

Subdivided 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

Course of Studies - Contents and Objectives

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.

The subject is divided into

Abbreviation	Module title	ECTS credits	Method of grading	pag
Compulsory Courses (130	ECTS credits)			
Mathematics (69 ECTS	redits)			
10-M-ANA-122-m01	Analysis	20	NUM	6
10-M-LNA-122-m01	Linear Algebra	20	NUM	15
10-M-MMP-122-m01	Mathematics in Mathematical Physics	20	NUM	19
10-M-VAN-122-m01	Advanced Analysis	9	NUM	25
component 11-TQM-F-2, sics), will be offered in t	a) In participating in the FOKUS programme, module 11-TQM-F will re which will prepare students for studying in the Master's program he form of a block course between the lecture periods of the wint udies in winter semester, block course will be offered between the	ne FOKUS er and sum	Physik (FOKUS 1mer semesters	Phy- s (for
11-KP-092-m01	Classical Physics (Mechanics, Thermodynamics, Waves, Oscil-	16	NUM	48
	lations, Electricity, Magnetism and Optics)			40
11-P-PA-112-m01	Lab Course A	5	B/NB	58
11-P-MPB-122-m01	Laboratory Course Mathematical Physics B	4	B/NB	54
11-P-MPC-122-m01	Advanced Laboratory Course Mathematical Physics C	4	B/NB	55
11-STE-092-m01	Statistical Mechanics, Thermodynamics and Electrodynamics	16	NUM	8
11-TQM-092-m01	Theoretical Mechanics and Quantum Mechanics	16	NUM	93
11-TQM-F-092-m01	Theoretical Mechanics and Quantum Mechanics for FOKUS Students	16	NUM	9
Compulsory Electives (20	ECTS credits)			
Mathematics				
10-M-COM-122-m01	Computational Mathematics	4	B/NB	9
10-M-ERP-122-m01	Selected Topics from Mathematics for Mathematical Physics	10	NUM	1:
10-M-EWP-122-m01	Further Topics from Mathematics for Mathematical Physics	20	NUM	13
10-M-MWR-122-m01	Modelling and Computational Science	10	NUM	2:
10-M-SEM-122-m01	Seminar Mathematics	5	B/NB	2/
Physics				
11-A4-072-m01	Astrophysics	6	NUM	2
11-AKM-092-m01	Cosmology	6	NUM	30
11-APL-092-m01	Plasma-Astrophysics	6	NUM	32
11-AST-092-m01	Theoretical Astrophysics	6	NUM	3
11-EPP-092-m01	Introduction to Plasmaphysics	6	NUM	38
11-FKP-092-m01	Solid State Physics 1	8	NUM	40
11-GRT-092-m01	Group Theory	6	NUM	42
11-KET-122-m01	Nuclear and Elementary Particle Physics	6	NUM	4
11-KM-092-m01	Condensed Matter (Quanta, Atoms, Molecules, Solid State Physics)	16	NUM	4
11-NMA-111-m01	Computational Astrophysics	6	NUM	50
11-PKS-092-m01	Physics of Complex Systems	6	NUM	52
11-QAM-092-m01	Quanta, Atoms, Molecules	8	NUM	6
11-QFT2-092-m01	Quantum Field Theory II	6	NUM	6
11-QIC-092-m01	Quantum Information and Quantum Computing	5	NUM	6
	Quantum Mechanics II	8	NUM	6
11-QM2-092-m01			110/01	

11-QVTP-092-mo1 Many Body Quantum Theory			
1-RMFT-102-mo1 Renormalization Group Methods in Field Theory			70
11-RMS-092-mo1 Relativistic Effects in Mesoscopic Systems			72
Renormalization Theory	6	NUM	74
Relativistical Quantumfield Theory	8	NUM	76
Theory of Relativity	6	NUM	78
Statistics, Data Analysis and Computer Physics	4	NUM	80
Supersymmetry I and II	6	NUM	85
Theoretical Elementary Particle Physics	8	NUM	87
Theoretical Solid State Physics	8	NUM	89
11-TPS-092-mo1 Particle Physics (Standard Model)		NUM	91
11-TSL-092-mo1 Theory of Superconduction		NUM	97
-BXMP5-122-mo1 Current Topics of Mathematical Physics		NUM	35
BXMP6-122-mo1 Current Topics of Mathematical Physics		NUM	36
Current Topics of Mathematical Physics	8	NUM	37
·			
Thesis Mathematical Physics (Bachelor Thesis)	10	NUM	8
st be taken.			
Introduction into mathematical thinking and working	4	B/NB	17
10-M-PRG-122-mo1 Programming course for students of Mathematics and other subjects		B/NB	23
Seminar Mathematical Physics	4	NUM	82
Computational Physics	6	NUM	26
11-A1-092-m01Computational Physics11-P-MR-092-m01Mathematical Methods of Physics			
	Renormalization Group Methods in Field Theory Relativistic Effects in Mesoscopic Systems Renormalization Theory Relativistical Quantumfield Theory Theory of Relativity Statistics, Data Analysis and Computer Physics Supersymmetry I and II Theoretical Elementary Particle Physics Theoretical Solid State Physics Particle Physics (Standard Model) Theory of Superconduction Current Topics of Mathematical Physics Current Topics of Mathematical Physics Current Topics of Mathematical Physics Thesis Mathematical Physics St be taken. Introduction into mathematical thinking and working Programming course for students of Mathematics and other subjects Seminar Mathematical Physics Computational Physics	Renormalization Group Methods in Field Theory6Relativistic Effects in Mesoscopic Systems5Renormalization Theory6Relativistical Quantumfield Theory8Theory of Relativity6Statistics, Data Analysis and Computer Physics4Supersymmetry I and II6Theoretical Elementary Particle Physics8Particle Physics (Standard Model)8Theory of Superconduction5Current Topics of Mathematical Physics6Current Topics of Mathematical Physics8Thesis Mathematical Physics (Bachelor Thesis)10St be taken.10Introduction into mathematical thinking and working4Programming course for students of Mathematics and other subjects3Seminar Mathematical Physics4Computational Physics4	Renormalization Group Methods in Field Theory6NUMRelativistic Effects in Mesoscopic Systems5NUMRenormalization Theory6NUMRelativistical Quantumfield Theory8NUMTheory of Relativity6NUMStatistics, Data Analysis and Computer Physics4NUMSupersymmetry I and II6NUMTheoretical Elementary Particle Physics8NUMTheoretical Solid State Physics8NUMParticle Physics (Standard Model)8NUMTheory of Superconduction5NUMCurrent Topics of Mathematical Physics6NUMCurrent Topics of Mathematical Physics8NUMThesis Mathematical Physics (Bachelor Thesis)10NUMSt be taken.10NUMIntroduction into mathematical thinking and working4B/NBProgramming course for students of Mathematics and other subjects3B/NBSeminar Mathematical Physics4NUMComputational Physics6NUM

Module	title				Abbreviation	
Analysi	S				10-M-ANA-122-m01	
Module	coord	inator		Module offered by		
Dean of	fStudie	es Mathematik (Mathema	atics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
20	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
2 seme	ster	undergraduate	By way of exception, assessments.	additional prerequi	sites are listed in the section on	
Conten	ts					
					ivergence of sequences and se- l calculus in several variables.	
Intende	ed learn	ning outcomes				
mathen	natical		hem adequately in w	ritten and oral form.	He/She is able to perform easy He/She is acquainted with the geometric interpretation.	
Course	s (type,	number of weekly conta	ct hours, language —	if other than Germa	n)	
compor • 10 • 10	This module comprises 3 module components. Information on courses will be listed separately for each module component.					
Method	l of ass		nguage — if other tha	in German, examina	tion offered — if not every seme-	
low. Un	less st	ated otherwise, successf			e components as specified be- successful completion of all indi-	
 vidual 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 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 admission to assessment at a later date, students will have to obtain the qualification for admission to assessment anew. 						
		n module component 10-1	-	-		
• w c; ir m m	rritten e an be re n group nodule nodule	eplaced by an oral examin s (groups of 2, approx. 30 component was selected	to 180 minutes); if ar ation of one candidat minutes). Module wi as subject of the ora ent purposes (Prüfung	nnounced by the lec e each (approx. 20 m ll also be considerec l examination cover gsteilmodul)) and thi	turer, the written examination ninutes) or an oral examination d successfully completed if the ing several modules (separate is examination was passed. er	

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

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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							
Thesis	Mathe	matical Physics (Bachel	or Thesis)		10-M-BAP-092-m01		
Modul	e coord	linator		Module offered by	<u> </u>		
Dean c	of Studi	es Mathematik (Mathem	natics)	Institute of Mathem	natics		
ECTS		od of grading	Only after succ. con	npl. of module(s)			
10	nume	rical grade					
Durati	on	Module level	Other prerequisites				
1 seme	ester	undergraduate	Registration for asse	essment: as specifie	d		
Conter	nts						
		y researching and writin 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	, number of weekly cont	act hours, language –	- if other than Germa	in)		
(no inf	ormatio	on on SWS (weekly conta	act hours) and course	language available)			
		sessment (type, scope, l ion on whether module (tion offered — if not every seme-		
	thesis age of a	ussessment: German, En	glish if agreed upon w	vith the examiner			
	tion of		<u> </u>				
Additio	onal inf	ormation					
Worklo	oad						
Teachi	ng cycl	e					
	- /						
Referre	ed to in	LPOI (examination reg	ulations for teaching-	degree programmes)			
		\ • • • 0	- 0				
Modul	e appea	ars in					
			cal Physics (2009)				
Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Mathematical Physics (2012)							

Module	e title				Abbreviation	
Compu	Itationa	l Mathematics			10-M-COM-122-mo	1
Module	e coord	inator		Module offered by	<u> </u>	
		es Mathematik (Mathen	natics)	Institute of Mathem	atics	
ECTS		od of grading	Only after succ. con			
4		uccessfully completed		<u> </u>		
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 asses	sment anew.		
lar diffe Intende The stu fields o Course V + Ü (r Methoo ster, int project beginni	erential ed learr udent le of applic s (type, no infor d of ass formati t in the f ing of t	I 10-M-LNA). Computer- and integral calculus; v ing outcomes arns the use of advance cation to solve mathem number of weekly com mation on SWS (weekly essment (type, scope, on on whether module form of programming ex- ne course) ssessment: German, Er	visualisation of function ed modern mathemati atical problems. Eact hours, language – V contact hours) and co language — if other the can be chosen to earn eercises (type and expo	ons. cal software package - if other than Germa ourse language avail an German, examina a bonus) enditure of time to be	es, and is able to as n) able) tion offered — if no	sess their t every seme-
Allocat	tion of p	laces				
 Additio	onal info	ormation				
 Wowlel-						
Worklo	Jau		-			
Teachir	ng cycl					
	ing cycli	-				
Referre	ed to in	LPO I (examination reg	ulations for teaching-	degree programmes)		
Module	e appea	rs in				
Bachel	or' degi	ree (1 major) Nanostruc ree (1 major) Economat ree (1 major) Mathemat	nematics (2012))		



Bachelor' degree (1 major) Functional Materials (2012) First state examination for the teaching degree Gymnasium Mathematics (2012)

