. Thermodyn equations, electrostati pecial relativity.			
Intend	ed lear	ning outcomes				
trodyna	amics,	thermodynamics and s	edge of the methods of statistical mechanics. T ntly apply them to the o	hey are familiar with	the corresponding	g calculation
Course	S (type, 1	number of weekly contact hou	rs, language — if other than Ge	rman)		
hours) Theore	+ Ü (2 tische	weekly contact hours),	ynamik (Statistical Meo once a year (winter ser etical Electrodynamics) ter)	nester)		
		sessment (type, scope, lan vle for bonus)	guage — if other than German,	examination offered — if no	ot every semester, inforn	nation on whether
1. Topi char 2. Topi mics 3. Topi	cs cove nics and cs cove)): writ cs cove	d Thermodynamics)): w red in lectures and ex- ten examination (appr red in lectures and ex-	ercises in part 1 (Statist vritten examination (ap ercises in part 2 (Theor	prox. 120 minutes). etische Elektrodynan : oral examination of	nik (Theoretical Ele	ectrodyna-
Succes ponent Studen cal Mee discuss Studen To pass compo	sful co ts 1 and ts are l chanics sed in t ts mus s this n nent 3.	mpletion of approx. 50 l 2. highly recommended to and Thermodynamics these two courses will t register for assessme hodule, students must	Fered in German; Englis 9% of practice work eac o attend both courses 9 6) and Theoretische Ele be covered in assessm ent components 1 throu first pass assessment	h is a prerequisite fo Statistische Mechani ktrodynamik (Theore ent component 3. gh 3 online (details t component 1 or 2 an	or admission to ass k und Thermodyna tical Electrodynam to be announced). d must then pass a	amik (Statisti- iics). The topic: assessment
	nent 3	will each count 50% to	owards the overall grad			
Additio	nal inf	ormation				
	inac init					
Worklo	ad					
		jor Mathematical Physics		• generated 26-Aug-2024 • ex		page 23 / 106

Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

Module appears in

Bachelor' degree (1 major) Mathematics (2012)

Bachelor' degree (1 major) Mathematics (2013)

Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Nanostructure Technology (2010)

Bachelor' degree (1 major) Mathematical Physics (2009)

Bachelor' degree (1 major) Mathematical Physics (2012)

Bachelor' degree (1 major) Computational Mathematics (2012)

Bachelor' degree (1 major) Computational Mathematics (2013)

Bachelor's degree (1 major, 1 minor) Physics (Minor, 2010)

Module	title				Abbreviation
Theoret	tical M	echanics and Quantum N	Aechanics		11-TQM-092-m01
Module	coord	inator		Module offered by	
Managi and Ast	•	ector of the Institute of Th	eoretical Physics	Faculty of Physics a	ind Astronomy
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)	
16		rical grade		, ,,,	
Duratio		Module level	Other prerequisites		
2 seme		undergraduate			o-M1-NST, 10-M2-NST and MPI-3
		undergraduate	10-111-111, 10-112-1		0-m1-n51, 10-m2-n51 and m1-5
Problen Limits c cillator. ny-parti	ian me ns of co of class Angul icle sys	entral forces, minor vibra sical physics. Schrödinge ar momentum and spin. stems.	tions, rigid body, mo r equation, mathema	tion in electromagne itical principles of qu	conservation laws. Applications: etic fields. Relativistic dynamics. aantum mechanics, harmonic os- on. Motion in electric fields. Ma-
		ning outcomes			
miliar w of quan	vith the itum th retical	e principles of theoretical eory. They are able to ap	mechanics and their ply the acquired calc	r different formulatio ulation methods and	Theoretical Physics. They are fa- ns and understand the principles d techniques to simple problems d knowledge of basic mathemati-
Course	S (type, n	number of weekly contact hours, l	anguage — if other than Ge	rman)	
year (w	inter se nmech	emester) anik (Quantum Mechani			(2 weekly contact hours), once a kly contact hours), once a year
Method	l of ass	-	ge — if other than German,	examination offered — if no	ot every semester, information on whether
 Topic amin Topic tion (3. Topic 	ation (ation (cs cove (appro) cs cove	approx. 120 minutes). red in lectures and exerc k. 120 minutes).	ises in part 1 (Theore ises in part 2 (Quante ises in parts 1 and 2:	enmechanik (Quantu oral examination of	eoretical Mechanics)): written ex- ım Mechanics)): written examina- one candidate each (approx. 30
ponent: To qual 2. Stud and Qu sessme Studen To pass compor The gra compor	s 1 and ify for a ents ar antenn ent com ts mus 5 this m nent 3. de ach nent 3.	2. admission to assessmen re highly recommended to nechanik (Quantum Mech ponent 3. t register for assessment nodule, students must fir ieved in assessment com will each count 50% towa	t component 3, stude o attend both course hanics). The topics d components 1 throu st pass assessment o nponent 1 or 2 (which	ents must pass asses s Theoretische Mech iscussed in these two gh 3 online (details t component 1 or 2 and never is better) and th	d must then pass assessment he grade achieved in assessment
Allocat	ion of p	Diaces			

Additional information
Workload
Teaching cycle
Referred to in LPO I (examination regulations for teaching-degree programmes)
Module appears in
Bachelor' degree (1 major) Mathematics (2012)
Bachelor' degree (1 major) Mathematics (2013)
Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Mathematical Physics (2012)
Pachalar' dagrag (a majar) Computational Mathematics (2010)
Bachelor' degree (1 major) Computational Mathematics (2012)
Bachelor' degree (1 major) Computational Mathematics (2012) Bachelor' degree (1 major) Computational Mathematics (2013)

Theore	e title				Abbreviation	
	etical M	echanics and Quantum	Mechanics for FOKUS	5 Students	11-TQM-F-092-m01	
Module	e coord	inator		Module offered by		
Manag and As	-	ector of the Institute of ⁻ sics	Theoretical Physics	Faculty of Physics	and Astronomy	
ECTS	T	od of grading	Only after succ. co	mpl. of module(s)		
16		rical grade		•	1 and 10-M-NST2 and	l 11-TQM-1,
Duratio	on	Module level	Other prerequisites	5		
2 seme	ester	undergraduate				
Conten	nts	·	- t			
Proble: Limits	ms of c of class r. Angu	echanics. Lagrangian ar entral forces, minor vib sical physics. Schröding ar momentum and spin stems	rations, rigid body, mo ger equation, mathema	otion in electromagn atical principles of q	etic fields. Relativisti uantum mechanics, I	c dynamics. harmonic os-
Intend	ed lear	ning outcomes				
miliar v of quar	with the ntum th pretical	have gained first experi e principles of theoretic neory. They are able to a Physics and to interpre	al mechanics and thei pply the acquired cal	r different formulation methods an	ons and understand t d techniques to simp	the principles ble problems
Course	es (type,	number of weekly contact hours	s, language — if other than Ge	erman)		
Quante + Ü (2 v ween s	enmech weekly summe	emester) nanik für FOKUS-Studier contact hours) + T (1 we r and winter semester)				
	s credital	s essment (type, scope, lang ble for bonus)	uage — if other than German,	examination offered — if n	ot every semester, informat	
This mo 1. Topic amir 2. Topic char 3. Topic	odule h cs cove nation h cs cove nics for cs cove		ment components rcises in part 1 (Theore rcises in part 2 (Quant ten examination (appr rcises in parts 1 and 2	etische Mechanik (Th eenmechanik für FOK rox. 120 minutes). : oral examination of	neoretical Mechanics US-Studierende (Qua	ion on whether)): written ex- antum Me-
This ma 1. Topic amir 2. Topic char 3. Topic minu Succes ponent To qua Studen Quante these t Studen To pass compo The gra compo	odule h cs cove nation f cs cove utes, us ssful co ts 1 and lify for nts are enmech wo cou nts mus s this n nent 3. ade ach nent 3	ble for bonus) has the following assessed ared in lectures and exer (approx. 120 minutes). Fred in lectures and exer FOKUS Students)): writh ared in lectures and exer sually chosen) or writter mpletion of approx. 50° 1 2. admission to assessme highly recommended to hanik für FOKUS-Studier arses will be covered in a st register for assessmen hodule, students must f lieved in assessment co will each count 50% tow	sment components rcises in part 1 (Theore rcises in part 2 (Quant ten examination (appr rcises in parts 1 and 2 n examination (approx % of practice work eac nt component 3, stud attend both courses ende (Quantum Mech assessment compone nt components 1 throu irst pass assessment	etische Mechanik (Th cenmechanik für FOK rox. 120 minutes). : oral examination of a. 120 minutes). :h is a prerequisite fo ents must pass asse Theoretische Mechar anics for FOKUS Stud nt 3. ugh 3 online (details component 1 or 2 an hever is better) and t	neoretical Mechanics US-Studierende (Qua ² one candidate each or admission to asses ssment component a hik (Theoretical Mech dents). The topics dis to be announced). d must then pass ass he grade achieved ir	ion on whether)): written ex- antum Me- (approx. 30 ssment com- and/or 2. hanics) and scussed in sessment
This ma 1. Topic amir 2. Topic char 3. Topic minu Succes ponent To qua Studen Quante these t Studen To pass compo The gra	odule h cs cove nation f cs cove utes, us ssful co ts 1 and lify for nts are enmech wo cou nts mus s this n nent 3. ade ach nent 3	ble for bonus) has the following assessed ared in lectures and exer (approx. 120 minutes). Fred in lectures and exer FOKUS Students)): writh ared in lectures and exer sually chosen) or writter mpletion of approx. 50° 1 2. admission to assessme highly recommended to hanik für FOKUS-Studier arses will be covered in a st register for assessmen hodule, students must f lieved in assessment co will each count 50% tow	sment components rcises in part 1 (Theore rcises in part 2 (Quant ten examination (appr rcises in parts 1 and 2 n examination (approx % of practice work eac nt component 3, stud attend both courses ende (Quantum Mech assessment compone nt components 1 throu irst pass assessment	etische Mechanik (Th cenmechanik für FOK rox. 120 minutes). : oral examination of a. 120 minutes). :h is a prerequisite fo ents must pass asse Theoretische Mechar anics for FOKUS Stud nt 3. ugh 3 online (details component 1 or 2 an hever is better) and t	neoretical Mechanics US-Studierende (Qua ² one candidate each or admission to asses ssment component a hik (Theoretical Mech dents). The topics dis to be announced). d must then pass ass he grade achieved ir	ion on whether)): written ex- antum Me- (approx. 30 ssment com- and/or 2. nanics) and scussed in sessment

Julius-Maximilians-UNIVERSITÄT WÜRZBURG

Additional information

Students who intend to study the FOKUS Master's degree programme must take Quantenmechanik für FO-KUS-Studierende (Quantum Mechanics for FOKUS Students) instead of Quantenmechanik (Quantum Mechanics).

Workload

Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

Module appears in

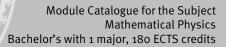
Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Nanostructure Technology (2010) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Mathematical Physics (2012)



Compulsory Electives

(20 ECTS credits)





Mathematics

(ECTS credits)

Module	title				Abbreviation	
		Il Mathematics			10-M-COM-122-mo1	L
					<u> </u>	
Module			··	Module offered by		
_		es Mathematik (Mathema	Γ	Institute of Mathem	latics	
ECTS		od of grading	Only after succ. com	ipl. of module(s)		
4	<u> </u>	successfully completed Module level				
Duratio			Other prerequisites			
1 seme:	SLEI	undergraduate	Certain prerequisite sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the set sessment into effect ted to assessment in sessment at a later of admission to assess	rer will inform stude he course. Registrat n of will to seek adm I the qualification fo mester, the lecturer Students who mee n the current or in th date, students will h	nts about the respection for the course win hission to assessment or admission to assess will put their registration t all prerequisites with e subsequent semest	tive details ill be con- nt. If stu- ssment over ation for as- ill be admit- ster. For as-
Conten	ts					
merical 10-M-A	compi NL) and	o modern mathematical s utation (e. g. Matlab) to s d 10-M-LNA). Computer-b and integral calculus; vi	supplement the basic ased solution of prob	modules in analysis lems in linear algeb	and linear algebra (((10-M-ANA or
Intende	ed learı	ning outcomes				
		earns the use of advanced cation to solve mathema		cal software package	es, and is able to ass	sess their
Course	S (type, n	number of weekly contact hours, l	anguage — if other than Ger	man)		
V + Ü (r	no infor	mation on SWS (weekly	contact hours) and co	ourse language avail	able)	
		sessment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	ot every semester, informati	ion on whether
beginni	ing of t	form of programming exe he course) ssessment: German, Eng			e specified by the le	cturer at the
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachir	ıg cycl	e				
Referre	d to in	LPO I (examination regulation	s for teaching-degree progra	mmes)		
Module						
	-	ree (1 major) Nanostructu				
Bachel	or' deg	ree (1 major) Economath ree (1 major) Mathematic	al Physics (2012)			
Bachel	or' deg	ree (1 major) Functional N	Materials (2012)			
Bachelor's (2012)	with 1 maj	or Mathematical Physics		generated 26-Aug-2024 • ex r (180 ECTS) Mathematische	-	page 31 / 106



First state examination for the teaching degree Gymnasium Mathematics (2012)