Modul					Abbreviation
Select	ed Topi	cs from Mathematics	for Mathematical Physi	ics	10-M-ERP-122-m01
Modul	Module coordinator			Module offered by	 /
		es Mathematik (Math	ematics)	Institute of Mathe	
ECTS		od of grading	Only after succ. cor		inatics
10		rical grade			
Duratio		Module level	Other prerequisites	.	
2 seme		undergraduate	· · _ · _ · _ ·		uisites are listed in the section or
2 50110	ester		assessments.	i, additional prefequ	
Conter	nts		•		
tegratic Stocha tion the sures a ted val Introdu Introdu tion, su metrice Geome ke's th Introdu applica	on) astics 1 eory, co and sto lue and uction t uction t ubmani s, main etric An eorem uction t ations,	(Combinatorics, Lapl ontinuous distribution chastic independence variance, limit theore o Algebra (Fundamer o Differential Geome folds in Euclidean sp theorem on local sur alysis (Fundamentals and applications in vo o Discrete Mathemat cryptographic method	ace models, selected dis ns: normal distribution, n e, elementary conditiona ems: law of large numbe ntal algebraic structures: try (Curves in Euclidean aces, hypersurfaces in p face theory, special clas in analysis on manifold ector analysis and topole ics (Techniques from co ds, error-correcting code	screte distributions, random variable, dis al probability, chara- rs, central limit theo groups, rings, field spaces, curvature, f particular, curvature ses of surfaces) ls, submanifolds, ca ogy) mbinatorics, introdu	
tional a	analysi	s).		· · ·	
		ning outcomes	<u> </u>		
these f	fundam	ental mathematical c		e/she is able to per	or applied mathematics. Based or sue further studies and interrelate edge.
Course	es (type	, number of weekly co	ontact hours, language -	– if other than Germ	an)
This m • 1	odule h 10-M-Nl and 10-	as 8 components; in JM-1-122, 10-M-STO- M-FAN-1-122: V + Ü (n	formation on courses lis 1-122,10-M-ALG-1-122,	ted separately for ea 10-M-DGE-1-122, 10 ge and number of w	ach component. -M-GAN-1-122, 10-M-DIM-1-122, reekly contact hours available)
			e, language — if other th le can be chosen to earr		ation offered — if not every seme
	issessm				e, students must pass one out of nt component that is last in the
module rung in tialgeo lysis (C duction sis (Int	e comp n die Alg ometrie Geomet n to Dis troducti	onent 10-M-STO-1-12 gebra (Introduction to (Introduction to Diffe ric Analysis), in modu	2: Stochastik 1 (Stochas Algebra), in module cor rential Geometry), in mo ile component 10-M-DIN andin module componer	tics 1), in module co nponent 10-M-DGE- dule component 10- I-1-122: Einführung i	1 (Numerical Mathematics 1), in omponent 10-M-ALG-1-122: Einfü 1-122: Einführung in die Differen- M-GAN-1-122: Geometrische Ana in die Diskrete Mathematik (Intro Einführung in die Funktionalanaly

- 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)

Module title					Abbreviation
Furthe	r Topics	from Mathematics for N	Nathematical Physics		10-M-EWP-122-m01
Modul	e coord	inator		Module offered by	• •
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathen	natics
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)	
20	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
2 seme	ester	undergraduate	By way of exception assessments.	, additional prerequ	isites are listed in the section or
Conter	Its				
tion the sures a ted val Introdu Introdu tion, su metries Geome ke's th Introdu applica	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 space theorem on local surface alysis (Fundamentals in a and applications in vecto o Discrete Mathematics cryptographic methods, e	normal distribution, ra lementary 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, dis l probability, charac rs, central limit theor groups, rings, fields spaces, curvature, Fr articular, curvature o ses of surfaces) s, submanifolds, cal ogy) nbinatorics, introdu	
tional a	analysis				
The stu these f	udent is undam	acquainted with advanc ental mathematical conc	epts and methods he	e/she is able to pers	r applied mathematics. Based or ue further studies and interrela- f different branches in mathema
Course	s (type	, number of weekly conta	act hours, language —	- if other than Germa	an)
 This module has 8 components; information on courses listed separately for each component. 10-M-NUM-1-122, 10-M-STO-1-122, 10-M-ALG-1-122, 10-M-DGE-1-122, 10-M-GAN-1-122, 10-M-DIM-1-122, and 10-M-FAN-1-122: V + Ü (no information on language and number of weekly contact hours available) 10-M-EWP-P-122: M (no information on language and number of weekly contact hours available) 					
		essment (type, scope, la on on whether module ca			ation offered — if not every seme
the ⁊ a	ssessm		e first in the list below		, students must select tow out of em, furthermore they must pass
modul e rung in tialgeo lysis (@	e comp die Alg metrie Geomet	onent 10-M-STO-1-122: S gebra (Introduction to Alg (Introduction to Different ric Analysis), in module c	itochastik 1 (Stochast gebra), in module com ial Geometry), in moc component 10-M-DIM	ics 1), in module con ponent 10-M-DGE-1 dule component 10-I -1-122: Einführung in	(Numerical Mathematics 1), in mponent 10-M-ALG-1-122: Einfül -122: Einführung in die Differen- M-GAN-1-122: Geometrische Ana n die Diskrete Mathematik (Intro Einführung in die Funktionalanal

- sis (Introduction to Functional Analysis) :
 8 ECTS credits, pass / fail

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(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-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

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)

ECTS Meth		Only after succ. con Other prerequisites	Module offered by Institute of Mathem	10-M-LNA-122-m01 natics		
Dean of Studi ECTS Meth 20 nume	es Mathematik (Mathem od of grading erical grade Module level	Only after succ. con Other prerequisites	Institute of Mathem	natics		
ECTS Meth	od of grading erical grade Module level	Only after succ. con Other prerequisites		atics		
20 nume	rical grade Module level	 Other prerequisites	npl. of module(s)			
ļI	Module level	1 · · · · ·				
Duration		1 · · · · ·				
	undergraduate					
2 semester		By way of exception assessments.	, additional prerequ	isites are listed in the	e section on	
Contents						
	and structures; vector s ; eigenvalue theory; bilin prm.					
Intended lear	ning outcomes					
perform easy He/She is ab	nows and masters the ba mathematical arguments le to apply the central pro metric background.	independently, and	can present them ad	lequately in written a	and oral form.	
Courses (type	e, number of weekly conta	act hours, language —	if other than Germa	n)		
 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-2-122: M (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 can be chosen to earn a bonus) Assessment in this module comprises the assessments in the individual module components as specified below. 						
 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 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 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 to assessment anew. 						
Bachelor's with 1 ma (2012)	ajor Mathematical Physics		generated 26-Aug-2024 • ex r (180 ECTS) Mathematische		page 15 / 98	
module module	component was selected component for assessm	d as subject of the ora ent purposes (Prüfun	l examination cover gsteilmodul)) and th	ing several modules is examination was p	(separate bassed.	

- 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

Additional information

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Workload

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Teaching cycle

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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)

Modul				Abbreviation	
Introd	uction i	nto mathematical thinkin	ng and working		10-M-MDA-122-m01
Modul	e coord	linator		Module offered by	
Dean o	of Studi	es Mathematik (Mathema	atics)	Institute of Mathem	atics
ECTS	Meth	od of grading	Only after succ. cor	npl. of module(s)	
4	(not)	successfully completed			
Durati	on	Module level	Other prerequisites	6	
1 seme	ester	undergraduate	By way of exceptior assessments.	n, additional prerequi	isites are listed in the section o
Contei	nts				
		ations of mathematical p and functions; basic tec			on; basic concepts in mathema matical writing.
Intend	ed lear	ning outcomes			
form e oral fo	asy ma rm.	thematical arguments inc	dependently and pres	sent them adequatel	nematics. He/She is able to per y and reasonably in written and
Course	es (type	, number of weekly conta	ct hours, language -	– if other than Germa	n)
• <u>·</u> Metho	10-M-M 10-M-M d of as	DA-2-122: V + Ü (no infor	mation on SWS (wee anguage — if other th	kly contact hours) an an German, examina	d course language available) d course language available) tion offered — if not every sem
low. U vidual Asses sic Not	nless st assess sment i tions ar	ated otherwise, success ments. n module component 10- nd Methods of Mathemat	ful completion of the M-MDA-1-122: Basic ical Reasoning	module will require s	e components as specified be- successful completion of all inc s of Mathematical Reasoning B
•	oroject course)		xpenditure of time to n, English if agreed u	be specified by the l upon with the examin	ecturer at the beginning of the her ission to assessment. The lec-

have to obtain the qualification for admission to assessment anew.

Assessment in module component 10-M-MDA-2-122: Reasoning and Writing in Mathematics Reasoning and Writing in Mathematics

- 2 ECTS, Method of grading: (not) successfully completed
- project assignments (type and expenditure of time to be specified by the lecturer at the beginning of the course)
- 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

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(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

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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) 5. Mathematik Angewandte Mathematik

Module appears in

Bachelor' degree (1 major) Mathematics (2012)

Bachelor' degree (1 major) Mathematics (2013)

Bachelor' degree (1 major) Economathematics (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 Gymnasium Mathematics (2012)

Module title					Abbreviation	
Mathematics in Mathematical Physics					10-M-MMP-122-m01	
Module coordinator M				Module offered by	^	
Dean of Studies Mathematik (Mathematics) Institute of Mathematics			natics			
ECTS	Metho	od of grading	Only after succ. compl. of module(s)			
20	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
2 seme	ster	undergraduate	By way of exception	, additional prerequ	isites 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 can be chosen to earn a 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.
- Language of assessment: German, English if agreed upon with the examiner

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(2012)	ta record Bachelor (180 ECTS) Mathematische Physik - 2012	

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

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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

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 title			_	Abbreviation	
Modelling ar	nd Computational Scie	ence		10-M-MWR-122-m01	
Module coor	dinator		Module offered by		
Dean of Stud	lies Mathematik (Math	nematics)	Institute of Mathem	natics	
ECTS Meth	nod of grading	Only after succ. co	mpl. of module(s)		
	erical grade				
Duration	Module level	Other prerequisites	5		
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.			
scaling the m ons, fundam	nodelling, asymptotic ental methods for nun	series, classical method	s for solving ordinary	rinciples of modelling, aspects of and partial differential equati- ns and the resulting systems of li	
near equatio					
	rning outcomes				
and enginee	ring sciences on a con	nputer.		o simulate processes from natura	
	· · · · ·	ontact hours, language -			
V + Ü (no info	ormation on SWS (wee	ekly contact hours) and c	ourse language avail	able)	
		e, language — if other th Ile can be chosen to earr		tion offered — if not every seme-	
if announced each (approx	k. 20 minutes) or an or		s (groups of 2, approx	l examination of one candidate x. 30 minutes)	
Allocation of	places				
Additional in	formation				
Workload					
Teaching cyc	le				
Referred to i	n LPO I (examination	regulations for teaching-	degree programmes)		
Module appears in					
		ucture Technology (2012	>		

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(2012)	ta record Bachelor (180 ECTS) Mathematische Physik - 2012	



Bachelor' degree (1 major) Computational Mathematics (2012) Bachelor' degree (1 major) Computational Mathematics (2013)