Module	e title				Abbreviation
Selecte	ed Topi	cs from Mathematics for	Mathematical Physic	CS	10-M-ERP-122-m01
Module	e coord	inator		Module offered by	·
Dean o	of Studio	es Mathematik (Mathema	atics)	Institute of Mathem	natics
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)	
10	nume	rical grade			
Duratio		Module level	Other prerequisites		
2 seme	ester	undergraduate	By way of exception assessments.	, additional prerequ	isites are listed in the section on
Conten	Its				
tion the sures a ted value introduction, su metrices Geome ke's the introduction	eory, cc and stoo ue and uction t uction t ubmani s, main etric Ana eorem a uction t ations,	ontinuous distributions: r chastic independence, el variance, limit theorems o Algebra (Fundamental o Differential Geometry (folds in Euclidean spaces theorem on local surface alysis (Fundamentals in a and applications in vecto o Discrete Mathematics cryptographic methods, e	normal distribution, ra ementary conditiona : law of large number algebraic structures: Curves in Euclidean s s, hypersurfaces in pa e theory, special class analysis on manifolds or analysis and topolo (Techniques from cor error-correcting codes	andom variable, dist l probability, charac s, central limit theor groups, rings, fields paces, curvature, Fr articular, curvature o ses of surfaces) s, submanifolds, cal gy) nbinatorics, introduc s)	
tional a					
The stu these f	udent is undam		epts and methods he	/she is able to pers	r applied mathematics. Based on ue further studies and interrelate dge.
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)	
This mo • 1 a	odule h .o-M-NL and 10-1	as 8 components; inform JM-1-122, 10-M-STO-1-122	nation on courses list 2, 10-M-ALG-1-122, 1 formation on languag	ed separately for ea o-M-DGE-1-122, 10-/ ge and number of we	M-GAN-1-122, 10-M-DIM-1-122, eekly contact hours available)
		Sessment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	ot every semester, information on whether
	ssessm				, students must pass one out of It component that is last in the
module rung in tialgeo lysis (G ductior sis (Int	e compo die Alg metrie Geomet n to Dis roducti	onent 10-M-STO-1-122: S gebra (Introduction to Alg (Introduction to Different ric Analysis), in module c	tochastik 1 (Stochast ebra), in module com ial Geometry), in moc omponent 10-M-DIM in module componen	ics 1), in module cor Iponent 10-M-DGE-1 Iule component 10-N -1-122: Einführung ir	(Numerical Mathematics 1), in mponent 10-M-ALG-1-122: Einfüh- -122: Einführung in die Differen- M-GAN-1-122: Geometrische Ana- n die Diskrete Mathematik (Intro- inführung in die Funktionalanaly-

Bachelor's with 1 major Mathematical Physics	JMU Würzburg • generated 26-Aug-2024 • exam. reg. da-	page 33 / 106
(2012)	ta record Bachelor (180 ECTS) Mathematische Physik - 2012	

- written examination (approx. 90 to 180 minutes). If announced by the lecturer, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 30 minutes). The module component will also be considered successfully completed if it is selected as subject of the oral examination covering several modules (separate module component for assessment purposes (Prüfungsteilmodul)) and this examination is passed.
- Language of assessment: German; English if agreed upon with examiner(s)
- Additional prerequisites: To qualify for admission to assessment, students must meet certain prerequisites. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.

Assessment in module component 10-M-ERP-P-122: Prüfung in Ergänzung Mathematik für Mathematische Physik (Assessment in Selected Topics from Mathematics for Mathematical Physics)

- 2 ECTS credits, numerical grading
- oral examination of one candidate each (approx. 30 minutes). Assessment will have reference to the topics covered in the module component selected by students.
- Language of assessment: German; English if agreed upon with examiner(s)
- Only after successful completion of module components: Module component 10-M-ERP-P can only be taken by students who passed the written examination in one of the other seven module components.

Allocation of places

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Additional information

UNIVERSITÄT

WÜRZBURG

Additional information on module duration: 1 to 2 semesters.

Workload

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Mathematical Physics (2012)

	e title				Abbreviation	
Furthe	r Topics	from Mathematics for I	Mathematical Physics		10-M-EWP-122-m01	
Modul	e coordi	nator		Module offered by		
Dean c	of Studie	es Mathematik (Mathem	atics)	Institute of Mathem	natics	
ECTS	Metho	d of grading	Only after succ. con	npl. of module(s)		
20	numer	ical grade				
Duratio	· r	Module level	Other prerequisites			
2 seme		undergraduate			isites are listed in th	e section on
Conter	nts					
ons an tegrati Stocha tion th sures a ted val Introdu tion, su metrice	d syster on) astics 1 (eory, co and stoc lue and uction to uction to ubmanif s, main	thematics 1 (Solution of ms of equations, interpo- (Combinatorics, Laplace ntinuous distributions: thastic independence, e variance, limit theorems o Algebra (Fundamental o Differential Geometry folds in Euclidean space theorem on local surfac	e models, selected dis normal distribution, r elementary conditiona s: law of large number algebraic structures: (Curves in Euclidean es, hypersurfaces in p	als, splines and trigo crete distributions, o andom variable, dist l probability, charac s, central limit theor groups, rings, fields spaces, curvature, Fr articular, curvature o	elementary measure tribution function, pr teristics of distribution rem) ; Galois theory) renet equations, loca	numerical in- and integra- oduct mea- ons: expec- al classifica-
ke's th Introdu applica Introdu tional a	eorem a uction to ations, c uction to analysis	•	analysis on manifold or analysis and topolo (Techniques from cor error-correcting codes	s, submanifolds, cal ogy) nbinatorics, introdu 6)	ction to graph theory	including
ke's th Introdu applica Introdu tional a	eorem a uction to ations, c uction to analysis	nd applications in vector Discrete Mathematics cryptographic methods, DFunctional Analysis (B	analysis on manifold or analysis and topolo (Techniques from cor error-correcting codes	s, submanifolds, cal ogy) nbinatorics, introdu 6)	ction to graph theory	including
ke's th Introdu applica Introdu tional a Intend The stu these f	eorem a uction to ations, c uction to analysis ed learn udent is fundame	nd applications in vector Discrete Mathematics cryptographic methods, D Functional Analysis (B).	analysis on manifold or analysis and topolo (Techniques from cor error-correcting codes anach spaces and Hil ced concepts and met cepts and methods he	s, submanifolds, cal ogy) nbinatorics, introduc 5) bert spaces, bounde hods of pure and/or e/she is able to pers	ction to graph theory ed operators, princip r applied mathematic ue further studies an	v including les of func- cs. Based on id interrela-
ke's th Introdu applica Introdu tional a Intend The stu these f te thes tics.	eorem a uction to ations, c uction to analysis ed learn udent is fundame se conce	and applications in vector Discrete Mathematics cryptographic methods, Defunctional Analysis (B). hing outcomes acquainted with advan- ental mathematical con-	analysis on manifold or analysis and topolo (Techniques from cor error-correcting codes anach spaces and Hil ced concepts and met cepts and methods he lvantages of thinking a	s, submanifolds, cal ogy) nbinatorics, introduc s) bert spaces, bounde hods of pure and/or e/she is able to pers across the borders o	ction to graph theory ed operators, princip r applied mathematic ue further studies an	v including les of func- cs. Based on id interrela-
ke's th Introdu applica Introdu tional a Intend The stu these f te these tics. Course This m	eorem a uction to ations, c uction to analysis ed learn udent is fundame se conce es (type, m odule ha to-M-NU and 10-M	and applications in vector Discrete Mathematics cryptographic methods, DFunctional Analysis (B). Ing outcomes acquainted with advan- ental mathematical con- pts, and realises the advances acquainted with advances (B) (B) (B) (B) (B) (B) (B) (B)	analysis on manifold or analysis and topolo (Techniques from cor error-correcting codes anach spaces and Hil ced concepts and met cepts and methods he lvantages of thinking language – if other than Ger mation on courses list 22, 10-M-ALG-1-122, 1 nformation on languag	s, submanifolds, cal ogy) nbinatorics, introduc bert spaces, bounde hods of pure and/or chods	ction to graph theory ed operators, princip r applied mathematic ue further studies an if different branches ch component. M-GAN-1-122, 10-M-I eekly contact hours a	v including oles of func- cs. Based on od interrela- in mathema- DIM-1-122, available)
ke's th Introdu applica Introdu tional a Intend The stu these f te these tics. Course This m 1 a 1 a Metho	eorem a ations, c ations, c analysis ed learn udent is fundame se conce es (type, nu odule ha to-M-NU and 10-M to-M-EW d of ass	and applications in vector Discrete Mathematics cryptographic methods, Discrete Mathematics cryptographic methods, Discrete Mathematics (B). Discrete Mathematics acquainted with advance acquainted with advance and realises the advance pts, and realises the advance umber of weekly contact hours, as 8 components; inform M-1-122, 10-M-STO-1-12 A-FAN-1-122: V + Ü (no in	analysis on manifolds or analysis and topolo (Techniques from cor error-correcting codes anach spaces and Hil ced concepts and met cepts and methods he lvantages of thinking language – if other than Gen mation on courses list 22, 10-M-ALG-1-122, 1 nformation on language tion on language and	s, submanifolds, cal ogy) nbinatorics, introduc bert spaces, bounde hods of pure and/or chods of pure and chods of chods	ction to graph theory ed operators, princip r applied mathematic ue further studies an f different branches ch component. M-GAN-1-122, 10-M-I eekly contact hours a ontact hours availabl	v including oles of func- cs. Based on nd interrela- in mathema- DIM-1-122, available)
ke's th Introdu applica Introdu tional a Intend The stu these f te these tics. Course This m • 1 a • 1 Metho module i This m the 7 a the ass Assess module rung in tialgeo lysis (C	eorem a uction to ations, c uction to analysis ed learn udent is fundame se conce es (type, no odule ha to-M-NU and 10-M to-M-EW d of ass s creditabl odule ha ssessmer sessmer in die Alg ometrie (Geometri	and applications in vector Discrete Mathematics cryptographic methods, DFunctional Analysis (B) ing outcomes acquainted with advance ental mathematical con- pts, and realises the advance umber of weekly contact hours, as 8 components; inforr M-1-122, 10-M-STO-1-12 A-FAN-1-122: V + Ü (no information (P-P-122: M (no information (P-P-122: M (no information)) as the following 8 assess ent components that are at component that is lass module component 10 onent 10-M-STO-1-122: Se ebra (Introduction to Alg (Introduction to Differentic Analysis), in module (Mathematica) in module component (Mathematica) in module (Mathematica) 	analysis on manifolds or analysis and topolo (Techniques from cor error-correcting codes anach spaces and Hil ced concepts and met cepts and methods he lvantages of thinking a language – if other than Ger mation on courses list 22, 10-M-ALG-1-122, 1 nformation on language tion on language and age – if other than German, assment components. The first in the list below. the list below. -M-NUM-1-122: Nume Stochastik 1 (Stochast gebra), in module com tial Geometry), in module com	s, submanifolds, cal pgy) nbinatorics, introduc bert spaces, bounde thods of pure and/or e/she is able to pers across the borders o man) red separately for ea o-M-DGE-1-122, 10-J ge and number of weekly co examination offered — if no fo pass this module, and pass one of the rische Mathematik 1 cics 1), in module com ponent 10-M-DGE-1 dule component 10-J -1-122: Einführung ir	ction to graph theory ed operators, princip r applied mathematic ue further studies an of different branches ch component. M-GAN-1-122, 10-M-I eekly contact hours a ontact hours availabl ot every semester, informati ot every semester, informati students must select em, furthermore they . (Numerical Mathem mponent 10-M-ALG-1 -122: Einführung in co M-GAN-1-122: Geome n die Diskrete Mathe	v including oles of func- cs. Based on d interrela- in mathema- DIM-1-122, tvailable) le) ion on whether ct tow out of v must pass patics 1), in i- 122: Einfüh- die Differen- etrische Ana- matik (Intro-
ke's th Introdu applica Introdu tional a Intend The stu these f te these tics. Course This m • 1 a • 1 Metho module i This m the 7 a the ass Assess module rung in tialgeo lysis (C duction	eorem a uction to ations, c uction to analysis ed learn udent is fundame se conce es (type, no odule ha to-M-NU and 10-M to-M-EW d of ass s creditabl odule ha ssessmer sment in e compon n die Alg ometrie (Geometr n to Disc	and applications in vector Discrete Mathematics cryptographic methods, DFunctional Analysis (B). ing outcomes acquainted with advance ental mathematical con- pts, and realises the advance umber of weekly contact hours, as 8 components; inform M-1-122, 10-M-STO-1-12 A-FAN-1-122: V + Ü (no in (P-P-122: M (no information (type, scope, langu e for bonus) as the following 8 assess ent components that are as the following 8 assess ent component that is lass module component 10 onent 10-M-STO-1-122: Se ebra (Introduction to Algorithmeter)	analysis on manifold or analysis and topolo (Techniques from cor error-correcting codes anach spaces and Hil ced concepts and met cepts and methods he lvantages of thinking a language – if other than Ger mation on courses list 22, 10-M-ALG-1-122, 1 nformation on language tion on language and age – if other than German, ssment components. The e first in the list below. component 10-M-DIM d in module components	s, submanifolds, cal pgy) nbinatorics, introduc bert spaces, bounde thods of pure and/or e/she is able to pers across the borders o man) red separately for ea o-M-DGE-1-122, 10-J ge and number of weekly co examination offered — if no fo pass this module, and pass one of the rische Mathematik 1 cics 1), in module com ponent 10-M-DGE-1 dule component 10-J -1-122: Einführung ir	ction to graph theory ed operators, princip r applied mathematic ue further studies an of different branches ch component. M-GAN-1-122, 10-M-I eekly contact hours a ontact hours availabl ot every semester, informati ot every semester, informati students must select em, furthermore they . (Numerical Mathem mponent 10-M-ALG-1 -122: Einführung in co M-GAN-1-122: Geome n die Diskrete Mathe	v including oles of func- cs. Based on d interrela- in mathema- DIM-1-122, tvailable) le) ion on whether ct tow out of v must pass patics 1), in i- 122: Einfüh- die Differen- etrische Ana- matik (Intro-

- 8 ECTS credits, pass / fail
- written examination (approx. 90 to 180 minutes). If announced by the lecturer, the written examination
 may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 30 minutes). The module component will also be considered successfully completed if it is selected as subject of the oral examination covering several modules (separate
 module component for assessment purposes (Prüfungsteilmodul)) and this examination is passed.
- Language of assessment: German; English if agreed upon with examiner(s)
- Additional prerequisites: To qualify for admission to assessment, students must meet certain prerequisites. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.