Module	e title				Abbreviation
Progra	mming	course for students of N	lathematics and othe	r subjects	10-M-PRG-122-m01
Module	e coord	inator		Module offered by	
Dean o	of Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics
ECTS		od of grading	Only after succ. com	pl. of module(s)	
3	(not) s	successfully completed			
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	nts				
		odern programming langı			
		ning outcomes	uage (e. g. c).		
				ming oversiges and	standard programming problem
in math	hematio	CS.	· · · ·		standard programming problems
		, number of weekly conta			
		tion on SWS (weekly cont			
		sessment (type, scope, la ion on whether module c			tion offered — if not every seme-
beginn	ing of t	form of programming exe he course) ssessment: German, Eng			e specified by the lecturer at the
Allocat					
Additio	onal inf	ormation	-		
Worklo	ad				
Teachi	ng cycl	e			
Referre	ed to in	LPOI (examination regu	lations for teaching-c	legree programmes)	
Module	e appea	ars in			
Bachel	or' deg	ree (1 major) Nanostructu	ure Technology (2012)	1	
	-	ree (1 major) Economath			
	-	ree (1 major) Mathematic	•		
	-	ree (1 major) Functional I mination for the teaching		Mathematics (2012)	
11151 510	מוכ כאל		s acgree Gymnasiulli	mathematics (2012)	

Bachelor's with 1 major Mathematical Physics	JMU Würzburg • generated 26-Aug-2024 • exam. reg. da-	page 23 / 98
(2012)	ta record Bachelor (180 ECTS) Mathematische Physik - 2012	

Module	e title				Abbreviation	
Semina	ar Math	ematics			10-M-SEM-122-m01	
A4				An dula offered bee		
Module coordinator				Module offered by	· · · · · · · · · · · · · · · · · · ·	
		es Mathematik (Mathem	Î.	Institute of Mathem	atics	
ECTS		od of grading	Only after succ. con	npl. of module(s)		
5	(not) s	successfully completed				
Duratio	on	Module level	Other prerequisites			
1 semesterundergraduateCertain prerequisites must be met to qualify for a sessment. The lecturer will inform students about at the beginning of the course. Registration for the sidered a declaration of will to seek admission the dents have obtained the qualification for admission the course of the semester, the lecturer will put is sessment into effect. Students who meet all presented to assessment in the current or in the subset sessment at a later date, students will have to o		nts about the respective de ion for the course will be co nission to assessment. If stu r admission to assessment will put their registration fo t all prerequisites will be ac e subsequent semester. Fo	on- u- over r as- dmit- r as-			
			admission to assess	sment anew.		
Conten						
		ic in mathematics.	_			
Intende	ed learr	ning outcomes				
ly in a s Course S (no in Method	scientif s (type, nformat d of ass	c discussion. number of weekly conta ion on SWS (weekly con	act hours, language – tact hours) and cours anguage — if other the	- if other than Germa e language available an German, examina		
talk (ap	prox. 6	o to 180 minutes) ssessment: German, Eng				
Allocat			<u> </u>			
	. <u> </u>					
Additio	nalinf	ormation				
Auditio		Jination				
Worklo						
WUIKIU	au					
Teachir	ng cycl	8				
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module	e appea	rs in				
Bachelo Bachelo Bachelo Bachelo	or' degi or' degi or' degi or' degi	ree (1 major) Mathematio ree (1 major) Mathematio ree (1 major) Mathematio ree (1 major) Computatio ree (1 major) Computatio mination for the teachin	cs (2013) cal Physics (2012) onal Mathematics (20 onal Mathematics (20	13)		
Bachelor's (2012)	with 1 maj	or Mathematical Physics	_	generated 26-Aug-2024 • ex r (180 ECTS) Mathematische		4 / 98

numerical grade	Module	e title				Abbreviation	
Dean of Studies Mathematik (Mathematics) Institute of Mathematics CTS Method of grading Only after succ. compl. of module(s) on numerical grade	Advanc	ced Ana	lysis			10-M-VAN-122-mo:	1
ECTS Method of grading Only after succ. compl. of module(s) numerical grade	Module	e coordi	nator		Module offered by		
numerical grade	Dean of	of Studie	s Mathematik (Mathen	natics)	Institute of Mathem	natics	
numerical grade	ECTS	Metho	d of grading	Only after succ. con	npl. of module(s)		
Duration Module level Other prerequisites semester undergraduate 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 or the course of the semester, the lecturer will put their registration for assessment are alter date, students will have to obtain the qualification of admission to assessment at a later date, students will have to obtain the qualification of admission to assessment and later date, students will have to obtain the qualification of admission to assessment and later date, students will have to obtain the qualification of admission to assessment and later date, students will have to obtain the qualification of admission to assessment and later date, students will have to obtain the qualification of admission to assessment and later date, students will have to obtain the qualification of admission to assessment and later date, students will have to obtain the qualification of admission to assessment for assessment in the current or in the subsequent semester. For assessment is acquainted with advanced topics in analysis. Taking the example of the Lesbegue integral, he or the is able to understand the construction of a complex mathematical concept. Contents Contents Content than German, examination on SWC (weekly contact hours) and course language available) Method of assessment (type, scope, language — if other than German, examination of one candidate each (approx. 20 on induces)) For the for the date induced topics (approx. 30 minutes)) Contanination of pace	9				, ,,		
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 considered a declaration of will to seek admission to assessment over the course of the semester, the lecturer will put their registration for assessment or early admission to assessment or the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment and admission to assessment anew. Contents Continuation of analysis in several variables, integration theorems. Interded learning outcomes The student is acquainted with advanced topics in analysis. Taking the example of the Lesbegue integral, he or she is able to understand the construction of a complex mathematical concept. Courses (type, number of weekly contact hours, language — if other than German) ////////////////////////////////////		on [Module level	Other prerequisites			
sessment at a later date, students will have to obtain the qualification for admission to assessment anew. Contents Continuation of analysis in several variables, integration theorems. Intended learning outcomes The student is acquainted with advanced topics in analysis. Taking the example of the Lesbegue integral, he or she is able to understand the construction of a complex mathematical concept. Courses (type, number of weekly contact hours, language — if other than German) /+ U (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 can be chosen to earn a bonus) written examination (approx. 90 to 180 minutes) f announced by the lecturer, the written examination in groups (groups of 2, approx. 30 minutes) anguage of assessment: German, English if agreed upon with the examiner Allocation of places - - Morkload - - Module appears in Bachelor' degree (1 major) Mathematics (2012) Bachelor' degree (1 major) Computational Mathematics (2012) Bachelor' degree (1 major) Computational Mathematics (2013) Bachelor' degree (1 major) Computational Mathematics (2013) Bachelor' degree (1 major) Comp			Certain prerequisite sessment. The lectu at the beginning of sidered a declaratio dents have obtained the course of the se sessment into effec	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-			
Continuation of analysis in several variables, integration theorems. ntended learning outcomes The student is acquainted with advanced topics in analysis. Taking the example of the Lesbegue integral, he or she is able to understand the construction of a complex mathematical concept. Courses (type, number of weekly contact hours, language — if other than German) / + 0 (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 can be chosen to earn a bonus) written examination (approx. 90 to 180 minutes) f 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) anguage of assessment: German, English if agreed upon with the examiner Aldocation of places - Morkload - Morkload - Module appears in Bachelor' degree (1 major) Mathematics (2012) Bachelor' degree (1 major) Mathematical Physics //////////////////////////////////						ave to obtain the qu	ualification for
Continuation of analysis in several variables, integration theorems. ntended learning outcomes The student is acquainted with advanced topics in analysis. Taking the example of the Lesbegue integral, he or she is able to understand the construction of a complex mathematical concept. Courses (type, number of weekly contact hours, language — if other than German) / + 0 (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 can be chosen to earn a bonus) written examination (approx. 90 to 180 minutes) f 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) anguage of assessment: German, English if agreed upon with the examiner Aldocation of places - Morkload - Morkload - Module appears in Bachelor' degree (1 major) Mathematics (2012) Bachelor' degree (1 major) Mathematical Physics //////////////////////////////////	Conten	its					
Intended learning outcomes The student is acquainted with advanced topics in analysis. Taking the example of the Lesbegue integral, he or she is able to understand the construction of a complex mathematical concept. Courses (type, number of weekly contact hours, language — if other than German) Y + Ü (no information on SWS (weekly contact hours) and course language available) Wethod of assessment (type, scope, language — if other than German, examination offered — if not every seme- ster, information on whether module can be chosen to earn a bonus) written examination (approx. 90 to 180 minutes) f 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) anguage of assessment: German, English if agreed upon with the examiner Allocation of places			f analysis in soveral va	riables integration th	orome		
The student is acquainted with advanced topics in analysis. Taking the example of the Lesbegue integral, he or she is able to understand the construction of a complex mathematical concept. Courses (type, number of weekly contact hours, language — if other than German) 7 + 0 (no information on SWS (weekly contact hours) and course language available) Wethod of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus) written examination (approx. 90 to 180 minutes) f 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) anguage of assessment: German, English if agreed upon with the examiner Allocation of places			· · · · · ·				
she is able to understand the construction of a complex mathematical concept. Courses (type, number of weekly contact hours, language — if other than German) /+ Ü (no information on SWS (weekly contact hours) and course language available) Wethod of assessment (type, scope, language — if other than German, examination offered — if not every seme- ster, information on whether module can be chosen to earn a bonus) written examination (approx. 90 to 180 minutes) f announced by the lecturer, the written examination in groups (groups of 2, approx. 30 minutes) .anguage of assessment: German, English if agreed upon with the examiner Allocation of places				<u> </u>			
V + Ú (no information on SWS (weekly contact hours) and course language available) Wethod of assessment (type, scope, language — if other than German, examination offered — if not every seme- ster, information on whether module can be chosen to earn a bonus) written examination (approx. 90 to 180 minutes) f 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) .anguage of assessment: German, English if agreed upon with the examiner Allocation of places						e of the Lesbegue in	tegral, he or
Wethod of assessment (type, scope, language — if other than German, examination offered — if not every seme- ster, information on whether module can be chosen to earn a bonus) written examination (approx. 90 to 180 minutes) f 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) .anguage of assessment: German, English if agreed upon with the examiner Allocation of places	Course	s (type,	number of weekly con	tact hours, language –	- if other than Germa	ın)	
ster, information on whether module can be chosen to earn a bonus) written examination (approx. 90 to 180 minutes) f 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) .anguage of assessment: German, English if agreed upon with the examiner Allocation of places	V + Ü (r	no infor	mation on SWS (weekly	/ contact hours) and co	ourse language avail	able)	
f 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) .anguage of assessment: German, English if agreed upon with the examiner Allocation of places - Additional information - Morkload - Feaching cycle - Referred to in LPO 1 (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 (2013) Bachelor' degree (1 major) Computational Mathematics (2014) Bachelor'						tion offered — if no	t every seme-
Allocation of places - Alditional information - Additional information - Morkload - Feaching cycle - Referred to in LPO I (examination regulations for teaching-degree programmes) - 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) Mathematics (2013) Bachelor' degree (1 major) Computational Mathematics (2012) Bachelor' degree (1 major) Computational Mathematics (2013) Bachelor'	if anno each (a	unced b approx.	by the lecturer, the write 20 minutes) or an oral	ten examination can b examination in groups	(groups of 2, approx		e candidate
Additional information Additional information Additional information Additional information Additional information Norkload - Feaching 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) Mathematics (2013) Bachelor' degree (1 major) Mathematics (2012) Bachelor' degree (1 major) Computational Mathematics (2012) Bachelor' degree (1 major) Computational Mathematics (2013) Bachelor degree (1 major) Computational Mathematics (2013) Bachelor degree (1 major) Computational Mathematics (2013) Bac		-		0			
- Workload - Feaching 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) Mathematics (2012) Bachelor' degree (1 major) Mathematical Physics (2012) Bachelor' degree (1 major) Computational Mathematics (2013) Bachelor' degree (1 major) Computational Mathematics (2013) Bac	Allocat		luces				
- Workload - Feaching 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) Mathematics (2012) Bachelor' degree (1 major) Mathematical Physics (2012) Bachelor' degree (1 major) Computational Mathematics (2013) Bachelor' degree (1 major) Computational Mathematics (2013) Bac	- :: ا ا ا	nal i-f-	rmation				
- Feaching 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) Mathematical Physics (2012) Bachelor' degree (1 major) Computational Mathematics (2012) Bachelor' degree (1 major) Computational Mathematics (2012) Bachelor' degree (1 major) Computational Mathematics (2013) Bachelor' degree (1 major) Computational Mathematics (2013) Bachelor' degree (1 major) Computational Mathematics (2013)	Auuilio						
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- 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) Bachelor' degree (1 major) Computational Mathematics (2013) Bachelor' degree (1 major) Computational Mathematics (2012) Bachelor' degree (1 major) Computational Mathematics (2013) Bachelor's with 1 major Mathematical Physics JMU Würzburg • generated 26-Aug-2024 • exam. reg. da-	Worklo	ad					
- 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) Bachelor' degree (1 major) Computational Mathematics (2013) Bachelor' degree (1 major) Computational Mathematics (2012) Bachelor' degree (1 major) Computational Mathematics (2013) Bachelor's with 1 major Mathematical Physics JMU Würzburg • generated 26-Aug-2024 • exam. reg. da-							
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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) Bachelor' degree (1 major) Computational Mathematics (2013) Bachelor's with 1 major Mathematical Physics JMU Würzburg • generated 26-Aug-2024 • exam. reg. da- page 25 / 98							
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) Bachelor's with 1 major Mathematical Physics JMU Würzburg • generated 26-Aug-2024 • exam. reg. da-	Referre	ed to in	L PO I (examination reg	ulations for teaching-o	degree programmes)		
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) Bachelor's with 1 major Mathematical Physics JMU Würzburg • generated 26-Aug-2024 • exam. reg. da-							
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Bachelor' degree (1 major) Computational Mathematics (2012) Bachelor' degree (1 major) Computational Mathematics (2013) achelor's with 1 major Mathematical Physics JMU Würzburg • generated 26-Aug-2024 • exam. reg. da- page 25 / 98							
Bachelor' degree (1 major) Computational Mathematics (2013) achelor's with 1 major Mathematical Physics JMU Würzburg • generated 26-Aug-2024 • exam. reg. da- page 25 / 98							
achelor's with 1 major Mathematical Physics JMU Würzburg • generated 26-Aug-2024 • exam. reg. da- page 25 / 98							
	Dachel	u uegr	ee (1 major) computati	unat mathematics (20	13)		
	Bachelor's (2012)	with 1 maj	or Mathematical Physics	-		-	page 25 / 98

Module					Abbreviation	
Compu	Itationa	ll Physics			11-A1-092-m01	
Module	e coord	inator		Module offered by		
Manag	ing Dire	ector of the Institute of	Theoretical Physics	Faculty of Physics a	and Astronomy	
-	trophys		·			
ECTS						
6	nume	rical grade				
Duratio		Module level	Other prerequisites			
Duration Module level Other prerequisites 1 semester undergraduate 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 admission to assessment anew. Contents - Introduction to programming on the basis of C++ / Java /Mathematica - numerical solution of differential equations - simulation of chaotic systems - generation of random numbers - summerical solution of random numbers					ctive details ill be con- nt. If stu- ssment over ation for as- ill be admit- ster. For as-	
Intend	-particl ed lear idents	e processes and reactic ning outcomes have knowledge of two owledge of numerical st	major programming la			
		ysical problems, e.g. al		,		
	-	, number of weekly con				
V + Ü (I	no info	mation on SWS (weekly	/ contact hours) and co	ourse language avail	able)	
		sessment (type, scope, ion on whether module			ition offered — if not	every seme-
Assess and wi	ment o ll be an	nation (approx. 120 min ffered: When and how o nounced in due form u egulations) 2009.	often assessment will			
Allocat	ion of _l	olaces				
Only as	s part o	f pool of general key sk	ills (ASQ): 15 places. P	laces will be allocate	ed by lot.	
Additio	onal inf	ormation				
Worklo	ad					
Teachi	ng cycl	e				
Referre	ed to in	LPO I (examination reg	gulations for teaching-	degree programmes)		
	with 1 ma	jor Mathematical Physics	-	generated 26-Aug-2024 • ex	-	page 26 / 98
2012)			ta record Bachelo	or (180 ECTS) Mathematische	Physik - 2012	

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) 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					Abbreviation	
Astroph	nysics				11-A4-072-m01	
Module	Module coordinator			Module offered by		
Managi	Managing Director of the Institute of Theoretical Physics			Faculty of Physics a	and Astronomy	
and Ast	-					
ECTS		od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duratio		Module level	Other prerequisites			
DiractionInducte tevelOther prerequisites1 semesterundergraduateAdmission prerequisite to assessment: successful completion of app 50% of exercises. Certain prerequisites must be met to qualify for adm sion to assessment. The lecturer will inform students about the resperve details at the beginning of the course. Registration for the course vertex be considered a declaration of will to seek admission to assessment. students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration assessment into effect. Students who meet all prerequisites will be a mitted to assessment in the current or in the subsequent semester. F assessment at a later date, students will have to obtain the qualification for admission to assessment anew.ContentsHistory of astronomy, coordinates and time measurement, the solar system, size scales in outer space, teleso pes and detectors, stellar structure, stellar atmospheres, stellar evolution, final stages of stellar evolution, in				must be met to qualify for admis- orm students about the respecti- e. Registration for the course will ek admission to assessment. If n for admission to assessment turer will put their registration for neet all prerequisites will be ad- n the subsequent semester. For l have to obtain the qualification e scales in outer space, telesco-		
nucleos Intende The stu physica	synthes ed lear dents a Il obse ey kno	sis, cosmic microwave ba ning outcomes are familiar with the mod rvations and evaluations	ern world view of Ast . They are able to use	structure formation, rophysics. They know these methods to p	s of the early universe, primordial inflation w methods and tools for astro- olan and analyse own observati- erstand the process of their deve	
		, number of weekly conta	act hours, language –	- if other than Germa	an)	
		mation on SWS (weekly				
Method ster, inf	l of ass formati	sessment (type, scope, la ion on whether module c	anguage — if other than an be chosen to earn	an German, examina	tion offered — if not every seme-	
		nation (approx. 120 minu	tes)			
Allocati						
		f pool of general key skil	ls (ASQ): 15 places. P	laces will be allocate	ed by lot.	
Additio	nal inf	ormation				
Worklo	ad					
Teachir	ıg cycl	e				
Referre	d to in	LPOI (examination regu	lations for teaching-	degree programmes)		
Module	appea	ars in				

(2012)

Bachelor' degree (1 major) Physics (2007)
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 (2011)
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					Abbreviation
Cosmo	logy				11-AKM-092-m01
Module	e coord	inator		Module offered by	
	ing Dire	ector of the Institute of	of Theoretical Physics	Faculty of Physics a	and Astronomy
ECTS	<u> </u>	od of grading	Only after succ. con	nnl of module(s)	
6	1	rical grade			
Duratio		Module level	Other prerequisites		
1 seme Conten Expance matter, and ga Intende	ster Iing spi primo laxy clu ed lear	graduate ace-time, Friedmanni rdial nucleosynthesis isters, intergalactic m ning outcomes	Certain prerequisite sessment. The lectu at the beginning of sidered a declaratio dents have obtained the course of the se sessment into effec ted to assessment i sessment at a later admission to assess an cosmology, basics of s, cosmic microwave back	es must be met to quarer will inform stude the course. Registration of will to seek adm d the qualification for mester, the lecturer t. Students who mee n the current or in the date, students will h sment anew. general relativity, the kground, structure for rameters	alify for admission to as- 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- nave to obtain the qualification fo e early universe, inflation, dark ormation, supercluster, galaxies ethods of cosmology and are ab-
scienti	fic que	stions.			ch topics and are able to work on
			ontact hours, language –		•
			kly contact hours) and co		
			e, language — if other th le can be chosen to earn		ation offered — if not every seme-
groups project (approz Assess and wil examin	(appro report x. 30 m ment o Il be an nation r	x. 30 minutes per car (approx. 8 to 10 page inutes) ffered: When and how	ndidate, for modules with es, time to complete: 1 to w often assessment will under observance of Se	h less than 4 ECTS ci 4 weeks) or d) preso 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 _l	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) 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)

Module	e title				Abbreviation
Plasma	a-Astro	physics			11-APL-092-m01
Module	a coord	inator		Module offered by	<u> </u>
	Module coordinator Managing Director of the Institute of Theoretical Physics			Faculty of Physics a	and Astronomy
and As	-		neoretical Filysics		and Astronomy
ECTS	<u> </u>	od of grading	Only after succ. con	npl. of module(s)	
6	1	rical grade		• • • •	
Duratio	on	Module level	Other prerequisites	;	
1 seme	ster	graduate	Certain prerequisite	es must be met to qu	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
			admission to asses	sment anew.	
Conten	lts				
galaxie Intend	es and o ed lear	other cosmic objects. ning outcomes			le acceleration and transport in
motion	and ad		articles in space, they		d the theoretical description of g measuring methods and can
Course	s (type	, number of weekly cont	act hours, language –	– if other than Germa	ın)
R + V (r	no infor	mation on SWS (weekly	contact hours) and co	ourse language avail	able)
		essment (type, scope, l on on whether module o			tion offered — if not every seme-
groups project (approz Assess and wil examir	(appro report x. 30 m ment o Il be an nation r	x. 30 minutes per candi (approx. 8 to 10 pages, inutes) ffered: When and how o	date, for modules with time to complete: 1 to ften assessment will der observance of Se	h less than 4 ECTS cr 9 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
Allocat					
Additio	onal inf	ormation			
			-		
Worklo	ad				
WUIKU	au				
 Tass1 *		_			
Teachi	ng cycl	e			
	•••	·			
Bachelor's (2012)	with 1 ma	jor Mathematical Physics		generated 26-Aug-2024 • ex or (180 ECTS) Mathematische	

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)