Assessment in module component 10-M-EWP-P-122: Prüfung in Erweiterung Mathematik für Mathematische Physik (Assessment in Further Topics from Mathematics for Mathematical Physics)

- 4 ECTS credits, numerical grading
- oral examination of one candidate each (approx. 30 minutes). Assessment will have reference to the topics covered in the two module components selected by students.
- Language of assessment: German; English if agreed upon with examiner(s)
- Only after successful completion of module components: Module component 10-M-EWP-P can only be taken by students who passed the written examination in one of the other seven module components.

Allocation of places

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Additional information

Additional information on module duration: 1 to 2 semesters.

Workload

--

Teaching cycle

--

Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Mathematical Physics (2012)

Module	e title				Abbreviation	
Modelli	ing and	Computational Scienc	e		10-M-MWR-122-mo	1
Module	e coord	inator		Module offered by	<u>I</u>	
Dean of	f Studie	es Mathematik (Mathem	natics)	Institute of Mathem	natics	
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)		
10	numei	rical grade				
Duratio	n	Module level	Other prerequisites			
		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment anew.				
Conten	ts					
scaling	the mo ndame	thematical modelling o odelling, asymptotic ser ntal methods for numer s.	ies, classical methods	for solving ordinary	and partial differen	tial equati-
Intende	ed learr	ning outcomes				
		asters the fundamental ng sciences on a compu		ds and techniques to	o simulate processes	s from natural
Course	S (type, n	umber of weekly contact hours	, language — if other than Ger	rman)		
V + Ü (r	no infor	mation on SWS (weekly	contact hours) and co	ourse language avail	able)	
		essment (type, scope, langule for bonus)	age — if other than German, o	examination offered — if no	ot every semester, informat	ion on whether
if annoi each (a	unced l pprox.	nation (approx. 90 to 18 by the lecturer, the writt 20 minutes) or an oral (ssessment: German, En	en examination can be examination in groups	(groups of 2, approx		e candidate
Allocati	. <u> </u>		<u> </u>			
	•					
Additio	nal info	ormation				
Worklo	ad					
Teachir	ng cycl	9				
Referre	d to in	LPO I (examination regulatio	ns for teaching-degree progra	immes)		
		•				
Module			huna Talahan la ang (ang)			
Bachelo	or' degi	ree (1 major) Nanostruc ree (1 major) Mathemat ree (1 major) Computati	ical Physics (2012)			
Bachelor's ((2012)	with 1 maj	or Mathematical Physics		generated 26-Aug-2024 • ex r (180 ECTS) Mathematische		page 37 / 106



Bachelor' degree (1 major) Computational Mathematics (2013)

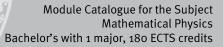
Module	e title				Abbreviation	
Semina	ar Math	ematics			10-M-SEM-122-m01	L
Module	coord	inator		Module offered by		
		es Mathematik (Mathema	atics)	Institute of Mathematics		
ECTS		od of grading	Only after succ. com			
5	· · · · · ·	successfully completed				
<u>Duratio</u>	· · · · · · · · · · · · · · · · · · ·	Module level	Other prerequisites			
1 semester undergraduate		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment anew.				
Conten	ts		ł			
		ic in mathematics.				
	· · · ·	ning outcomes				
ly in a s Courses S (no in Methoc module is talk (ap	scientifi s (type, n format d of ass creditab oprox. 6	c using selected literatur ic discussion. umber of weekly contact hours, l ion on SWS (weekly cont cessment (type, scope, langua le for bonus) to to 180 minutes) ssessment: German, Eng	language — if other than Ger tact hours) and cours age — if other than German, e	man) e language available examination offered — if no	2)	·
Allocat	ion of p	olaces				
			_			
Additio	nal info	ormation				
Worklo	ad					
Teachir	ng cycl	e				
Referre	d to in	LPO I (examination regulation	s for teaching-degree progra	mmes)		
Module	e appea	irs in				
Bachelo Bachelo Bachelo Bachelo Bachelo	or' degi or' degi or' degi or' degi or' degi	ree (1 major) Mathematic ree (1 major) Mathematic ree (1 major) Mathematic ree (1 major) Computatio ree (1 major) Computatio mination for the teaching	es (2013) al Physics (2012) nal Mathematics (201 nal Mathematics (201	13)		
Bachelor's ((2012)	with 1 maj	or Mathematical Physics		generated 26-Aug-2024 • ex r (180 ECTS) Mathematische	-	page 39 / 106



Physics (ECTS credits)

Module	e title				Abbreviation		
Astrop	hysics				11-A4-072-m01		
Madul	e coord	instar		Madula offered by	<u> </u>		
		ector of the Institute of 1	Chapter of the second second	Module offered by Faculty of Physics a	nd Astronomy		
	strophys				and Astronomy		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)			
6	nume	rical grade					
Duratio	on	Module level	Other prerequisites				
1 seme	ester	undergraduate	Admission prerequisite to assessment: successful completion of approx 50% of exercises. Certain prerequisites must be met to qualify for admiss sion to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be ad- mitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.				
Conten				sessment anew.			
large-s nucleo Intende The stu physica	ecale str synthes ed lean udents a al obse ney kno	n, structure of the Milky ucture of the universe, sis, cosmic microwave b ning outcomes are familiar with the mo rvations and evaluation w the structure of the un	Friedmann World Mod background radiation, dern world view of Ast s. They are able to use	els, thermodynamics structure formation, rophysics. They know these methods to p	s of the early univers inflation w methods and tools lan and analyse own	e, primordial s for astro- n observati-	
		umber of weekly contact hours	language — if other than Ge	man)			
		mation on SWS (weekly			able)		
Metho	d of ass	essment (type, scope, langule for bonus)				ion on whether	
written	n exami	nation (approx. 120 min	utes)				
Allocat	tion of p	olaces					
		f pool of general key ski	ills (ASQ): 15 places. P	laces will be allocate	ed by lot.		
Additio	onal inf	ormation					
Worklo	Jau						
	ing cycl	e					
 Teachi 	ng cycl						
 Teachi 	ng cycl	e LPOI (examination regulatio	ns for teaching-degree progra	immes)			
 Teachi Referre	ng cycl ed to in	LPOI (examination regulation	ns for teaching-degree progra	mmes)			
 Teachi Referre Module	ng cycl ed to in e appea	LPO I (examination regulations in the second		immes)			
 Teachi Referre Module Bachel	ing cycl ed to in e appea lor' deg	LPOI (examination regulation		mmes)			





Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2009) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Physics (2008) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Mathematical Physics (2012) Bachelor' degree (1 major) Aerospace Computer Science (2011) Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2010) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) Computational Mathematics (2012) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2008) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2010)

Module	e title				Abbreviation
Cosmo	logy				11-AKM-092-m01
Module	e coord	linator		Module offered by	Į.
	ing Dir	ector of the Institute of	Theoretical Physics	Faculty of Physics a	and Astronomy
ECTS		od of grading	Only after succ. con	npl. of module(s)	
6	1	rical grade			
Duratio	on in the second	Module level	Other prerequisites		
1 semester graduate		sessment. The lecture at the beginning of sidered a declaration dents have obtained the course of the se sessment into effect ted to assessment i	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for		
Conten	ts	1			
matter,	, primo	rdial nucleosynthesis,		kground, structure fo	e early universe, inflation, dark ormation, supercluster, galaxies
Intend	ed lear	ning outcomes			
	late the	em to observations. Th			ethods of cosmology and are ab- th topics and are able to work on
Course	S (type, I	number of weekly contact hou	rs, language — if other than Ge	rman)	
R + V (r	no info	rmation on SWS (week	ly contact hours) and co	ourse language avail	able)
		sessment (type, scope, lan ble for bonus)	guage — if other than German,	examination offered — if no	ot every semester, information on whether
groups project (approz Assess and wil examin	(appro report x. 30 m ment o Il be an nation r	ox. 30 minutes per can (approx. 8 to 10 pages inutes) offered: When and how	didate, for modules with s, time to complete: 1 to often assessment will l under observance of Sec	n less than 4 ECTS cr 4 weeks) or d) prese be offered depends o	idate each or oral examination in redits approx. 20 minutes) or c) entation/seminar presentation on the method of assessment 3 ASPO (general academic and
Allocat	ion of	places			
Additio	onal inf	ormation			
Worklo	ad				
Teachi	ng cycl	e			
 Referre	ed to in	LPO I (examination regulat	ions for teaching-degree progra	nmmes)	
			·····		am. reg. da- page 43 / 106
acholor's	with 1 ma	jor Mathematical Physics	IMII Würzhurg●	generated 26-Aug-2024 • ex	

Module appears in

Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) Computational Mathematics (2012)

Diacma	title				Abbreviation	
Plasma-Astrophysics					11-APL-092-m01	
Module coordinator				Module offered by		
Managin and Astr		ector of the Institute of ics	Theoretical Physics	Faculty of Physics a	and Astronomy	
		d of grading	Only after succ. con	npl. of module(s)		
		rical grade		•		
Duration	า	Module level	Other prerequisites			
sessment. The lectu at the beginning of sidered a declaration dents have obtaine the course of the se sessment into effect ted to assessment in sessment at a later				rer will inform stude the course. Registrat on of will to seek adn d the qualification fo mester, the lecturer t. Students who mee n the current or in th	alify for admission to as- nts about the respective details ion for the course will be con- nission to assessment. If stu- or admission to assessment over will put their registration for as- et all prerequisites will be admit- e subsequent semester. For as- ave to obtain the qualification for	
Contents	s					
The stud motion a compare Courses	lents h and ac e and e (type, n	celeration of charged evaluate theory and ex umber of weekly contact hour	particles in space, they	know corresponding	d the theoretical description of g measuring methods and can able)	
		essment (type, scope, lang le for bonus)	guage — if other than German,	examination offered — if no	ot every semester, information on whether	
groups (project r (approx.	appro eport 30 mi nent o be an	x. 30 minutes per cana (approx. 8 to 10 pages inutes) ffered: When and how nounced in due form u egulations) 2009.	lidate, for modules with , time to complete: 1 to often assessment will l nder observance of Sec	n less than 4 ECTS cr 4 weeks) or d) prese be offered depends o	date each or oral examination in redits approx. 20 minutes) or c) entation/seminar presentation on the method of assessment 3 ASPO (general academic and	
and will examina		ssessment: German, E	ngusu			
and will examina Languag	ge of a					
and will examina	ge of a on of p	laces				
and will examina Languag Allocatic Addition	ge of a on of p nal info	laces				
and will examina Languag Allocatic Addition	ge of a on of p nal info	laces				
and will examina Languag Allocatio Addition Workloa	e of a on of p nal info	ormation				
and will examina Languag Allocatio Addition Workloa 	e of a on of p nal info	ormation				
and will examina Languag Allocatio Addition	e of a on of p nal info	ormation				

Referred to in LPO I (examination regulations for teaching-degree programmes)

Module appears in

Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) Computational Mathematics (2012)

Modul	e title				Abbreviation
Theore	etical As	strophysics			11-AST-092-m01
Module	e coord	inator		Module offered by	/
Manag and As	•		of Theoretical Physics	Faculty of Physics	and Astronomy
ECTS	Meth	od of grading	Only after succ. co	mpl. of module(s)	
6	nume	rical grade			
Duratio	on	Module level	Other prerequisites	5	
1 seme	ster	graduate			
Conten	nts	10			
		trophysics, models f	for the description of com	nlex observation re	sults, numeric simulations.
		ning outcomes			
			re of the methods of The	visitional Actrophysics	s. They are able to design complex
			ls with the help of simula		s. They are able to design complex
Course	S (type, 1	number of weekly contact h	ours, language — if other than Ge	rman)	
R + V (r	no infoi	mation on SWS (wee	ekly contact hours) and c	ourse language ava	ilable)
written Allocat		nation (approx. 120 r places	ninutes)		
Additio	onal inf	ormation			
 Worklo	ad				
Teachi	ng cycl	e			
Referre	ed to in	LPO I (examination regu	lations for teaching-degree progr	ammes)	
Module	e appea	ars in			
Bachel	or' deg	ree (1 major) Physics	(2010)		
Bachel	or' deg	ree (1 major) Physics	(2012)		
Bachel	or' deg	ree (1 major) Mathen	natical Physics (2009)		
	-	-	natical Physics (2012)		
	-	ee (1 major) Physics			
Master	's degr	ee (1 major) Physics	(2011)		
Master	's degr	ee (1 major) Mathem	atical Physics (2012)		
Master	's degr	ee (1 major) FOKUS F	Physics (2010)		
	's degr	ee (1 major) FOKUS F	Physics (2011)		