Module title				Abbreviation			
Theoretical	Astrophysics			11-AST-092-m01			
Module coor	rdinator		Module offered by				
Managing Di and Astroph	irector of the Institute of Th ysics	eoretical Physics	Faculty of Physics and Astronomy				
ECTS Met	hod of grading	Only after succ. con	npl. of module(s)				
6 num	erical grade						
Duration	Module level	Other prerequisites					
1 semester	graduate						
Contents							
Theoretical A	Astrophysics, models for th	e description of com	plex observation res	sults, numeric simulations.			
	arning outcomes		•				
The students				. They are able to design complex			
Courses (typ	e, number of weekly conta	ct hours, language –	- if other than Germa	an)			
	ormation on SWS (weekly o						
ster, informa	ation on whether module ca	an be chosen to earn		ition offered — if not every seme-			
	nination (approx. 120 minu	tes)					
Allocation o	f places						
Additional in	nformation						
Workload							
Teaching cy	cle						
Referred to i	n LPO I (examination regu	lations for teaching	degree programmos				
Keleneu lu l			acsiec programmes)				
··							
Module app							
Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012)							
Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Mathematical Physics (2009)							
Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Mathematical Physics (2012)							
Master's degree (1 major) Physics (2010)							
Master's deg	Master's degree (1 major) Physics (2011)						
Master's deg	gree (1 major) Mathematica	al Physics (2012)					
	gree (1 major) FOKUS Physi						
Master's degree (1 major) FOKUS Physics (2011)							
Master's deg	Master's degree (1 major) FOKUS Physics (2006)						

	e title			Abbreviation		
Current Topics of Mathematical Physics					11-BXMP5-122-m01	
Module coordinator				Module offered by	Nodule offered by	
chairperson of examination committee Mathematische Physik (Mathematical Physics)				Faculty of Physics and Astronomy		
ECTS	Meth	od of grading	Only after succ. compl. of module(s)			
5	nume	rical grade				
Duration		Module level	Other prerequisite	Other prerequisites		
1 semester undergraduate		undergraduate				
Conter	nts					
	t topics abroad.	-	sics. Credited academic	c achievements, e.g.	in case of change of university or	
Intend	ed lear	ning outcomes				
unders subjec	tand th t-speci	ne numeric and analyt fic contexts and know	ic methods necessary t the application areas.	o acquire this knowle	ine of Mathematical Physics and edge. They are able to classify the	
Course	s (type	, number of weekly co	ontact hours, language	— if other than Germa	an)	
V + R (1	no info	mation on SWS (weel	kly contact hours) and c	course language avail	able)	
			e, language — if other tl le can be chosen to ear		ation offered — if not every seme-	
groups weeks)	(appro) or pre	ox. 30 minutes per car	ndidate) or project repo esentation (approx. 30	rt (approx. 8 to 10 pag	e each or oral examination in ges, time to complete: 1 to 4	
Alloca	tion of	places				
Additio	onal inf	ormation				
	-					
Worklo	ad					
	_					
Teachi	ng cycl	e				
	<u>5</u> cycl					
Poforr	ad to in	IPOL (overnination r	egulations for teaching	dograo programmac		
Referre			egulations for teaciling	-uegiee programmes,)	
 Modul	e appea	ars in				

Modu				Abbreviation		
Current Topics of Mathematical Physics					11-BXMP6-122-m01	
Module coordinator				Module offered by	odule offered by	
chairperson of examination committee Mathematische Physik (Mathematical Physics)				Faculty of Physics and Astronomy		
ECTS	Meth	od of grading	Only after succ. co	mpl. of module(s)		
6	nume	rical grade				
Duration		Module level	Other prerequisite	Other prerequisites		
1 semester undergraduate			-			
Conte	nts					
	nt topics abroad		sics. Credited academic	c achievements, e.g. i	in case of change of university or	
Intend	led lear	ning outcomes				
under: subjec	stand tł ct-speci	ne numeric and analyt fic contexts and know	ic methods necessary t the application areas.	o acquire this knowle	ine of Mathematical Physics and edge. They are able to classify the	
	-		ontact hours, language			
V + R (no info	rmation on SWS (weel	kly contact hours) and c	course language avail	able)	
			e, language — if other tl le can be chosen to ear		ation offered — if not every seme-	
group: weeks	s (appro) or pre	ox. 30 minutes per car	ndidate) or project repo esentation (approx. 30	rt (approx. 8 to 10 pag	e each or oral examination in ges, time to complete: 1 to 4	
Alloca	tion of	places				
Additi	onal inf	ormation				
Workl	oad					
Teach	ing cycl	e				
Referr	ed to in	LPOI (examination r	egulations for teaching	-degree programmes		
 Modul	le appe	ars in				

Module title					Abbreviation	
Current	t Topic	s of Mathematical Phy	/sics		11-BXMP8-122-m01	
Module	e coord	inator		Module offered by	1	
chairperson of examination committee Mathematische Physik (Mathematical Physics)			tee Mathematische	Faculty of Physics a	and Astronomy	
			Only after succ. co	mpl. of module(s)		
8						
Duratio	on	Module level	Other prerequisite	S		
1 seme	ster	undergraduate				
Conten	ts					
Current study a	•	-	sics. Credited academic	c achievements, e.g. i	in case of change of university or	
Intende	ed lear	ning outcomes				
unders [.] subject	tand th t-speci	ne numeric and analyti fic contexts and know	c methods necessary t the application areas.	o acquire this knowle	ine of Mathematical Physics and edge. They are able to classify the	
Course	s (type	, number of weekly co	ntact hours, language	— if other than Germa	an)	
V + R (n	no info	rmation on SWS (week	ly contact hours) and c	ourse language avail	able)	
			e, language — if other th e can be chosen to ear		ation offered — if not every seme-	
groups weeks)	(appro or pre	ox. 30 minutes per can	didate) or project repo esentation (approx. 30	rt (approx. 8 to 10 pag	e each or oral examination in ges, time to complete: 1 to 4	
Allocat	ion of	places				
Additio	onal inf	ormation				
Worklo	ad					
Teachi		۵				
	Seyer	~				
Doforro	d to in	IPOL (ovamination w	aulations for toaching	dogroo programmas		
Reieffe			egulations for teaching	-uegree programmes)		
 Module		arc in				
			atical Dhusics (cours)			
Dachel	or deg	ree (1 major) Mathema	aucal Physics (2012)			

Module				_	Abbreviation
Introdu	ction t	o Plasmaphysics			11-EPP-092-m01
Module	coord	inator		Module offered by	
		-	of Theoretical Physics	Faculty of Physics a	and Astronomy
and Ast	-		of medicilear mysics		and Astronomy
		Only after succ. con	npl. of module(s)		
6	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate		•	alify for admission to as-
					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-
					e subsequent semester. For as-
					nave to obtain the qualification fo
			admission to asses	sment anew.	
Conten	ts				
Intende The stu	ed lear dents	ning outcomes know the principles		ially the description	diation. of transport phenomena in plas- knowledge to Astrophysics.
			contact hours, language –		
			ekly contact hours) and co		•
					ation offered — if not every seme-
			ule can be chosen to earn		
groups project (approx Assess and wil examin	(appro report k. 30 m ment o l be an ation r	ox. 30 minutes per ca (approx. 8 to 10 pag inutes) (ffered: When and ho nounced in due forn egulations) 2009.	ndidate, for modules wit es, time to complete: 1 to w often assessment will n under observance of Se	h less than 4 ECTS co 4 weeks) or d) preso 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
-	-	ssessment: German	, English		
Allocat		JIALES			
Additio	nal 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) 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	
Solid S	itate Ph	ysics 1			11-FKP-092-m01	
Module	e coord	inator		Module offered by		
		ector of the Institute of	Applied Physics	Faculty of Physics a	and Astronomy	
ECTS	<u> </u>	od of grading	Only after succ. cor		and Astronomy	
8		rical grade		1		
Duratio	on	Module level	Other prerequisites	6		
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	its					
		of solids: Bonding and lectron gas).	structure, lattice dyna	mics, thermal prope	rties, principles of e	lectronic pro-
-		ning outcomes				
		understand the basic c rties, principles of elec			nd structure, lattice	dynamics,
	· ·	number of weekly con	· · ·	-	ın)	
V + Ü (r	no infor	mation on SWS (weekl	y contact hours) and c	ourse language avail	able)	
		essment (type, scope, on on whether module			ition offered — if no	t every seme-
otherw Assess and wil	ise spe ment o ll be an	nation (approx. 120 min cified) ffered: When and how nounced in due form u egulations) 2009.	often assessment will	be offered depends	on the method of as	sessment
Allocat		<u> </u>				
Additio	onal info	ormation				
			_			
Worklo	ad					
Teachi	ng cycl	9				
 Def			aulations for to a lit			
Referre	ea to in	LPOI (examination reg	guiations for teaching-	uegree programmes)		
 Module		rcin				
Module Bachel		ree (1 major) Mathema	tics (2012)			
	-	ree (1 major) Mathema				
	-	ree (1 major) Mathema	-			

Julius-Maximilians-UNIVERSITÄT WÜRZBURG

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)

Modul	e title				Abbreviation	
Group	Theory				11-GRT-092-m01	
Modul	e coord	inator		Module offered by		
Manag	ing Dire	ector of the Institute of ⁻	Theoretical Physics	Faculty of Physics a	and Astronomy	
-	trophys		, 		,	
ECTS		od of grading	Only after succ. con	npl. of module(s)		
6	nume	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.				
Conter						
		Finite groups. Lie group	os. Lie algebra. Depicti	on. Tensors. Classifi	cation theorem. App	olications.
		ning outcomes				
group t lation a	theory a and pro	know the basics of grou and to solve them by us cessing of physical pro , number of weekly con	ing the acquired meth blems.	ods. They are able to	apply group theory	
		mation on SWS (weekly				
Metho	d of ass	sessment (type, scope, ion on whether module	language — if other th	an German, examina		t every seme-
groups project (appro Assess and wi examir	s (appro t report x. 30 m sment o Il be an nation r	mination (approx. 90 m ix. 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 I nder observance of Sec	n less than 4 ECTS cr 4 weeks) or d) prese be offered depends o	redits approx. 20 min entation/seminar pro on the method of as	nutes) or c) esentation sessment
Allocat	tion of p	olaces				
 Worklo Teachi 	oad ng cycl		rulations for tooching	degree programmes)		
Referre		LPOI (examination reg		regree programmes)		
 Modul		arc in				
	e appea	or Mathematical Physics	IAIL MPS-L.	generated 26-Aug-2024 • ex	am rog de	page 42 / 98

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	
Nuclear	r and Ele	ementary Particle Phy	sics		11-KET-122-m01	
Module	e coordi	nator		Module offered by	l	
			Applied Physics	Faculty of Physics a	and Astronomy	
Managing Director of the Institute of Applied PhysicECTSMethod of gradingOnly after		Only after succ. con		and Astronomy		
6 numerical grade						
Duration Module level Other prerequisites						
1 seme		undergraduate		s must be met to qu	alify for admission t	0.25-
i Sente.				rer will inform stude		
				the course. Registrat		
				on of will to seek adm		
			dents have obtained	d the qualification fo	or admission to asse	ssment over
				mester, the lecturer		
			sessment into effec	t. Students who mee	et all prerequisites w	vill be admit-
				n the current or in th		
			sessment at a later	date, students will h	ave to obtain the qu	alification for
			admission to asses	sment anew.		
Conten	its		<i>.</i>			
Nuclear	r models	s. Structure of nuclei. I	tary Particle Physics. H Radioactivity and spect tic interaction. Strong	troscopy. Nuclear en	ergy. Radiation and	matter. Acce
Intende	ed learn	ing outcomes				
V + Ü (r Methoo	s (type, no inforr d of asse	nation on SWS (weekle essment (type, scope,	tact hours, language – y contact hours) and co language — if other the can be chosen to earn	ourse language avail an German, examina	able)	t every seme-
		ation (approx. 120 mir				
	ion of p					
Additio	onal info	rmation				
, aurilio	-nat init					
Worklo						
WUTKIO	du					
leachir	ng cycle					
Keferre	ea to in l	.PUI (examination reg	gulations for teaching-	uegree programmes)		
Module	e appeai	's in				
		ee (1 major) Mathemat				
Bachelo Bachelo Bachelo	or' degre or' degre	ee (1 major) Mathemat ee (1 major) Physics (2 ee (1 major) Mathemat ee (1 major) Computat	012)	12)		



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

Module title				Abbreviation		
Conder	nsed M	atter (Quanta, Atoms, 1	Molecules, Solid State	Physics)	11-KM-092-m01	
Module	e coord	inator		Module offered by		
Manag	ing Dire	ector of the Institute of	Applied Physics	Faculty of Physics a	nd Astronomy	
ECTS	1	od of grading	Only after succ. con	npl. of module(s)		
16		rical grade				
Duratio		Module level	Other prerequisites			
2 seme		undergraduate				
Conten						
Quantu Atoms mical b (FEG). (propert	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 che- mical 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 lear	ning outcomes				
ding ar They ar apply t	The students know the basic contexts and principles of quantum phenomena, Atomic Physics and solids (bon- ding and structure, lattice dynamics, thermal properties, principles of electronic properties (free electron gas)). They are able to apply mathematical methods to the formulation of modern physical contexts and autonomously apply their knowledge to the solution of mathematical-physical tasks.					
Course	s (type	, number of weekly cor	itact hours, language –	- if other than Germa	n)	
kly con Konder	tact ho nsierte	urs) + Ü (2 weekly cont Materie 2 (Festkörperp	ome, Moleküle) (Conde act hours), once a year hysik 1) (Condensed M once a year (summer s	' (winter semester) atter 2 (Solid State P		
			language — if other the can be chosen to earn		tion offered — if not	every seme-
1. Topio amir 2. Topio amir 3. Topio	 This module has the following assessment components 1. Topics covered in lectures and exercises in part 1 (Kondensierte Materie 1 (Condensed Matter 1)): written examination (approx. 120 minutes). 2. Topics covered in lectures and exercises in part 2 (Kondensierte Materie 2 (Condensed Matter 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). 					: written ex-
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. Allocation of places						
Allocat	ion of p	naces				
 Additio	onal inf	ormation				
Bachelor's (2012)	with 1 ma	or Mathematical Physics		generated 26-Aug-2024 • exa r (180 ECTS) Mathematische		page 46 / 98

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' degree (1 major, 1 minor) Physics (Minor, 2010) Julius-Maximilians-UNIVERSITÄT WÜRZBURG

Module	e title		Abbreviation			
Classic	al Phys	sics (Mechanics, Thermo	dynamics, Waves, Os	cillations, Electrici-	11-KP-092-m01	
•		n and Optics)				
Module	e coord	inator		Module offered by		
Managing Director of the Institute of A			plied Physics	Faculty of Physics a	nd Astronomy	
ECTS		od of grading	Only after succ. com	pl. of module(s)		
16		rical grade				
Duratio		Module level	Other prerequisites			
2 seme	ster	undergraduate			ethoden der Physik (Mathemati-	
			cal Methods of Phys	ics) for first-semeste	er students.	
Conten						
Physical laws of mechanics, thermodynamics, vibrations, waves, science of electricity, magnetism, electroma-						
-					. Physical values. Force and mo-	
			-	_	s. Friction. Vibration and waves. ics. Electrostatics. Electric cur-	
					axwell equations. Science of al-	
		ent. Electromagnetic wav		-	·	
Intende	ed lear	ning outcomes				
The stu	dents (understand the basic prir	nciples and connectio	ons of mechanics, th	ermodynamics, vibrations, wa-	
					diation and wave optics. They	
				of physical contexts	and autonomously apply their	
		the solution of mathema				
		, number of weekly conta				
					, Waves, Heat)): V (4 weekly con-	
) (2 weekly contact hours			agnetism, Optics)): V (4 weekly	
) + Ü (2 weekly contact ho			agnetism, Optics)): V (4 weekty	
					tion offered — if not every seme-	
		on on whether module ca			,	
This mo	odule h	as the following assessm	ient components			
			ises in part 1 (Klassis	che Physik 1 (Classio	cal Physics 1)): written examinati-	
		120 minutes).	in a set a (Klassia	ah a Dhuaile a (Classi		
		red in lectures and exerc k. 120 minutes).	ises in part 2 (Klassis	che Physik 2 (Classi	cal Physics 2)): written examina-	
			ises in parts 1 and 2:	oral examination of	one candidate each (approx. 30	
		ually chosen) or written e				
Accorc	monte	omponent 3 will be offere	d in Cormon, English	if agreed upon with	o vaminar(c)	
					r admission to assessment com-	
ponent						
			t component 3, stude	nts must pass asses	ssment component 1 and/or 2.	
					Classical Physics 1) and Klassi-	
	•	(Classical Physics 2). The	e topics discussed in	these two courses w	vill be covered in assessment	
compo Studon	-	t register for assessment	components 1 through	rh a onling (dotails t	a ba announcad)	
					d must then pass assessment	
compo			pass assessment c			
The gra	de ach				ne grade achieved in assessment	
compo	nent 3	will each count 50% towa	ards the overall grade	awarded for the mo	dule.	
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)
No final examination Special study offering (2010)

Module	e title				Abbreviation	
Computational Astrophysics					11-NMA-111-m01	
Module	e coord	inator		Module offered by		
Manag	ing Dire	ector of the Institute of T	heoretical Physics	Faculty of Physics a	and Astronomy	
and As			1			
ECTS Method of grading Only after succ. compl. of module(s)						
6	I	rical grade				
Duratio		Module level	Other prerequisites			
rithms Lattice-	i ts s metho (tree- a -Boltzm	nd polynomial codes). I iann). Hyperbolic conse	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 it sessment at a later admission to assess al simulations with sp Particle-mesh method rvation laws (fluid dyn	rer will inform stude the course. Registrat on 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 sment anew. ecial emphasis on th s (particle-in-cell me tamics, finite differer	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 heir applications. N-body algo- thods). Vlasow methods (e.g., nce method, Riemann solver, PI). GPGPU programming (Open-	
The stu sics wit	idents a th the h		tions. They are espec		and other subdisciplines of Phy- osing adequate strategies to ap-	
-		, number of weekly cont		- if other than Germa	ın)	
		mation on SWS (weekly				
Metho	d of ass		anguage — if other th	an German, examina	tion offered — if not every seme-	
in grou weeks) Assess and wil examin Langua	ps (app or d) p ment o Il be an nation r age of a	orox. 30 minutes per car resentation/seminar pr ffered: When and how o nounced in due form ur egulations) 2009. ssessment: German, En	ndidate) or c) project r esentation (approx. 30 ften assessment will l nder observance of Sec	eport (approx. 8 to 1 o minutes) be offered depends (lidate each or oral examination o pages, time to complete: 1 to 4 on the method of assessment 3 ASPO (general academic and	
Allocat	ion of _l	olaces				
 Additio	onal inf	ormation	_			
 Additio 	onal inf	ormation				
 Additio Worklo		ormation				
		ormation				
	ad					
 Worklo 	ad					
 Worklo 	ad					

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)

Modul	e title				Abbreviation	
Physic	s of Co	mplex Systems			11-PKS-092-m01	
Modul	e coord	inator		Module offered by		
Manag	Managing Director of the Institute of Theoretical Physic			Faculty of Physics a	and Astronomy	
and As	trophys	sics	· · · · · · · · · · · · · · · · · · ·			
ECTS Method of grading Only after succ. compl. of module(s)						
6	nume	rical grade				
Duration Module level Other prerequisites						
2. Intro 3. Entro 4. Phas 5. Univ 6. Spin	nts ory of cr oduction opy pro se trans versality n glasse	st	sessment. The lecture at the beginning of sidered a declaration dents have obtained the course of the set sessment into effect ted to assessment it sessment at a later admission to assess rmal equilibriumt equilibriumt st	trer will inform stude the course. Registrat on of will to seek adn d the qualification for mester, the lecturer t. Students who mee n the current or in th date, students will h	alify for admission to as- ints about the respective deta ion for the course will be con- nission to assessment. If stu- or admission to assessment or will put their registration for a et all prerequisites will be adm e subsequent semester. For a ave to obtain the qualification	
Intend The stu	ed lear udents				omplex systems. They know th	
		atistical Physics, Comp . They are able to work o			s, which are used to describe	
Course	es (type	, number of weekly cont	act hours, language –	- if other than Germa	an)	
R + V (1	no infor	mation on SWS (weekly	contact hours) and co	ourse language avail	able)	
		essment (type, scope, on on whether module			tion offered — if not every ser	
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 cand (approx. 8 to 10 pages, inutes) ffered: When and how c	date, for modules with time to complete: 1 to often assessment will oder observance of Se	h less than 4 ECTS cr 4 weeks) or d) prese be offered depends	idate each or oral examination redits approx. 20 minutes) or entation/seminar presentatio on the method of assessment 3 ASPO (general academic an	
Allocat	tion of j	olaces				
Additio	onal inf	ormation				
Worklo	bad					
Bachelor's	with 1 ma	or Mathematical Physics	IM∐ Würzhurσ●	generated 26-Aug-2024 • ex	am. reg. da- page 52 /	
			-	or (180 ECTS) Mathematische	P~5C J2 /	

Teaching cycle

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) 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
Laboratory Course Mathematical Physics B			11-P-MPB-122-m01
Module coordinator		Module offered by	
Managing Director of the Institute of A	pplied Physics	Faculty of Physics a	nd Astronomy
ECTS Method of grading Only after succ. c		pl. of module(s)	
4 (not) successfully completed			
Duration Module level	Other prerequisites		
1 semester undergraduate	-		
Contents			
Physical laws of optics, vibrations and	waves, science of ele	ectricity and circuits	with electric components.
Intended learning outcomes			
The students know and have mastered le to independently plan and conduct measuring protocol. They are able to e principles of statistics and to draw, pr	experiments, to coop valuate the measurin	erate with others, an g results on the basi	d to document the results in a
Courses (type, number of weekly conta	act hours, language –	- if other than Germa	n)
P (no information on SWS (weekly con	tact hours) and cours	e language available	<u>a)</u>
Method of assessment (type, scope, la ster, information on whether module of			tion offered — if not every seme-
a) Preparing, performing and evaluatir if a Testat (exam) is passed. Experime (with discussion; approx. 30 minutes) the module component. Talks that we the assessment have to be successful	nts that were not succ to test the candidate re not successfully co	essfully completed of the standard standard standard standard standard standard standard standard standard stan	can be repeated once. And b) talk the physics-related contents of
Allocation of places			
Additional information			
Additional information on module dur	ation: 1 to 2 semester	s.	
Workload			
Teaching cycle			
	_		
Referred to in LPO I (examination regu	ulations for teaching-o	degree programmes)	
Module appears in			
Bachelor' degree (1 major) Mathematic	cal Physics (2012)		
- • •	<u> </u>		

A dura m	Module title			Abbreviation	
Advanced Laboratory Course Mathematical Physics C		oratory Course Mathema	atical Physics C		11-P-MPC-122-m01
Module	e coord	inator		Module offered by	
Manag	ing Dire	ector of the Institute of A	oplied Physics	Faculty of Physics a	nd Astronomy
ECTS		od of grading	Only after succ. con	n pl. of module(s)	
4	(not) s	successfully completed			
Duratio		Module level	Other prerequisites	i	
1 seme	ster	undergraduate			
Conten	ts				
		of wave optics, Molecula ised devices with examp			n measuring methods using spe-
Intend	ed lear	ning outcomes			
le to in measu princip	depend ring pro les of s	dently plan and conduct e otocol. They are able to e statistics and to draw, pre	experiments, to coop valuate the measurin esent and discuss the	erate with others, an g results on the basi conclusions.	menting techniques. They are ab- d to document the results in a s of error propagation and of the
Course	s (type	, number of weekly conta	ect hours, language –	- if other than Germa	n)
P (no ir	nformat	tion on SWS (weekly cont	act hours) and cours	e language available	2)
		sessment (type, scope, la ion on whether module c			tion offered — if not every seme-
a) Preparing, performing and evaluating (lab report) the experiments will be considered successfully completed if a Testat (exam) is passed. Experiments that were not successfully completed can be repeated once. And b) talk (with discussion; approx. 30 minutes) to test the candidate's understanding of the physics-related contents of the module component. Talks that were not successfully completed can be repeated once. Both components of the assessment have to be successfully completed.					
use use	Allocation of places			inpleted can be repe	ated once. Both components of
	ion of _l		y completed.		ated once. Both components of
	ion of _l		y completed.		ated once. Both components of
Allocat			y completed.		ated once. Both components of
Allocat Additio	onal inf	olaces	· · · ·		ated once. Both components of
Allocat Additio	onal inf	olaces ormation	· · · ·		ated once. Both components of
Allocat Additio	onal inf	olaces ormation	· · · ·		ated once. Both components of
Allocat Additio	onal inf onal info oad	olaces ormation ormation on module dura	· · · ·		ated once. Both components of
Allocat Additio Additio Worklo	onal inf onal info oad	olaces ormation ormation on module dura	· · · ·		ated once. Both components of
Allocat Additio Morklo Teachin 	onal info onal info oad ng cycl	olaces ormation ormation on module dura	ation: 1 to 2 semester	S.	
Allocat Additio Morklo Teachin 	onal info onal info oad ng cycl	olaces ormation ormation on module dura e	ation: 1 to 2 semester	S.	
Allocat Additio Morklo Teachin 	onal info onal info oad ng cycl ed to in	ormation ormation on module dura e LPOI (examination regu	ation: 1 to 2 semester	S.	