Module	e title				Abbreviation
Introdu	uction t	o Plasmaphysics			11-EPP-092-m01
Module	e coord	inator		Module offered by	<u> </u>
Manag and As		ector of the Institute of T sics	heoretical Physics	Faculty of Physics a	and Astronomy
ECTS	1	od of grading	Only after succ. con	npl. of module(s)	
6	1	rical grade			
Duratio	on	Module level	Other prerequisites		
1 semester graduate		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment anew.			
Conten	its				
Transp thin the celerat	ort equ e solar ion and	ations for energetic par wind, Particle accelerat I transport in galaxies a	ticles, Properties of ma ion via shock waves ar	agnetic turbulence, F nd via interaction wit	elds, Magnetohydrodynamics, Propagation of solar particles wi- th plasma turbulence, Particle ac liation.
		ning outcomes			<i>C</i> , , , , , , , , , , , , , , , , , , ,
					of transport phenomena in plas- nowledge to Astrophysics.
Course	S (type, r	number of weekly contact hours	, language — if other than Ger	rman)	
V + R (r	no infor	mation on SWS (weekly	contact hours) and co	ourse language avail	able)
		sessment (type, scope, langu le for bonus)	lage — if other than German,	examination offered — if no	ot every semester, information on whether
groups project (approz Assess and wil examir	(appro report x. 30 m ment o Il be an nation r	ox. 30 minutes per candi (approx. 8 to 10 pages, inutes) ffered: When and how c	date, for modules with time to complete: 1 to often assessment will h oder observance of Sec	n less than 4 ECTS cr 4 weeks) or d) prese pe offered depends o	date each or oral examination in redits approx. 20 minutes) or c) entation/seminar presentation on the method of assessment 3 ASPO (general academic and
Allocat	ion of _l	places	-		
Additio	onal inf	ormation			
	-				
Worklo	ad				
 Teachi	ng cycl	e			
Referre	ed to in	LPO I (examination regulatio	ns for teaching-degree progra	immes)	
		ing Mathematical Disc. 1		generated 26-Aug-2024 • ex	
Bacholor's	with 1 ma	jor Mathematical Physics	INUL Würzburg •	UNITERATED 26-010-2026 OV	am. reg. da- page 48 / 106

Module appears in

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Computational Mathematics (2012)

Module	Module title Abbreviation					
Solid State Physics 1					11-FKP-092-m01	
Module	coord	inator		Module offered by		
Managi	ng Dire	ector of the Institute of	Applied Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
8	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
		sessment. The lecture at the beginning of sidered a declaration dents have obtained the course of the set sessment into effect ted to assessment i sessment at a later	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment anew.			
Conten	ts					
		of solids: Bonding and lectron gas).	structure, lattice dyna	mics, thermal proper	ties, principles of el	ectronic pro-
Intende	d learr	ning outcomes				
			ontexts and principles tronic properties (free		nd structure, lattice	dynamics,
Courses	5 (type, n	umber of weekly contact hour	s, language — if other than Ge	rman)		
V + Ü (n	o infor	mation on SWS (week	y contact hours) and co	ourse language avail	able)	
		e essment (type, scope, lang le for bonus)	guage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
otherwi Assessi and will	se spe ment o l be an	cified) ffered: When and how	nutes, for modules with often assessment will nder observance of Se	be offered depends o	on the method of ass	sessment
Allocati						
Additio	nal info	ormation				
Worklo	ad					
Teachin	ıg cycl	9				
Referre	d to in	LPOI (examination regulati	ons for teaching-degree progra	ammes)		
Module						
Bachelo Bachelo	or' degi or' degi	ree (1 major) Mathema ree (1 major) Mathema ree (1 major) Mathema ree (1 major) Mathema	tics (2013) tical Physics (2009)			
Bachelor's v (2012)	with 1 maj	or Mathematical Physics		generated 26-Aug-2024 • exa or (180 ECTS) Mathematische		page 50 / 106



Bachelor' degree (1 major) Computational Mathematics (2012) Bachelor' degree (1 major) Computational Mathematics (2013) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2010)

Module	Module title Abbreviation						
Group T	heory				11-GRT-092-m01		
Module	coord	inator		Module offered by			
Managi and Ast		ector of the Institute of ics	Theoretical Physics	Faculty of Physics a	Faculty of Physics and Astronomy		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)			
6	nume	rical grade					
Duratio	n	Module level	Other prerequisites				
1 semester graduate		sessment. The lectur at the beginning of the sidered a declaration dents have obtained the course of the set sessment into effect ted to assessment in sessment at a later	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment anew.				
Conten	ts						
Group t	heory.	Finite groups. Lie grou	ps. Lie algebra. Depicti	on. Tensors. Classifi	cation theorem. App	lications.	
Intende	d learr	ning outcomes					
group tl	heory a		up theory, especially of sing the acquired methologies.				
Courses	5 (type, n	umber of weekly contact hour	s, language — if other than Gei	rman)			
R + V (n	o infor	mation on SWS (weekl	y contact hours) and co	ourse language avail	able)		
		e essment (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informati	on on whether	
groups project (approx Assessi and will	a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.						
Allocati	ion of p	olaces					
Additio	nal inf	ormation					
Worklo	ad						
Teachin	ig cycl	e					
Referre	d to in	LPO I (examination regulati	ons for teaching-degree progra	mmes)			
		•					
Module	appea	irs in					
Bachelor's v (2012)	with 1 maj	or Mathematical Physics		generated 26-Aug-2024 • exa r (180 ECTS) Mathematische	-	page 52 / 106	

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Computational Mathematics (2012)

Module	e title				Abbreviation	
Nuclea	r and E	lementary Particle Phys	ics		11-KET-122-m01	
Module				As dula offered by	<u> </u>	
				Module offered by		
	<u> </u>	ector of the Institute of A	T	Faculty of Physics a	and Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 semester undergraduate		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment anew.				
Conten	nte					
Nuclea lerators Intende The stu	r mode s and d ed lear udents ave an	of Nuclear and Element ls. Structure of nuclei. R etectors. Electromagnet ning outcomes understand the basic co overview of the experim	adioactivity and spect ic interaction. Strong nnections between fu	troscopy. Nuclear en interaction. Weak int ndamental Nuclear a	ergy. Radiation and teraction. Standard and Elementary Part	matter. Acce- model. icle Physics.
		number of weekly contact hours, mation on SWS (weekly			able)	
		sessment (type, scope, langu le for bonus)	age — if other than German,	examination offered — if no	ot every semester, informa	tion on whether
written	exami	nation (approx. 120 min	utes)			
Allocat	tion of j	olaces				
Additio	onal inf	ormation				
Worklo	ad					
Teachi	ng cycl	e				
Referre	ed to in	LPO I (examination regulatio	ns for teaching-degree progra	immes)		
				· · · · · /		
Module	aannos	ors in				
		ree (1 major) Mathemati	cc (2012)			
Bachel Bachel Bachel Bachel	or' deg or' deg or' deg or' deg	ree (1 major) Mathemati ree (1 major) Mathemati ree (1 major) Mathemati ree (1 major) Computati ree (1 major) Computation	cs (2013) 012) cal Physics (2012) onal Mathematics (20			
		jor Mathematical Physics		generated 26-Aug-2024 • ex	am reg da-	page 54 / 106
Jacinetor S	with Tilld	or mathematical FligSICS		r (180 ECTS) Mathematische		page 54 / 106

Module	e title		Abbreviation			
Conder	ised Ma	atter (Quanta, Atoms, Mo	olecules, Solid State	Physics)	11-KM-092-m01	
Module	coord	inator		Module offered by		
Managi	ng Dire	ector of the Institute of Ap	oplied Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
16	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
2 seme	ster	undergraduate				
Conten	ts		·			
Quantu Atoms i mical b (FEG). C	Quantum phenomena, introduction to Atomic Physics and physical laws of solids. Experimental principles of Quantum Physics. Mathematical formulation of quantum mechanics. Quantum mechanics of hydrogen atoms. Atoms in external fields. Many-electron atoms. Optical transitions and spectroscopy. Laser. Molecules and chemical bonding. Molecule rotations and vibrations. Bonding in crystals. Mechanical properties. Free electron gas (FEG). Crystal structure. The reciprocal lattice. Structure determination. Lattice vibrations (phonons). Thermal properties of insulators. Electrons in a periodic potential.					
Intende	ed learr	ning outcomes	· · · · · ·			
ding an They ar	d struc e able t	ture, lattice dynamics, th	nermal properties, pri ethods to the formula	nciples of electronic ation of modern phy	tomic Physics and solids (bon- properties (free electron gas)). sical contexts and autonomously	
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
kly con Konder hours)	tact ho isierte + Ü (2 v	urs) + Ü (2 weekly contac Materie 2 (Festkörperphy veekly contact hours), or	et hours), once a year ysik 1) (Condensed Ma nce a year (summer se	(winter semester) atter 2 (Solid State P emester)	ita, Atoms, Molecules)): V (4 wee- hysics)): V (4 weekly contact	
		le for bonus)				
 Topic amin Topic amin Topic 	ation (ation (cs cove ation (cs cove	approx. 120 minutes). red in lectures and exerc approx. 120 minutes). red in lectures and exerc	ises in part 1 (Konder ises in part 2 (Konder ises in parts 1 and 2:	nsierte Materie 2 (Co oral examination of	ndensed Matter 1)): written ex- ondensed Matter 2)): written ex- one candidate each (approx. 30	
Succes ponent To qual Studen Konder sessme Studen To pass compoi The gra	minutes, usually chosen) or written examination (approx. 120 minutes). Assessment component 3 will be offered in German; English if agreed upon with examiner(s). Successful completion of approx. 50% of practice work each is a prerequisite for admission to assessment com- ponents 1 and 2. To qualify for admission to assessment component 3, students must pass assessment component 1 and/or 2. Students are highly recommended to attend both courses Kondensierte Materie 1 (Condensed Matter 1) and Kondensierte Materie 2 (Condensed Matter 2). The topics discussed in these two courses will be covered in as- sessment component 3. Students must register for assessment components 1 through 3 online (details to be announced). To pass this module, students must first pass assessment component 1 or 2 and must then pass assessment component 3. The grade achieved in assessment component 1 or 2 (whichever is better) and the grade achieved in assessment component 3 will each count 50% towards the overall grade awarded for the module.					
Allocat	ion of p	olaces				

Additional information
Workload
Teaching cycle
Referred to in LPO I (examination regulations for teaching-degree programmes)
Module appears in
Bachelor' degree (1 major) Mathematics (2012)
Bachelor' degree (1 major) Mathematics (2013)
Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Nanostructure Technology (2010)
Bachelor' degree (1 major) Nanostructure Technology (2012)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Mathematical Physics (2012)
Bachelor' degree (1 major) Computational Mathematics (2012)
Bachelor' degree (1 major) Computational Mathematics (2013)
Bachelor's degree (1 major, 1 minor) Physics (Minor, 2010)

Compu	e title				Abbreviation	
	utationa	al Astrophysics			11-NMA-111-m01	
Modul	e coord	linator		Module offered by	l	
	ging Dire strophy:	ector of the Institute of sics	Theoretical Physics	Faculty of Physics a	and Astronomy	
ECTS Method of grading Only after succ. compl. of module(s)						
6	nume	rical grade				
Duration Module level Other prere			Other prerequisites	i		
1 seme	ester	graduate	sessment. The lecture at the beginning of sidered a declaration dents have obtained the course of the se sessment into effect ted to assessment i	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification fo		
Conter	nts	1				
CL). Intend The stu	ed lear udents	ning outcomes		-	PI). GPGPU programming (Open-	
		nelp of numerical simul	ations. They are espec		and other subdisciplines of Phy- sing adequate strategies to ap-	
proach	n such p	nelp of numerical simul problems and of validat	ations. They are espec ing the results.	ially capable of choo		
proach Course	n such p es (type, 1	nelp of numerical simul problems and of validat number of weekly contact hour	ations. They are espec ing the results. s, language — if other than Ge	ially capable of choc	osing adequate strategies to ap-	
proach Course V + R (i Metho	n such p es (type, r no info d of as	nelp of numerical simul problems and of validat number of weekly contact hour rmation on SWS (weekly	ations. They are espec ing the results. s, language — if other than Ge y contact hours) and co	ially capable of choc man) purse language avail	osing adequate strategies to ap-	
proach Course V + R (I Metho module i a) writti in grou weeks) Assess and wi examir	n such p no infor d of ass is creditat ten exa ups (ap)) or d) p sment c ill be ar nation r	nelp of numerical simul problems and of validat number of weekly contact hour rmation on SWS (weekly sessment (type, scope, lang ble for bonus) mination (approx. 120 r prox. 30 minutes per ca presentation/seminar p offered: When and how	ations. They are especing the results. s, language — if other than Gery y contact hours) and construct (uage — if other than German, minutes) or b) oral example andidate) or c) project r resentation (approx. 30 often assessment will be nder observance of Seconstructs	ially capable of choo man) purse language avail examination offered — if no mination of one cano eport (approx. 8 to 1 o minutes) be offered depends of	able)	
proach Course V + R (m Metho module i a) writti in grou weeks) Assess and wi examir Langua	n such p no infor d of ass is creditat ten exa ups (ap)) or d) p sment c ill be ar nation r	nelp of numerical simul problems and of validat number of weekly contact hour rmation on SWS (weekly sessment (type, scope, lang ble for bonus) mination (approx. 120 r prox. 30 minutes per ca presentation/seminar p offered: When and how anounced in due form u regulations) 2009. assessment: German, El	ations. They are especing the results. s, language — if other than Gery y contact hours) and construct (uage — if other than German, minutes) or b) oral example andidate) or c) project r resentation (approx. 30 often assessment will be nder observance of Seconstructs	ially capable of choo man) purse language avail examination offered — if no mination of one cano eport (approx. 8 to 1 o minutes) be offered depends of	able) able) of every semester, information on whether lidate each or oral examination o pages, time to complete: 1 to 4 on the method of assessment	
proach Course V + R (m Metho module i a) writti in grou weeks) Assess and wi examir Langua Allocat	es (type, i no info d of as: is creditat ten exa ups (ap)) or d) p sment c ill be ar nation r age of a tion of	nelp of numerical simul problems and of validat number of weekly contact hour rmation on SWS (weekly sessment (type, scope, lang ble for bonus) mination (approx. 120 r prox. 30 minutes per ca presentation/seminar p offered: When and how anounced in due form u regulations) 2009. assessment: German, El	ations. They are especing the results. s, language — if other than Gery y contact hours) and construct (uage — if other than German, minutes) or b) oral example andidate) or c) project r resentation (approx. 30 often assessment will be nder observance of Seconstructs	ially capable of choo man) purse language avail examination offered — if no mination of one cano eport (approx. 8 to 1 o minutes) be offered depends of	able) able) of every semester, information on whether lidate each or oral examination o pages, time to complete: 1 to 4 on the method of assessment	
proach Course V + R (n Metho module i a) writti in grou weeks) Assess and wi examir Langua Allocat Additio	es (type, i no info d of as: is creditation ten exa ups (ap)) or d) p sment c ill be ar nation r age of a tion of onal inf	nelp of numerical simul problems and of validat number of weekly contact hour rmation on SWS (weekly sessment (type, scope, lang ble for bonus) mination (approx. 120 r prox. 30 minutes per ca presentation/seminar p offered: When and how mounced in due form u regulations) 2009. Issessment: German, El places	ations. They are especing the results. s, language — if other than Gery y contact hours) and construct (uage — if other than German, minutes) or b) oral example andidate) or c) project r resentation (approx. 30 often assessment will be nder observance of Seconstructs	ially capable of choo man) purse language avail examination offered — if no mination of one cano eport (approx. 8 to 1 o minutes) be offered depends of	able) able) ot every semester, information on whether lidate each or oral examination o pages, time to complete: 1 to 4 on the method of assessment	
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Proach Course V + R (n Metho module i a) writti in grou weeks) Assess and wi examir Langua Allocat Additio Worklo	es (type, i no info d of as: is creditation ten exa ups (ap)) or d) p sment c ill be ar nation r age of a tion of onal inf	nelp of numerical simul problems and of validat number of weekly contact hour rmation on SWS (weekly sessment (type, scope, lang ole for bonus) mination (approx. 120 r prox. 30 minutes per ca presentation/seminar p offered: When and how inounced in due form u regulations) 2009. Issessment: German, El places	ations. They are especing the results. s, language — if other than Gery y contact hours) and construct (uage — if other than German, minutes) or b) oral example andidate) or c) project r resentation (approx. 30 often assessment will be nder observance of Seconstructs	ially capable of choo man) purse language avail examination offered — if no mination of one cano eport (approx. 8 to 1 o minutes) be offered depends of	able) able) ot every semester, information on whether lidate each or oral examination o pages, time to complete: 1 to 4 on the method of assessment	
proach Course V + R (n Metho module i a) writti in grou weeks) Assess and wi examir Langua Allocat Additio Worklo Teachi 	es (type, i no info d of as: is creditation ten exa ups (ap)) or d) p sment c ill be ar nation r age of a tion of onal inf	nelp of numerical simul problems and of validat number of weekly contact hour rmation on SWS (weekly sessment (type, scope, lang ole for bonus) mination (approx. 120 r prox. 30 minutes per ca presentation/seminar p offered: When and how inounced in due form u regulations) 2009. Issessment: German, El places	ations. They are especting the results. s, language — if other than Ge y contact hours) and co guage — if other than German, minutes) or b) oral exam- indidate) or c) project r resentation (approx. 30 often assessment will l nder observance of Sec nglish	ially capable of choo man) purse language avail examination offered — if no mination of one cano eport (approx. 8 to 1 o minutes) be offered depends of	able) ot every semester, information on whether lidate each or oral examination o pages, time to complete: 1 to 4 on the method of assessment 3 ASPO (general academic and	

Referred to in LPO I (examination regulations for teaching-degree programmes)

Module appears in

Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) Mathematics (2012)

Master's degree (1 major) Physics (2011)

Master's degree (1 major) Mathematical Physics (2012)

Master's degree (1 major) FOKUS Physics (2011)

Master's degree (1 major) Computational Mathematics (2012)

Module title		Abbreviation		
Physics of Complex Systems			11-PKS-092-m01	
Module coordinator		Module offered by		
Managing Director of the Institute of T and Astrophysics	heoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS Method of grading	Only after succ. con	npl. of module(s)		
6 numerical grade				
Duration Module level	Other prerequisites			
1 semester graduate	sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the se sessment into effect ted to assessment in	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for		
Contents	•			
 Theory of critical phenomena in thermal equilibriumt Introduction into the physics out of equilibriumt Entropy production and fluctuationst Phase transitions away from equilibriumt Universalityt Spin glassest Theory of neural networks 				
Intended learning outcomes				
The students have specific and advar methods of Statistical Physics, Comp such systems. They are able to work o	utational Physics and	non-linear dynamics		
Courses (type, number of weekly contact hours	language — if other than Ger	man)		
R + V (no information on SWS (weekly	contact hours) and co	ourse language availa	able)	
Method of assessment (type, scope, langumodule is creditable for bonus)	age — if other than German, o	examination offered — if no	t every semester, information on whether	
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009. Language of assessment: German, English				
Allocation of places				
Additional information				
Workload				

Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

Module appears in

Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Nanostructure Technology (2012) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2010)

Module title Abbreviation						
Quanta, A	toms, Molecules			11-QAM-092-m01		
Module co	oordinator		Module offered by			
Managing	Director of the Institute of	Applied Physics	Faculty of Physics a	nd Astronomy		
ECTS M	ethod of grading	Only after succ. con	Only after succ. compl. of module(s)			
8 nı	umerical grade					
Duration	Module level	Other prerequisites				
1 semester undergraduate		sessment. The lecture at the beginning of the sidered a declaration dents have obtained the course of the set sessment into effect ted to assessment in sessment at a later	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment anew.			
Contents						
Physical la	aws of Atomic, Quantum a	nd Molecular Physics.				
Intended	learning outcomes					
Quantum	nts have knowledge of the mechanical atom model, o olecules: Bonding models	ne/multi-electron atom	ns, electronic dipole	transitions, atoms ir	n B field, as	
Courses (t	ype, number of weekly contact hou	rs, language — if other than Ge	rman)			
Ü + Ü (no	information on SWS (week	ly contact hours) and co	ourse language avail	able)		
	f assessment (type, scope, langeditable for bonus)	guage — if other than German,	examination offered — if no	t every semester, informat	ion on whether	
otherwise Assessme and will b	amination (approx. 120 mi specified) ent offered: When and how e announced in due form u on regulations) 2009.	often assessment will	be offered depends o	on the method of ass	sessment	
Allocation						
	- F					
Additiona	l information					
Workload						
Teaching	cycle					
 Referred t	o in LPO I (examination regulat	ions for teaching-degree progra	ummes)			
Module ap	ppears in					
Bachelor'	degree (1 major) Mathema	tics (2012)				
	degree (1 major) Mathema	-				
	degree (1 major) Mathema degree (1 major) Mathema	• •				
Bachelor's with (2012)	1 major Mathematical Physics	-	generated 26-Aug-2024 • exa r (180 ECTS) Mathematische	-	page 61 / 106	



Bachelor' degree (1 major) Computational Mathematics (2012) Bachelor' degree (1 major) Computational Mathematics (2013) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2010)

Modul	e title				Abbreviation	
Quanti	um Fiel	d Theory ll			11-QFT2-092-m01	
Modul	e coord	inator		Module offered by		
-	Aanaging Director of the Institute of Theoretical Physics and Astrophysics			Faculty of Physics a	and Astronomy	
ECTS Method of grading Only after succ			Only after succ. con	npl. of module(s)		
6 numerical grade						
Duratio	on	Module level	Other prerequisites			
1 semester graduate C se a si d th se te			Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment anew.			
Conter	nts	1				
		theory II. Generating function function function function for the symmetry breaters breater			Renormalisation group. Gau	ge
	-	ning outcomes	0			
red the proble	e princi ms of q		malisation and gauge using the acquired cal	theories. They are al culation methods.	um field theory. They have m ole to formulate and solve sin	
R + V (I	no infoi	rmation on SWS (weekly	contact hours) and co	ourse language avail	able)	
		s essment (type, scope, lang ole for bonus)	uage — if other than German,	examination offered — if no	ot every semester, information on whe	her
groups project (appro Assess and wi examir	s (appro t report x. 30 m sment o Il be an nation r	ox. 30 minutes per cand (approx. 8 to 10 pages, inutes) iffered: When and how o	date, for modules with time to complete: 1 to often assessment will h der observance of Sec	n less than 4 ECTS cr 4 weeks) or d) prese be offered depends o	date each or oral examination redits approx. 20 minutes) or entation/seminar presentation on the method of assessmen 3 ASPO (general academic an	c) on t
Allocat	tion of	places				
Additio	onal inf	ormation				
Worklo	bad					
Teachi	ng cycl	e				
 D.c.f.						
Referre	ed to in	LPO I (examination regulation	ns for teaching-degree progra	mmoc)		
				unines)		

Module appears in

Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2011)

Modul	e title				Abbreviation	
Quantı	um Info	rmation and Quantur	n Computing		11-QIC-092-m01	
Module	e coord	inator		Module offered by	offered by	
	Managing Director of the Institute of Theoretical Physics and Astrophysics			Faculty of Physics a	and Astronomy	
ECTS	5 Method of grading Only after succ			npl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites	i		
1 semestergraduateCertain prerequisites must be met to qualify for admission to as sessment. The lecturer will inform students about the respective at the beginning of the course. Registration for the course will be sidered a declaration of will to seek admission to assessment. I 				ents about the respective details tion for the course will be con- nission to assessment. If stu- or admission to assessment over will put their registration for as- et all prerequisites will be admit- ne subsequent semester. For as-		
Conten	te		admission to asses			
tron sp states. Intende The stu They an	in state ed learn idents l re able	es. The third part cove ning outcomes have an advanced un to solve simple probl	ers the description and e	xplanation of decoh theory and basic kn tion theory.	nipulation of coherent two-elec- erence of quantum mechanical	
	_		kly contact hours) and co		lable)	
Metho	d of ass				ot every semester, information on whether	
a) writt groups project (appro Assess and wi examir	en exa (appro report x. 30 m ment o ll be an	mination (approx. 90 x. 30 minutes per cal (approx. 8 to 10 page inutes) ffered: When and ho	ndidate, for modules with es, time to complete: 1 to w often assessment will under observance of Se	h less than 4 ECTS c 4 weeks) or d) pres be offered depends	idate each or oral examination in redits approx. 20 minutes) or c) entation/seminar presentation on the method of assessment 3 ASPO (general academic and	
Allocat	tion of p	olaces				
Additio	onal inf	ormation				
 Worklo	oad					
Teachi	ng cycl	e				

Referred to in LPO I (examination regulations for teaching-degree programmes)

Module appears in

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)

Modul	e title			Abbreviation		
Quantı	um Meo	hanics II			11-QM2-092-m01	
Modul	e coord	inator		Module offered by	<u> </u>	
	ing Dire	ector of the Institute of sics	Theoretical Physics	Faculty of Physics a	and Astronomy	
ECTS				npl. of module(s)		
8		rical grade				
Duratio		Module level	Other prerequisites	i		
1 seme	ester	undergraduate	sessment. The lecture at the beginning of sidered a declaration dents have obtained the course of the se sessment into effect ted to assessment i	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for		
Conter	nts					
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moder thods a	n theor and to i	etical Quantum Physic nterpret the results ph	s mathematically, to so sysically. The course is p	lve problems analyti pivotal to subsequen	cally, to use approximati t theory courses in Astro nandatory for all Master'	on me- physics,
						s stu-
Course	S (type, i	number of weekly contact hou	rs, language — If other than Ge	rman)		s stu-
			rs, language – if other than Ge ly contact hours) and co		able)	s stu-
R + V (r Metho	no info d of as:	mation on SWS (week	ly contact hours) and co	ourse language avail	able) ot every semester, information or	
R + V (r Methor module is a) writt groups project (appro. Assess and wi examir	no infor d of ass s creditab ten exa s (approt t report x. 30 m sment o Il be an nation r	rmation on SWS (week sessment (type, scope, lan ble for bonus) mination (approx. 90 r ox. 30 minutes per can (approx. 8 to 10 pages inutes) ffered: When and how	ly contact hours) and co guage — if other than German, ninutes) or b) oral exam didate, for modules with 5, time to complete: 1 to often assessment will under observance of Sec	ourse language avail examination offered — if no nination of one candi h less than 4 ECTS cr o 4 weeks) or d) prese be offered depends o		whether nation in 5) or c) tation ment
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Allocation of places
Additional information
Workload
Teaching cycle
Referred to in LPO I (examination regulations for teaching-degree programmes)
Module appears in
Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Nanostructure Technology (2012)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Computational Mathematics (2012)