Module title			Abbreviation			
Mather	natical	Methods of Physics			11-P-MR-092-m01	
Module	e coord	inator		Module offered by		
Managi and Ast		ector of the Institute of T sics	heoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6		successfully completed				
Duratio	n	Module level	Other prerequisites	i		
2 seme	ster	undergraduate				
Conten	ts					
duction on of b	n to and asic kn	nathematics and basic of d preparation of the mod owledge, functions of s stribution, Fourier trans	dules of Theoretical Ph everal real variables, o	nysics and Classical (or Experimental Phys	sics. Repetiti-
Intende	ed lear	ning outcomes				
require	d in Th	have knowledge of the p eoretical and Experimer he field of Physics.				
Course	s (type	, number of weekly cont	act hours, language –	- if other than Germa	n)	
hour), o Mather	once a natisch	ne Rechenmethoden 1 (N year (winter semester) ne Rechenmethoden 2 (J year (summer semester)	Nathematical Method			
		essment (type, scope, on on whether module			tion offered — if not	every seme-
1. Topio 1)): e 2. Topio	cs cove xercise cs cove	as the following assess red in lectures and exer es or talk (approx. 15 min red in lectures and exer es or talk (approx. 15 mi	cises in part 1 (Mathe nutes, usually chosen cises in part 2 (Mathe) or written examinat matische Rechenme	ion (approx. 60 minu thoden 2 (Mathemat	utes) ical Methods
ponent Studen	s 1 and ts mus	mpletion of approx. 50% 2. t register for assessmer nodule, students must p	it components 1 and 2	online (details to be	e announced).	
· ·		· · · · ·		component i anu as	sessment componer	11 2.
Allocat		JIALES				
Additío	nal inf	ormation				
Worklo	ad					
Teachi	ng cycl	e				
Referre	d to in	LPOI (examination reg	ulations for teaching-	degree programmes)		
		hysik Mechanik, Wärme hysik "Grundlagen der E		re, Optik, der speziel	len Relativitätstheor	ie
Module	e appea	urs in				
		ree (1 major) Physics (20	010)			
Bachelor's (2012)	with 1 ma	or Mathematical Physics	-	generated 26-Aug-2024 • ex or (180 ECTS) Mathematische	_	page 56 / 98

Julius-Maximilians-UNIVERSITÄT WÜRZBURG

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)

Module					Abbreviation	
Lab Co					11-P-PA-112-m01	
Module	e coord	inator		Module offered by		
Managi	ing Dire	ector of the Institute of	Applied Physics	Faculty of Physics a	nd Astronomy	
ECTS		od of grading	Only after succ. con	npl. of module(s)		
5	<u> </u>	successfully completed				
Duratio		Module level	Other prerequisites			
1 seme		undergraduate				
Conten						
			ynamics, science of el			
		ons, linear regression, a of lab reports and publ	average values and sta cations	ndard deviation, dist	tribution functions, s	Significance
		ning outcomes				
			ed physical measuring			
			t experiments, to coop			
		-	evaluate the measurin resent and discuss the	-	s of error propagatio	n and of the
Course	s (type	, number of weekly con	tact hours, language –	- if other than Germa	n)	
			lerrechnung (Measurer	nents and Data Anal	ysis): V (1 weekly co	ntact hour) +
		ntact hour), once a yea				
			und Elektrik (Example	s from Mechanics, T	hermodynamics and	Electricity,
		ekly contact hours)	if a the with		tion offered if not	
			language — if other the can be chosen to earn		tion offered — if not	every seme-
This mo	dule h	as the following asses	sment components	-		
1. Topio	cs cove	red in lectures and exe	rcises: written examina			
			ng and evaluating the e			
		at (exam) is passed. b) hts of the course (appr	Talk (with discussion)	to test the students'	understanding of th	e physics-re-
iaieu	Conter	its of the course (appro	<i>Jx</i> . 30 mmutes).			
Succes	sful co	mpletion of approx. 50	% of practice work is a	prerequisite for adm	ission to assessmer	it component
	s asses	sment component 2. s	udents must pass both	n elements a) and b).	. Students will be off	ered one op-
		take element a) and/o		, ,		
			nt components 1 and 2			
			n Messungen und Fehl , Wärmelehre und Eleki			
Electric	-	eispiele aus mechanik		tink (Examples nom n	Mechanics, mennou	ynannes anu
		odule, students must	bass both assessment	component 1 and as	sessment componer	ıt 2.
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachi	ng cycl	e				
Referre	d to in	LPOI (examination re	gulations for teaching-o	degree programmes)		
§ 53 (1)	1. a) P	hysik Mechanik, Wärm	elehre, Elektrizitätslehi	re, Optik, der speziel	len Relativitätstheor	ie
	with 1 maj	or Mathematical Physics		generated 26-Aug-2024 • exa		page 58 / 98
(2012)			ta record Bachelo	r (180 ECTS) Mathematische I	Physik - 2012	

§ 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)
Dechalar' degree (1 major) Mathematics (2010)

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					Abbreviation		
Quanta	, Atom	s, Molecules			11-QAM-092-m01		
Module	coord	inator		Module offered by	<u> </u>		
		ector of the Institute of A	Applied Physics	· · · · · · · · · · · · · · · · · · ·			
ECTS		od of grading	Only after succ. con	· · · ·	ind Astronomy		
8		rical grade					
Duratio	n	Module level	Other prerequisites				
1 semester undergraduate		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						
		of Atomic, Quantum an	d Molecular Physics				
		ning outcomes					
Course Ü + Ü (r Methoc ster, inf written otherwi Assessi and wil	s (type) no infor d of ass formati examin ise spe ment o l be an	ules: Bonding models a number of weekly cont mation on SWS (weekly essment (type, scope, on on whether module nation (approx. 120 min cified) ffered: When and how c nounced in due form ur egulations) 2009.	tact hours, language – y contact hours) and co language — if other th can be chosen to earn utes, for modules with often assessment will l	- if other than Germa ourse language avail an German, examina a bonus) n less than 4 ECTS cr	n) able) tion offered — if not edits approx. 90 mir on the method of as:	every seme- nutes; unless sessment	
Allocat	ion of p	olaces					
 Additio	nal inf	ormation					
Worklo	ad		_				
Teachir							
	is cycl	-					
Referre	d to in	LPOI (examination reg	ulations for teaching-	degree programmes)			
Module		rs in					
Bachel Bachel	or' deg or' deg	ree (1 major) Mathemat ree (1 major) Mathemat ree (1 major) Mathemat	ics (2013)				
Bachelor's (2012)	with 1 maj	or Mathematical Physics		generated 26-Aug-2024 • ex r (180 ECTS) Mathematische	-	page 60 / 98	

Julius-Maximilians-UNIVERSITÄT WÜRZBURG

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	e title				Abbreviation	
Quantu	Quantum Field Theory II				11-QFT2-092-m01	
M = deste		•		Madula offered bee		
Module		-		Module offered by		
Managi and Asi	-	ector of the Institute of T sics	heoretical Physics	Faculty of Physics a	ind 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 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-			ective details vill be con- ent. If stu- essment over ation for as- vill be admit-	
				n the current or in th date, students will h	•	
			admission to assess			
Conten	ts					
Quantu	ım field	l theory II. Generating fu ntaneous symmetry brea			Renormalisation gr	oup. Gauge
Intende	ed lear	ning outcomes				
Course R + V (n Method ster, int a) writt groups	s (type no infor d of ass formati en exan (appro	uantum field theory by u number of weekly cont mation on SWS (weekly cessment (type, scope, l on on whether module of mination (approx. 90 mi x. 30 minutes per candi	act hours, language – contact hours) and co anguage — if other th can be chosen to earn nutes) or b) oral exam date, for modules witl	- if other than Germa ourse language avail an German, examina a bonus) iination of one candi n less than 4 ECTS cr	able) tion offered — if no date each or oral ex edits approx. 20 mi	(amination in nutes) or c)
(approx Assess and wil examin	x. 30 m ment o Il be an nation r	(approx. 8 to 10 pages, inutes) ffered: When and how o nounced in due form un egulations) 2009. ssessment: German, En	ften assessment will l der observance of Sec	be offered depends of	on the method of as	sessment
Allocat	ion of p	olaces				
Additio	onal inf	ormation				
Worklo	ad					
Teachiı	ng cycl	e				
Referre	ed to in	LPOI (examination reg	ulations for teaching-	degree programmes)		
	with a mai	or Mathematical Physics				
Sachelore		Ior Mathematical Physics	IMIL M/0rzhurg	generated 26-Aug-2024 • ex	am reg da-	page 62 / 98

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)

Bachelor's with 1 major Mathematical Physics

(2012)