Bachelor's with 1 major Mathematical Physics

(2012)

8 numerical grade Duration Module level Other prerequisites 1 semester graduate Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment anew. Contents 1 Single-particle Green's function 2 Review of second quantization 3 Diagrammatic method using many particle Green's functions at temperature T=o 4 Diagrammatic method for finite T 5 Landau theory of Fermi liquids 6 Superconductivity 7 One-dimensional systems and bosonization Intended learning outcomes The students have mastered the principles of quantum field theory in many-particle systems. They are able to ap ply the acquired methods to current problems of Theoretical Solid-State Physics. Courses (type, number of weekly contact hours, language – if other than German) R + V (no information on SWS (weekly contact hours) and course language available) Method of assessment (type, scope, l	Module	e title				Abbreviation
Managing Director of the Institute of Theoretical Physics Faculty of Physics and Astronomy ECTS Method of grading Only after succ. compl. of module(s) 8 numerical grade Duration Module level Other prerequisites 1 semester graduate Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. Tor assessment time of the c. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment in the feat. Students will have to obtain the qualification for admission to assessment and admission to assessment. For assessment in the current or in the subsequent semester. For assessment in the current or in the subsequent semester. For assessment in the current or in the subsequent semester. For assessment in the current or in the subsequent semester. For assessment in the current or in the subsequent semester. For assessment in the current or in the subsequent semester. For assessment in the current or in the subsequent semester. For assessement is developed admission to assessment in the current or in the subsequent semester. For assessment is developed admission to assessment in the current or in the subsequent semester. For assessment is certain admission to assessment in the current of in the current of in the semester of a diagrammatic method using many particle physics approached by the perturbative methods using Green's function 1 Single-particle Green's function 1	Many B	Body Qı	uantum Theory			11-QVTP-092-m01
and Astrophysics Method of grading Only after succ. compl. of module(s) 8 numerical grade 1 semester graduate Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew. Contents This will usually be a course on quantum many particle physics approached by the perturbative methods using Green's functions. An outline could be: 1 Single-particle Green's function 2 Review of second quantization 3 Diagrammatic method using many particle Green's functions at temperature T=o 4 Diagrammatic method using many particle Green's functions at temperature T=o 5 Landau theory of Fermi liquids 6 Superconductivity 7 One-dimensional systems and bosonization Intended learning outcomes The students have mastered the principles of quantum field theory in many-particle systems. They are able to apply the acquired methods to current problems of Theoretical Solid-State Physics. Courses (typen, number of weekly contact hours, language – if other than German	Module	e coord	inator		Module offered by	1
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1 semester graduate Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment in the current or in the subsequent semester. For asferen's functions. Contents This will usually be a course on quantum many particle physics approached by the perturbative methods using Green's functions. 1 Single-particle Green's function 2 Review of second quantization 3 Diagrammatic method for finite T 5 Jandau theory of Fermi liquids 6 Superconductivity 7 One-dimensional systems and bosonization Intended learning outcomes The students whor meety in many-particle systems. They are able to apply the acquired methods to current problems of Theoretical Solid-State Physics. Courses (type, number of weekly contact hours) and course language available) Method of assessment (uppc. scope, language – if other than German) R + V (no information on SWS (weekly contact hours) and course language available) Method of assessment (uppc. scope, language – if other than German) R + V (no information (approx. 90 minutes) or b) oral examination of one candidate each or oral ex	8 numerical grade					
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Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus) a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009. Language of assessment: German, English Allocation of places						-11-)
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009. Language of assessment: German, English Allocation of places			·	-		
groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009. Language of assessment: German, English Allocation of places				ige — if other than German,	examination offered — If no	of every semester, information on whether
	a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.					
 Additional information 			-			
Additional information						
	<u>Additio</u>	onal inf	ormation			

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Workload

Teaching cycle

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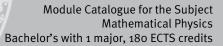
Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2010)

Module	title				Abbreviation	
Renorm	nalizati	on Group Methods in	Field Theory		11-RMFT-102-m01	
Module	coord	inator		Module offered by		
	ng Dire	ector of the Institute of	Theoretical Physics	Faculty of Physics a	and Astronomy	
ECTS		od of grading	Only after succ. con	npl. of module(s)		
6		rical grade				
Duratio	Duration Module level Other prerequ					
1 semester graduate Certain possessment at the beg sidered a dents hav the cours sessment ted to ass sessment			sessment. The lecture at the beginning of the sidered a declaration dents have obtained the course of the se sessment into effect ted to assessment i	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for		
Conten	ts					
		on group methods for aviour of cryogenic ten	non-linear partial differ	ential equations, fie	ld theoretical contex	ts and non-
		ning outcomes	· _			
		gain an overview of no alisation group method	n-linearities in partial d	ifferential equations	and their solution c	on the basis
Courses	S (type, r	number of weekly contact hou	rs, language — if other than Gei	rman)		
V + R (n	o infor	mation on SWS (week	ly contact hours) and co	ourse language avail	able)	
		eessment (type, scope, lan le for bonus)	guage — if other than German,	examination offered — if no	ot every semester, informat	ion on whether
groups project (approx Assessi and wil examin	(appro report x. 30 m ment o l be an ation r	x. 30 minutes per can (approx. 8 to 10 pages inutes) ffered: When and how	ninutes) or b) oral exam didate, for modules with s, time to complete: 1 to often assessment will h under observance of Sec English	n less than 4 ECTS cr 4 weeks) or d) prese pe offered depends o	edits approx. 20 min entation/seminar pro on the method of as	nutes) or c) esentation sessment
Allocati	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Toachin		0				
Teachir	ig tytt	C				
	d to in	LPO I (examination regulat	ions for teaching-degree progra	immes)		
Module	appea	urs in				
						r ,
Bachelor's \ (2012)	with 1 ma	or Mathematical Physics		generated 26-Aug-2024 • ex r (180 ECTS) Mathematische		page 71 / 106



Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) FOKUS Physics (2011)

moaule	e title				Abbreviation	
Relativ	istic Ef	fects in Mesoscopic Sy	ystems		11-RMS-092-m01	
Modul	e coord	inator		Module offered by		
Manag		ector of the Institute of	Theoretical Physics			
ECTS	1	od of grading	Only after succ. con	pl. of module(s)		
5	1	rical grade				
		Other prerequisites				
1 semester graduate		graduate	sessment. The lecture at the beginning of sidered a declaration dents have obtained the course of the se sessment into effect ted to assessment i	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for		
Conten	nts	1				
		fects in mesoscopic sy tors Majorana fermio		oling Dirac equatio	n Quantum Hall effect Topo-	
-		ning outcomes				
The stu	udents	have mastered the ma			elativistic quantum systems, edge to simple systems.	
Course	es (type, r	number of weekly contact hou	rs, language — if other than Ge	rman)		
R + V (r	no infoi	rmation on SWS (week	ly contact hours) and co	ourse language avail	able)	
		s essment (type, scope, lan ble for bonus)	guage — if other than German,	examination offered — if no	t every semester, information on whether	
groups project (approz Assess and wil examin Langua	(appro t report x. 30 m ment o Il be an nation r age of a	ox. 30 minutes per cana (approx. 8 to 10 pages inutes) Iffered: When and how nounced in due form u regulations) 2009.	didate, for modules with s, time to complete: 1 to often assessment will l under observance of Sec	n less than 4 ECTS cr 4 weeks) or d) prese pe offered depends o	date each or oral examination in edits approx. 20 minutes) or c) entation/seminar presentation on the method of assessment 3 ASPO (general academic and	
Allocat	tion of _l	places				
Additic	onal inf	ormation				
	ad					
 Worklo	oad					
 Worklo	oad ng cycl	e				
 Worklo		e				
 Worklo Teachin Referre	ng cycl		ions for teaching-degree progra	mmes)		
 Worklo Teachin Referre	ng cycl	LPO I (examination regulat	ions for teaching-degree progra	immes)		

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)

Module	e title				Abbreviation	
Renorm	nalizati	on Theory			11-RNT-092-m01	
Module	e coord	inator		Module offered by		
Managi and Ast		ector of the Institute of Th sics	eoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS Method of grading			Only after succ. com	pl. of module(s)		
6	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for			
admission to assessment anew.						
behavio levance ons. Sto berg-M and con Intende The stu	our for e for ph ochast a differ mparis ed learn	dynamics beyond the eq ase diagrams in cryogen ic non-linear partial differ rential equations. Symme on of different RG method ning outcomes have gained an overview	uilibrium. Classical-c ic temperatures. Insta rential equations. Con stries, e.g. in the stoc ds. of renormalisation gr	ritical and quantum- ability of statistical a nstruction of generat hastic Burgers' equa oup methods for not	erential equations with scaling critical phenomena and their re- and dynamic mean-field soluti- ting functionals. Halperin-Hohen- ation (KPZ equation). Introduction n-linear partial differential equa- are able to apply them to specific	
	S (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)		
		mation on SWS (weekly o			able)	
Method	d of ass	· · · · · · · · · · · · · · · · · · ·			t every semester, information on whether	
groups project (approx Assess and wil examin	a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009. Language of assessment: German, English					
Allocat	_					
Additio	nal inf	ormation				
Worklo	ad					

Teaching cycle

Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor's with 1 major Mathematical Physics

(2012)

Module title				Abbreviation
Relativistical	Quantumfield Theory			11-RQFT-092-m01
Module coord	linator		Module offered by	
Managing Dir and Astrophy	ector of the Institute of Tl sics	neoretical Physics	Faculty of Physics a	and Astronomy
ECTS Meth	od of grading	Only after succ. con	ompl. of module(s)	
8 nume	erical grade			
Duration Module level Other prerec		Other prerequisites		
1 semester graduate		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for		
Contents	<u> </u>	admission to assess	sment anew.	
	nan rules. Quantum elect			and interaction. Perturbation ion. Radiative corrections and re-
Intended lear	ning outcomes	-		
They know ho processes in	ow to use perturbation the	eory and how to apply m electrodynamics in	/ Feynman rules. The	tivistic quantum field theories. By are able to calculate basics Bover, they have a basic under-
Courses (type,	number of weekly contact hours,	language — if other than Gei	rman)	
R + V (no info	rmation on SWS (weekly	contact hours) and co	ourse language avail	able)
Method of as module is credita		age — if other than German,	examination offered — if no	ot every semester, information on whether
groups (appro project report (approx. 30 n Assessment o and will be ar examination	ox. 30 minutes per candic (approx. 8 to 10 pages, t hinutes) offered: When and how of	date, for modules with ime to complete: 1 to ften assessment will h der observance of Sec	n less than 4 ECTS ci 4 weeks) or d) prese be offered depends	idate each or oral examination in redits approx. 20 minutes) or c) entation/seminar presentation on the method of assessment 3 ASPO (general academic and
Allocation of	-			
Additional in	formation			
Workload				
Teaching cyc	le			

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Module appears in

Module	e title				Abbreviation	
Theory	of Rela	ativity			11-RTT-092-m01	
Module	e coord	inator		Module offered by		
	ing Dir	ector of the Institute of	of Theoretical Physics	Faculty of Physics a	and Astronomy	
ECTS		od of grading	Only after succ. con	npl. of module(s)		
6	1	rical grade				
Duration Module level		Module level	Other prerequisites			
1 seme	ster	graduate	sessment. The lecture at the beginning of sidered a declaration dents have obtained the course of the se sessment into effect ted to assessment i	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for		
Conten	ts		,			
ments	of diffe	rential geometry; ele		nple of a relativistic §	nmary of special relativity; ele- gauge theory; field equations of Ilation	
		ning outcomes				
mather able to Course	natical apply s (type, r	understanding of the the acquired knowled number of weekly contact he		elativity on the basis physics and cosmolo rman)		
Metho	d of as				ot every semester, information on whether	
groups project (approz Assess and wil examin	(appro report x. 30 m ment o Il be an nation r	ox. 30 minutes per ca (approx. 8 to 10 page inutes) iffered: When and ho	ndidate, for modules with es, time to complete: 1 to w often assessment will under observance of Sec	n less than 4 ECTS cr 4 weeks) or d) prese be offered depends	idate each or oral examination in redits approx. 20 minutes) or c) entation/seminar presentation on the method of assessment 3 ASPO (general academic and	
Allocat	ion of	places				
Additio	onal inf	ormation				
	-					
Worklo	ad					
 Teachi	ng cycl	e				
 Referre	ed to in	LPO I (examination regul	ations for teaching-degree progra	nmmes)		
Jackelowe	with 1 mg	jor Mathematical Physics		generated 26-Aug-2024 • ex	am. reg. da- page 79 / 106	

Module t	title				Abbreviation			
Statistics	s, Data	Analysis and Compu	ter Physics		11-SDC-092-m01			
Module c	coordin	ator		Module offered by	<u> </u>			
		or of the Institute of	Applied Physics	· · · · · · · · · · · · · · · · · · ·				
-	-	of grading		Only after succ. compl. of module(s)				
		al grade		· · · · · · · · · · · · · · · · · · ·				
Duration		lodule level	Other prerequisites					
sessment. The lecturer will in at the beginning of the course sidered a declaration of will t dents have obtained the qual the course of the semester, th sessment into effect. Student ted to assessment in the curr			rer will inform stude the course. Registrat n of will to seek adm d the qualification fo mester, the lecturer t. Students who mee n the current or in th date, students will h	nust be met to qualify for admission to as- will inform students about the respective details course. Registration for the course will be con- of will to seek admission to assessment. If stu- ne qualification for admission to assessment over ster, the lecturer will put their registration for as- tudents who meet all prerequisites will be admit- ne current or in the subsequent semester. For as- te, students will have to obtain the qualification for				
Contents	5		•					
Statistics	s, data a	analysis and comput	er physics.					
Intended	l learnir	ig outcomes						
The stude Physics.		ve specific and adva	nced knowledge in the	field of statistics, da	ata analysis and Com	nputational		
Courses ((type, num	ber of weekly contact hour	s, language — if other than Ger	man)				
R + V (no	inform	ation on SWS (weekl	y contact hours) and co	ourse language avail	able)			
Method of module is cr			uage — if other than German, e	examination offered — if no	t every semester, informat	ion on whether		
groups (a project re (approx. Assessm and will b examinat Language	approx. eport (a 30 min nent offe be anno tion reg e of ass	30 minutes per cand pprox. 8 to 10 pages utes) ered: When and how punced in due form u ulations) 2009. essment: German, E	inutes) or b) oral exam lidate, for modules with , time to complete: 1 to often assessment will b nder observance of Sec nglish	n less than 4 ECTS cr 4 weeks) or d) prese pe offered depends o	edits approx. 20 mir entation/seminar pre on the method of ass	nutes) or c) esentation sessment		
Allocatio	on of pla	ces						
 Additiona	al infor	mation						
Workless	d							
Workload	u							
 Tooching								
Teaching	s cycle							
Poforrod	toinl		ons for teaching-degree progra	mmoc)				
			ons for teaching-degree progra	ninies)				
Module a	annearc	in						
Bachelor	r' degree	e (1 major) Physics (2 e (1 major) Physics (2						
	-	Mathematical Physics	JMU Würzburg •	generated 26-Aug-2024 • ex r (180 ECTS) Mathematische	-	page 81 / 106		

WÜRZBURG
Bachelor' degree (1 major) Nanostructure Technology (2010)
Bachelor' degree (1 major) Nanostructure Technology (2012)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) EOKUS Dhusics (2010)

Master's degree (1 major) FOKUS Physics (2010)

Julius-Maximilians-UNIVERSITÄT

Master's degree (1 major) FOKUS Physics (2011)

Master's degree (1 major) Computational Mathematics (2012)

Bachelor's with 1 major Mathematical Physics

(2012)

Module	e title				Abbreviation
Supers	ymmet	ry I and II		,	11-SUS-092-m01
Module	e coord	inator		Module offered by	
Manag and As		ector of the Institute of Th	eoretical Physics	Faculty of Physics a	and Astronomy
ECTS			Only after succ. com	npl. of module(s)	
6	nume	rical grade			
Duratio			Other prerequisites		
1 seme	ster	graduate	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for		
persym	ymmet Imetry:	Algebra and multiplets.	Superfield formalism.	. Breaking of supers	puszanski-Sohnius theorem. Su- ymmetry. spectrum of supersymmetric par-
					s models. Violation of R-parity.
		ning outcomes			
tric mo	dels. Tł		y's formalism and red		persymmetry and supersymme- ons to other models as well as its
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	rman)	
V + R (r	no infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)
		eessment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	ot every semester, information on whether
groups project (approx Assess and wil examin	a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009. Language of assessment: German, English				
Allocat		-			
Additio	onal info	ormation			
Worklo	ad				
Teachi	ng cycl	e			

JMU Würzburg • generated 26-Aug-2024 • exam. reg. data record Bachelor (180 ECTS) Mathematische Physik - 2012

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Module appears in

Module title				Abbreviation	
Theoretical E	lementary Particle Physic	CS		11-TEP-092-m01	
Module coord	linator		Module offered by		
Managing Dir and Astrophy	ector of the Institute of Th sics	neoretical Physics	Faculty of Physics a	and Astronomy	
ECTS Meth	od of grading	Only after succ. con	npl. of module(s)		
8 nume	rical grade				
Duration	Module level	Other prerequisites			
1 semester graduate		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for			
Contents	I	admission to asses	sment anew.		
Gauge theorie				ples of quantum field theory. . Quantum chrome dynamics. Ex-	
Intended lear	ning outcomes	-			
structure of th lation method	ne standard model based	on symmetry princip imple problems and p	les and experimenta processes of Elemen	e Physics. They understand the al observations. They know calcu- tary Particle Physics. Furthermo- nded theories.	
	number of weekly contact hours,				
R + V (no info	rmation on SWS (weekly	contact hours) and co	ourse language avail	able)	
Method of as module is credital		age — if other than German,	examination offered — if no	ot every semester, information on whether	
groups (appro project report (approx. 30 m Assessment o and will be ar examination	ox. 30 minutes per candic (approx. 8 to 10 pages, t hinutes) offered: When and how of	date, for modules with ime to complete: 1 to ften assessment will l der observance of Sec	n less than 4 ECTS cr 4 weeks) or d) prese be offered depends	idate each or oral examination in redits approx. 20 minutes) or c) entation/seminar presentation on the method of assessment 3 ASPO (general academic and	
Allocation of	places				
Additional inf	formation				
Workload					
Teaching cyc	le				

Module appears in

Module title					Abbreviation	
Theoret	ical So	lid State Physics			11-TFK-092-m01	
Module	coord	inator		Module offered by	Ile offered by	
Managi and Ast		ector of the Institute of ⁻ sics	Theoretical Physics	eoretical Physics Faculty of Physics and Astronomy		
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
8	nume	rical grade	 Other presequisites			
Duratio	n	Module level	Other prerequisites			
1 semester graduate		sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the se sessment into effect ted to assessment in	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for			
Conten	ts		1			
		heoretical Solid-State F tism. Superconductivity		eory. Electron-electro	on interaction. Varia	tional me-
Intende	d learn	ning outcomes				
respond theory a	ding mand to	nave basic knowledge of athematical or theoretic understand the connec opic of solid-state theo	cal methods and are al tions to experimental r	ble to apply them to lesults. The individua	basic problems of sc al students have elat	olid-state
Courses	5 (type, n	umber of weekly contact hours	s, language — if other than Ger	man)		
R + V (n	o infor	mation on SWS (weekly	/ contact hours) and co	ourse language availa	able)	
		s essment (type, scope, lang le for bonus)	uage — if other than German, e	examination offered — if no	t every semester, informati	on on whether
groups project (approx Assessi and will examin	(appro report 30 m ment o l be an ation re	nination (approx. 90 m x. 30 minutes per cand (approx. 8 to 10 pages, inutes) ffered: When and how o nounced in due form un egulations) 2009. ssessment: German, Er	idate, for modules with time to complete: 1 to often assessment will b nder observance of Sec	1 less than 4 ECTS cr 4 weeks) or d) prese pe offered depends c	edits approx. 20 min entation/seminar pre on the method of ass	utes) or c) esentation sessment
Allocati	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachin	ig cycl	9				
			_			
Referre	d to in	LPO I (examination regulation	ons for teaching-degree progra	mmes)		
Bachelor's v (2012)	with 1 maj	or Mathematical Physics	_	generated 26-Aug-2024 • exa r (180 ECTS) Mathematische F	-	page 87 / 106

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Computational Mathematics (2012)

Module	e title				Abbreviation	
Particl	e Physi	cs (Standard Model)			11-TPS-092-m01	
Modul	e coord	inator		Module offered by		
		ectors of the Institute of f Theoretical Physics an		Faculty of Physics a	nd Astronomy	
ECTS	1	od of grading	Only after succ. con	pl. of module(s)		
8	nume	rical grade				
Duration Module level		Other prerequisites				
sessm at the sidere dents the co sessm ted to sessm		sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the se sessment into effect ted to assessment in	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for			
		o the theory of electrowe el and determination of		ontaneous symmetr	y breaking. Experim	ents on the
	-	ning outcomes	· ·			
perime	nts tha	know the theoretical fun t have established and sults in the framework o	confirmed the standar	d model. They are al	ble to interpret expe	
		umber of weekly contact hours,				
		mation on SWS (weekly				
		s essment (type, scope, langu le for bonus)	age — if other than German, o	examination offered — if no	ot every semester, informat	ion on whether
groups project (approz Assess and wil examin	(appro report x. 30 m ment o Il be an nation r	nination (approx. 90 mi x. 30 minutes per candi (approx. 8 to 10 pages, inutes) ffered: When and how o nounced in due form ur egulations) 2009. ssessment: German, En	date, for modules with time to complete: 1 to ften assessment will h der observance of Sec	n less than 4 ECTS cr 4 weeks) or d) prese pe offered depends o	edits approx. 20 min entation/seminar pro on the method of as	nutes) or c) esentation sessment
Allocat	ion of p	olaces				
Additio	onal inf	ormation				
			_			
Worklo	ad		_			
Teachi	ng cycl	9				
 Referre	ed to in	LPO I (examination regulatio	ns for teaching-degree progra	mmes)		

Modul	e title				Abbreviation
Theory	of Sup	erconduction			11-TSL-092-m01
Modul	e coord	inator		Module offered by	
	Managing Director of the Institute of Theoretical Physics and Astrophysics			Faculty of Physics a	and Astronomy
ECTS	5 Method of grading Only after suc			npl. of module(s)	
5	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for			
Conter	te		admission to assess	sinch ancw.	
elemen Intend The stu	nts. ed lear udents l operties	ning outcomes have basic knowledge of	the theoretical mode	els for the description	computing with superconductive n of superconductivity. They know ulation methods to simple pro-
Course	es (type, r	number of weekly contact hours, I	anguage — if other than Gei	rman)	
		mation on SWS (weekly o			able)
		sessment (type, scope, langua ile for bonus)	ge — if other than German,	examination offered — if no	ot every semester, information on whether
groups project (appro Assess and wi examir	s (appro t report x. 30 m sment o Il be an nation r	x. 30 minutes per candic (approx. 8 to 10 pages, t inutes) ffered: When and how of	late, for modules with ime to complete: 1 to ten assessment will h der observance of Sec	n less than 4 ECTS cr 4 weeks) or d) prese pe offered depends o	idate each or oral examination in redits approx. 20 minutes) or c) entation/seminar presentation on the method of assessment 3 ASPO (general academic and
Allocat	tion of _l	olaces			
Additio	onal inf	ormation			
Worklo	bad				
Teachi	ng cycl	e			

Module appears in

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Computational Mathematics (2012)

Module title Abbreviation						
Current	Topics	s of Mathematical Physic	CS		11-BXMP5-122-m01	
Module	e coord	inator		Module offered by		
•		f examination committee matical Physics)	e Mathematische	Faculty of Physics	and Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites	i		
1 seme	ster	undergraduate				
Conten	ts					
Current study a		in Mathematical Physics	s. Credited academic	achievements, e.g.	in case of change of university or	
Intende	ed lear	ning outcomes				
unders subject	tand th -specif	e numeric and analytic n ic contexts and know the	nethods necessary to application areas.	acquire this knowle	line of Mathematical Physics and edge. They are able to classify the	
		number of weekly contact hours,				
		mation on SWS (weekly				
		Sessment (type, scope, langua le for bonus)	age — if other than German,	examination offered — if n	ot every semester, information on whether	
written groups weeks)	examii (appro or pres	nation (approx. 120 minu	late) or project report ntation (approx. 30 m	t (approx. 8 to 10 pa	e each or oral examination in ges, time to complete: 1 to 4	
Allocat	_					
Additio	nal inf	ormation				
Worklo	ad					
Teachi	ıg cycl	e				
Referre	d to in	LPOI (examination regulation	s for teaching-degree progra	ammes)		
Module	appea	ars in				
Bachel	or' deg	ree (1 major) Mathematic	al Physics (2012)			

Module title Abbreviation					
Current	t Topic	s of Mathematical Physic		11-BXMP6-122-m01	
Module	e coord	inator		Module offered by	
•	chairperson of examination committee Mathematische Physik (Mathematical Physics)			Faculty of Physics a	and Astronomy
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)	
6	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
Current study a		in Mathematical Physics	. Credited academic	achievements, e.g. i	n case of change of university or
Intende	ed lear	ning outcomes			
sics of unders subject	the Bao tand th -specif	chelor's programme. The le numeric and analytic n fic contexts and know the	y have knowledge of nethods necessary to application areas.	a current subdiscipl acquire this knowle	of a module of Mathematical Phy- ine of Mathematical Physics and dge. They are able to classify the
Course	S (type, r	number of weekly contact hours, l	anguage — if other than Ge	rman)	
V + R (n	infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)
		sessment (type, scope, langua le for bonus)	ge — if other than German,	examination offered — if no	ot every semester, information on whether
groups weeks)	(appro or pres		late) or project report ntation (approx. 30 m	approx. 8 to 10 pag	e each or oral examination in ges, time to complete: 1 to 4
Allocat					
Additio	nal inf	ormation			
Worklo	ad				
Teachi	ng cycl	e			
Referre	d to in	LPO I (examination regulation	s for teaching-degree progra	mmes)	
Module	appea	ars in			
Bachel	or' deg	ree (1 major) Mathematic	al Physics (2012)		

Module title Abbreviation					
Current	Topic	s of Mathematical Physic	:S		11-BXMP8-122-m01
Module	coord	inator		Module offered by	
	hairperson of examination committee Mathematische Physik (Mathematical Physics)			Faculty of Physics a	and Astronomy
			Only after succ. con	npl. of module(s)	
8	nume	rical grade			
Duratio	n	Module level	Other prerequisites	i	
1 seme	ster	undergraduate			
Conten	ts				
Current study a	•	in Mathematical Physics	5. Credited academic	achievements, e.g. i	n case of change of university or
Intende	ed lear	ning outcomes			
unders subject	tand th -specif		nethods necessary to application areas.	acquire this knowle	ine of Mathematical Physics and dge. They are able to classify the
		mation on SWS (weekly contact nours, i			ahla)
		· · · · ·			ot every semester, information on whether
		le for bonus)	ige — Il other than German,		st every semester, information on whether
groups weeks)	(appro or pres		late) or project report ntation (approx. 30 n	t (approx. 8 to 10 pag	e each or oral examination in ges, time to complete: 1 to 4
Allocat	-				
Additio	nal inf	ormation			
Worklo	ad				
Teachir	ıg cycl	e			
Referre	d to in	LPO I (examination regulation	s for teaching-degree progra	ammes)	
Module	appea	ars in			
Bachel	or' deg	ree (1 major) Mathematic	al Physics (2012)		



Thesis (10 ECTS credits)

Module title Abbreviation					
Thesis	Mathe	matical Physics (Bachelo	or Thesis)		10-M-BAP-092-m01
Modul	e coord	inator	Module offered by		
Dean of Studies Mathematik (Mathematics)			atics)	Institute of Mathem	atics
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)	
10	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ester	undergraduate	Registration for asse	essment: as specifie	d.
Conter	nts				
		y researching and writing ation with the superviso		erdisciplinary) topic i	n mathematics or physics selec-
Intend	ed lear	ning outcomes			
and ap	ply the	•	, .	, , , ,	topic in mathematics or physics e can write down the result of
Course	es (type, r	number of weekly contact hours,	language — if other than Gei	rman)	
(no inf	ormatic	on on SWS (weekly conta	ct hours) and course	language available)	
		Sessment (type, scope, langua ole for bonus)	age — if other than German,	examination offered — if no	t every semester, information on whether
	thesis	ssessment: German, Eng	glish if agreed upon w	vith the examiner	
Allocat	tion of _l	places			
Additio	onal inf	ormation			
Worklo	bad				
Teachi	ng cycl	e			
Referre	ed to in	LPOI (examination regulation	s for teaching-degree progra	ammes)	
Modul	e appea	ars in			
	-	ree (1 major) Mathematio			
Bachel	lor' deg	ree (1 major) Mathematio	cal Physics (2012)		



Subject-specific Key Skills

(ECTS credits)

10-M-MDA and 11-SMP must be taken.

Module	e title			Abbreviation		
Introdu	uction i	nto mathematical thinkir	ng and working		10-M-MDA-122-m01	
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
4	(not) s	successfully completed				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate	By way of exception, assessments.	, additional prerequi	sites are listed in the section on	
Conten	ts					
		ations of mathematical p and functions; basic tecl			on; basic concepts in mathema- matical writing.	
Intend	ed lear	ning outcomes				
	asy mat				nematics. He/She is able to per- y and reasonably in written and	
Course	S (type, r	umber of weekly contact hours, l	anguage — if other than Ger	man)		
compo • 1	nent. o-M-MI	DA-1-122: V + Ü (no inforn	nation on SWS (week	ly contact hours) and	sted separately for each module d course language available) d course language available)	
module is	s creditab	le for bonus)			t every semester, information on whether	
	iless st	ated otherwise, successf			e components as specified be- successful completion of all indi-	
sic Not 2 p c L C t t c c c c t s c c c c c c c c c c c c c	ions an ECTS, project a course) anguag Other pl urer wi he cour botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botaine botai botaine	d Methods of Mathemati Method of grading: (not) assignments (type and ex- ge of assessment: Germa rerequisites: Certain prer Il inform students about rse will be considered a d the qualification for ador registration for assessment in the current or in t obtain the qualification f n module component 10- natics Method of grading: (not) assignments (type and ex-	cal Reasoning successfully complet spenditure of time to an, English if agreed u equisites must be me the respective detail declaration of will to mission to assessmen ent into effect. Stude he subsequent seme or admission to asses M-MDA-2-122: Reaso successfully complet spenditure of time to	ed be specified by the l pon with the examine to qualify for admit s at the beginning of seek admission to nt over the course of ents who meet all pro- ester. For assessment ssment anew. ning and Writing in <i>N</i> red be specified by the l	ission to assessment. The lec- of the course. Registration for assessment. If students have the semester, the lecturer will erequisites will be admitted to at at a later date, students will Mathematics Reasoning and Wri- ecturer at the beginning of the	
• () t t	Other pi urer wi he cou obtaine	ll inform students about rse will be considered a d the qualification for add	equisites must be me the respective detail declaration of will to mission to assessmen	t to qualify for admi s at the beginning seek admission to nt over the course of	er ission to assessment. The lec- of the course. Registration for assessment. If students have the semester, the lecturer will erequisites will be admitted to	

Bachelor's with 1 major Mathematical Physics	JMU Würzburg • generated 26-Aug-2024 • exam. reg. da-	page 99 / 106
(2012)	ta record Bachelor (180 ECTS) Mathematische Physik - 2012	

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assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.

Allocation of places -- Additional information -- Workload -- Teaching cycle -- Referred to in LPO I (examination regulations for teaching-degree programmes) § 73 (1) 5. Mathematik Angewandte Mathematik Module appears in Bachelor' degree (1 major) Mathematics (2012) Bachelor' degree (1 major) Mathematics (2012) Bachelor' degree (1 major) Computational Mathematics (2012)

Module	e title				Abbreviation
Progra	mming	course for students of M	athematics and othe	r subjects	10-M-PRG-122-m01
Module	e coord	inator		Module offered by	
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics
ECTS Method of grading		Only after succ. com	pl. of module(s)		
3		successfully completed		•	
Duratio		Module level	Other prerequisites		
1 semester		undergraduate	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective detai at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment ov the course of the semester, the lecturer will put their registration for as sessment into effect. Students who meet all prerequisites will be adm ted to assessment in the current or in the subsequent semester. For as sessment at a later date, students will have to obtain the qualification admission to assessment anew.		ints about the respective details ion for the course will be con- nission to assessment. If stu- or admission to assessment over will put their registration for as- et all prerequisites will be admit- e subsequent semester. For as-
Contents					
		odern programming langu	Jage (e. g. C).		
		ning outcomes			
	dent is	able to work independe	ntly on small program	nming exercises and	standard programming problems
Course	S (type, r	number of weekly contact hours, I	anguage — if other than Ger	man)	
P (no ir	format	tion on SWS (weekly cont	act hours) and cours	e language available	e)
		sessment (type, scope, langua	ge — if other than German, e	examination offered — if no	ot every semester, information on whether
beginn	ing of t	form of programming exe he course) ssessment: German, Eng			e specified by the lecturer at the
Allocat					
Additio	nal inf	ormation			
Worklo	ad				
Teachi	ng cycl	е			
Referre	d to in	LPO I (examination regulation	s for teaching-degree progra	mmes)	
Module	e appea	ars in			
	-	ree (1 major) Nanostructu)	
		ree (1 major) Economath			
	-	ree (1 major) Mathematic ree (1 major) Functional N			
	-	mination for the teaching		Mathematics (2012)	
			5		

Bachelor's with 1 major Mathematical Physics	
(2012)	

Module	e title				Abbreviation
Semina	ar Math	ematical Physics			11-SMP-092-m01
Module	e coord	inator		Module offered by	
		f examination committee matical Physics)	Mathematische	Faculty of Physics a	and Astronomy
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)	
4	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	undergraduate		site to assessment: of seminar presenta	regular attendance and suc- tion.
Conten	ts				
A selec	ted top	ic of Mathematical Phys	ics.		
Intend	ed lear	ning outcomes			
	a giver	n topic on the basis of lite			olves the development and divi- ell as the ability to actively partici-
Course	S (type, r	number of weekly contact hours,	anguage — if other than Ge	rman)	
S (no ir	format	ion on SWS (weekly cont	tact hours) and cours	e language available	e)
		Sessment (type, scope, langua le for bonus)	ge — if other than German,	examination offered — if no	ot every semester, information on whether
Assess and wil examin	ment o l be an ation r		ten assessment will l der observance of Se	ction 32 Subsection	on the method of assessment 3 ASPO (general academic and
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
Teachi	ng cycl	e			
Referre	d to in	LPOI (examination regulation	s for teaching-degree progra	ammes)	
Module	e appea	urs in			
Bachel	or' deg	ree (1 major) Mathematic	al Physics (2009)		
Bachel	or' deg	ree (1 major) Mathematic	al Physics (2012)		

Module	e title				Abbreviation	
Compu	Itationa	al Physics			11-A1-092-m01	
Module	e coord	inator		Module offered by		
Manag and As		ector of the Institute of sics	Theoretical Physics	Faculty of Physics a	and Astronomy	
ECTS	T	od of grading	Only after succ. con	npl. of module(s)		
6	1	rical grade				
Duratio	on	Module level	Other prerequisites			
1 semester undergraduate		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment anew.				
Contents						
- rando - many Intende The stu They ha solutio	om wall -particl ed lear udents ave kno on of ph	e processes and reaction ning outcomes have knowledge of two bwledge of numerical st hysical problems, e.g. a	major programming la andard methods and a Igorithms for solving nu	re able to apply com umerical problems o	nputer-assisted pro	
		number of weekly contact hour				
		rmation on SWS (weekl	· · ·			
		sessment (type, scope, lang ble for bonus)	uage — if other than German,	examination offered — if no	ot every semester, inform	ation on whether
written Assess and wi	exami sment c ll be ar	nation (approx. 120 min iffered: When and how inounced in due form u regulations) 2009.	often assessment will l			
Allocat						
		f pool of general key sk	ills (ASQ): 15 places. P	laces will be allocate	ed by lot.	
Additio	onal inf	ormation				
	_					
Worklo	bad					
Teachi	ng cycl	e				
Keterre	ea to in	LPO I (examination regulati	ons for teaching-degree progra	immes)		

Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Nanostructure Technology (2010) Bachelor' degree (1 major) Nanostructure Technology (2012) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Mathematical Physics (2012) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2010)

Module title					Abbreviation	
Mathematical Methods of Physics					11-P-MR-092-m01	
Module	coord	inator		Module offered by	ered by	
Managing Director of the Institute of Theoretical Physics Faculty of Physics and Astronomy and Astrophysics						
ECTS Method of grading		Only after succ. con	Only after succ. compl. of module(s)			
6	(not) s	successfully completed				
Duration		Module level	Other prerequisites			
2 semester		undergraduate				
Contents						
Principles of mathematics and basic calculation methods beyond the school curriculum, especially for the intro- duction to and preparation of the modules of Theoretical Physics and Classical or Experimental Physics. Repetiti- on of basic knowledge, functions of several real variables, differential equations, linear algebra, vector analysis, other (delta distribution, Fourier transform).						
Intended learning outcomes						
The students have knowledge of the principles of mathematics and elementary calculation methods which are required in Theoretical and Experimental Physics. They are able to apply these methods to simple problems, especially in the field of Physics.						
Courses (type, number of weekly contact hours, language — if other than German)						
Mathematische Rechenmethoden 1 (Mathematical Methods 1): V (2 weekly contact hours) + Ü (1 weekly contact hour), once a year (winter semester) Mathematische Rechenmethoden 2 (Mathematical Methods 2): V (2 weekly contact hours) + Ü (1 weekly contact hour), once a year (summer semester)						
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether						
module is creditable for bonus)						
 This module has the following assessment components 1. Topics covered in lectures and exercises in part 1 (Mathematische Rechenmethoden 1 (Mathematical Methods 1)): exercises or talk (approx. 15 minutes, usually chosen) or written examination (approx. 60 minutes) 2. Topics covered in lectures and exercises in part 2 (Mathematische Rechenmethoden 2 (Mathematical Methods 2)): exercises or talk (approx. 15 minutes, usually chosen) or written examination (approx. 60 minutes) Successful completion of approx. 50% of practice work each is a prerequisite for admission to assessment com- 						
ponents 1 and 2. Students must register for assessment components 1 and 2 online (details to be announced).						
To pass this module, students must pass both assessment component 1 and assessment component 2.						
Allocation of places						
Additional information						
Workload						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
§ 53 (1) 1. a) Physik Mechanik, Wärmelehre, Elektrizitätslehre, Optik, der speziellen Relativitätstheorie § 77 (1) 1. a) Physik "Grundlagen der Experimentalphysik"						
Module	appea	nrs in				
Bachelor's ((2012)	with 1 maj	or Mathematical Physics	-	generated 26-Aug-2024 • ex r (180 ECTS) Mathematische	-	page 105 / 106

Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Nanostructure Technology (2012) Bachelor' degree (1 major) Mathematical Physics (2012) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2010)