Quantum Information and Quantum Computing 11-QiC-092-m01 Module coordinator Module offered by Managing Director of the institute of Theoretical Physics Faculty of Physics and Astrophysics ECTS Method of grading Only after succ. compl. of module(s) 5 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 as sessment in the fuccurse of the semester, the lecturer will put their registration for admission to assessment or et the course of the semester, the lecturer will put their registration for admission to assessment at a later date, students will have to obtain the qualification admission to assessment at a discusses experimental possibilities for the realisation of entangled states. One of the main topics is the production, controlling and manipulation of decoherence of quantum mechanical states. The third part covers the description and explanation of decoherence of quantum mechanical states. Intended learning outcomes Intended to assessment information on whether module can be chosen to earn a boxus) Astrophysics Intended to assessment a dual to for modules with least charts approach and discusses experimental possibilities for the realisation of entangled states. The third part covers the description and explanation of decoherence of quantum mechanical states. Intended learning outcomes <	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) 5 numerical grade - Duration Module level Other preequisites 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 stu- dents have obtained the qualification for admission to assessment. If stu- dents have obtained the qualification for admission to assessment ove the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit te do assessment and a later date, students will have to obtain the qualification in admission to assessment arew. Contents The first part introduces the theoretical concepts of quantum information and quantum computers. It discus- ses the main quantum algorithms. The second part discusses experimental possibilities for the realisation of entangled states. One of the main topics is the production, controlling and manipulation of coherent two-elec- tron spin states. The third part covers the description and explanation of decoherence of quantum mechanical states. Intended learning outcomes The students have an advanced understanding of quantum theory and basic knowledge of quantum calculation they are able to solve simple problemes of quantum information neory. <	Quantu	ım Info	rmation and Quantu	m Computing		11-QIC-092-m01		
Managing Director of the Institute of Theoretical Physics Faculty of Physics and Astronomy ECTS Method of grading Only after succ. compl. of module(s) 5 numerical grade - Duration Module level Other preequisites 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 stu- dents have obtained the qualification for admission to assessment. If stu- dents have obtained the qualification for admission to assessment ove the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit te do assessment and a later date, students will have to obtain the qualification in admission to assessment arew. Contents The first part introduces the theoretical concepts of quantum information and quantum computers. It discus- ses the main quantum algorithms. The second part discusses experimental possibilities for the realisation of entangled states. One of the main topics is the production, controlling and manipulation of coherent two-elec- tron spin states. The third part covers the description and explanation of decoherence of quantum mechanical states. Intended learning outcomes The students have an advanced understanding of quantum theory and basic knowledge of quantum calculation they are able to solve simple problemes of quantum information neory. <	Modula	e coord	inator		Module offered by	<u> </u>		
and Astrophysics Method of grading Only after succ. compl. of module(s) 5 numerical grade				of Theoretical Physics		and Astronomy		
ECTS Method of grading Only after succ. compl. of module(s) 5 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 ove 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 The first part introduces the theoretical concepts of quantum information and quantum computers. It discus- ses the main quantum algorithms. The second part discusses experimental possibilities for the realisation of entangled states. The third part covers the description and explanation of decoherence of quantum mechanical states. Intended learning outcomes The the students have an advanced understanding of quantum theory and basic knowledge of quantum calculation they are able to solve simple problems of quantum information theory. 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 assessesment (ype, scope, la	-	-		of medicilear rhysics		and Astronomy		
5 numerical grade Duration Module level Other preequisites 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 or the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitited to assessment into effect. Students who meet all prerequisites will be admitited to assessment at later date, students will have to obtain the qualification of a duentum information and quantum domitims. The second part discusses experimental possibilities for the realisation of entangled states. One of the main topics is the production, controlling and manipulation of coherent two-electron spin states. The third part covers the description and explanation of decoherence of quantum mechanical states. Intended learning outcomes The summation of quantum theory and basic knowledge of quantum calculation free are bit to solve simple problems of quantum information theory. 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, language — if other than German, examination offered — if not every semister, information and puoy 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				Only after succ. cor	npl. of module(s)			
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 ove the course of the semester, the lecturer will put their registration for assessment ove the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prequisites will be admit ted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification I admission to assessment arew. Contents The first part introduces the theoretical concepts of quantum information and quantum computers. It discusses the main quantum algorithms. The second part discusses experimental possibilities for the realisation of entangled states. One of the main topics is the production, controlling and manipulation of coherent two-electron spin states. The third part covers the description and explanation of decoherence of quantum mechanical states. Intended learning outcomes The subdents have an advanced understanding of quantum theory and basic knowledge of quantum calculation They are able to solve simple problems of quantum information theory. 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 (fype, scope, language — if other than German) A = V (no information on whether module can be consent to a bonus) A written examination (approx. 30 minutes) or c) project report (approx. 30 minutes) or c) prolect repo	5							
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Additional information Workload		. -		, English				
 Workload	Allocat	ion of	places					
 Workload								
	Additio	onal inf	ormation					
	 Worklo	ad						
Teaching cycle								
	Teachi	ng cvcl	e					
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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		
Quanti	um Mec	hanics II			11-QM2-092-m01		
Modul	e coord	inator		Module offered by			
-	ing Dire trophys	ector of the Institute of sics	Theoretical Physics	Faculty of Physics a	and Astronomy		
ECTS	<u> </u>	od of grading	Only after succ. con	npl. of module(s)			
8		rical grade					
Duratio	on	Module level	Other prerequisites	Other prerequisites			
1 seme	ester	undergraduate	sessment. The lecture at the beginning of sidered a declaration dents have obtained the course of the set sessment into effect ted to assessment in sessment at a later	trer will inform stude the course. Registration of will to seek adr d the qualification for mester, the lecturer t. Students who mee n the current or in the date, students will h	alify for admission to as- 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- nave to obtain the qualification for		
			admission to asses	sment anew.			
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Intend	ed lear	ning outcomes					
of the moder thods a	mathen n theor and to i	natical and theoretical etical Quantum Physics nterpret the results ph	concepts of the listed t s mathematically, to so ysically. The course is p	opics. They are able lve problems analyt pivotal to subsequer	d have a thorough understanding to describe or model problems ically, to use approximation me- nt theory courses in Astrophysics mandatory for all Master's stu-		
Course	es (type	, number of weekly cor	itact hours, language –	- if other than Germa	an)		
R + V (I	no infor	mation on SWS (weekl	y contact hours) and co	ourse language avai	lable)		
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Language of assessment: German, English

Bachelor's with 1 major Mathematical Physics	JMU Würzburg • generated 26-Aug-2024 • exam. reg. da-	page 66 / 98
(2012)	ta record Bachelor (180 ECTS) Mathematische Physik - 2012	

Allocation of places

Additional information

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Workload

Teaching cycle

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

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Module appears in

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

Module	e title				Abbreviation		
Many E	Body Qi	uantum Theory			11-QVTP-092-m01		
Module coordinator				Module offered by			
Managing Director of the Institute of Theoretical Physic			heoretical Physics	Faculty of Physics a	and Astronomy		
and As							
ECTS							
8		rical grade					
		Module level	Other prerequisites				
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Intend	ed lear	ning outcomes					
		have mastered the princ ed methods to current p				are able to ap	
Course	s (type	, number of weekly cont	act hours, language –	- if other than Germa	ın)		
R + V (r	no infor	mation on SWS (weekly	contact hours) and co	ourse language avail	able)		
		sessment (type, scope, l on on whether module			ition offered — if not	every seme-	
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Allocat	ion of p	olaces					
 Additio	onal info	ormation					
Bachelor's	with 1 ma	jor Mathematical Physics	JMU Würzburg •	generated 26-Aug-2024 • ex	am. reg. da-	page 68 / 98	

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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) 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)

Modul	e title				Abbreviation	
Renormalization Group Methods in Field Theory					11-RMFT-102-m01	
Module coordinator				Module offered by	<u>I</u>	
Managing Director of the Institute of Theoretical Physi				Faculty of Physics and Astronomy		
-	trophys		·		,	
				npl. of module(s)		
6		rical grade				
Duration Module level		Other prerequisites				
1 semester g		graduate	sessment. The lectur at the beginning of the sidered a declaration dents have obtained the course of the service sessment into effect ted to assessment in sessment at a later	prerequisites must be met to qualify for admission to as- one the first of the course will inform students about the respective details reginning of the course. Registration for the course will be con- a declaration of will to seek admission to assessment. If stu- ave obtained the qualification for admission to assessment over se of the semester, the lecturer will put their registration for as- nt into effect. Students who meet all prerequisites will be admit- sessment in the current or in the subsequent semester. For as- nt at a later date, students will have to obtain the qualification for on to assessment anew.		
		on group methods for n	on linear partial differ	ontial aquations fin	Id theoretical contex	vtc and non
		aviour of cryogenic temp		ential equations, ne		
		ning outcomes				
of the I	renorma	gain an overview of non alisation group method.	·			on the basis
		, number of weekly cont				
		mation on SWS (weekly				
ster, in	formati	sessment (type, scope, on on whether module	can be chosen to earn	a bonus)		
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Allocat	ion of _l	olaces				
 Worklo	ad	ormation				
Teachi	ng cycl	e				
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Referre	ed to in	LPO I (examination reg	ulations for teaching-	legree programmes)		
an o duil.	e annea	rc in				
Modul		or Mathematical Physics		generated 26-Aug-2024 • ex		page 70 / 98

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 (2010)

Modul	e title				Abbreviation		
Relativistic Effects in Mesoscopic Systems					11-RMS-092-m01		
Module coordinator				Module offered by			
Manag	ing Dire	ector of the Institute of	Theoretical Physics	Faculty of Physics a	and Astronomy		
-	trophys			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	, , , , , , , , , , , , , , , , , , ,		
ECTS Method of grading Only at			Only after succ. con	npl. of module(s)			
5	nume	rical grade					
			Other prerequisites	ther 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 fo admission to assessment anew.				
Conten	nte	1					
Relativ	istic eff	ects in mesoscopic sys ors Majorana fermior		oling Dirac equatio	n Quantum Hall effect Topo-		
Intend	ed lear	ning outcomes					
especi	ally in t	he field of mesoscopic	physics. They are able	to apply their knowl	elativistic quantum systems, edge to simple systems.		
		, number of weekly con					
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		ormation					
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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)

Modul	e title				Abbreviation
Renorr	nalizat	ion Theory			11-RNT-092-m01
Modul	e coord	linator		Module offered by	<u> </u>
Manag	Managing Director of the Institute of Theoretical Physics and Astrophysics			Faculty of Physics a	and Astronomy
ECTS	<u> </u>	od of grading	Only after succ. cor	npl. of module(s)	
6		erical grade			
Duratio	on	Module level	Other prerequisites	;	
1 semester graduate		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		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-
			admission to asses	sment anew.	
Conter	nts	·			
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Course	es (type	e, number of weekly c	ontact hours, language –	– if other than Germa	an)
R + V (I	no info	rmation on SWS (wee	ekly contact hours) and co	ourse language avail	able)
			be, language — if other th ule can be chosen to earn		ation offered — if not every seme-
groups project (appro Assess and wi	s (appro t report x. 30 m sment o Il be ar	ox. 30 minutes per ca (approx. 8 to 10 pag ninutes) offered: When and ho nnounced in due form regulations) 2009.	ndidate, for modules wit es, time to complete: 1 to w often assessment will n under observance of Se	h less than 4 ECTS ci 9 4 weeks) or d) preso 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
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Langua Allocat	age of a		, English		
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Teaching cycle

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

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Module appears in

Module	e title				Abbreviation
Relativ	istical	Quantumfield Theory			11-RQFT-092-m01
Module	coord	inator		Module offered by	
		ector of the Institute of T	hoorotical Physics	Faculty of Physics a	and Astronomy
and As			neoretical Physics	Faculty of Filysics a	and Astronomy
ECTS		od of grading	Only after succ. con	npl. of module(s)	
8		rical grade			
Duratio	on	Module level	Other prerequisites	;	
1 seme	ster	graduate	Certain prerequisite	es must be met to qu	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
_			admission to asses	sment anew.	
Conten					
	Feynm	an rules. Quantum elect			and interaction. Perturbation ion. Radiative corrections and re-
		ning outcomes	_		
			inlas and underlying	mathematics of relat	ivistic quantum field theories.
They kr proces	now hov ses in t	w to use perturbation th he framework of quantu	eory and how to apply m electrodynamics in	y Feynman rules. The	ey are able to calculate basics over, they have a basic under-
		diative corrections and I			
		, number of weekly cont			
		mation on SWS (weekly			
		essment (type, scope, l on on whether module o			ition offered — if not every seme-
groups project (approx Assess and wil examin	(appro report x. 30 m ment o Il be an action r	x. 30 minutes per candi (approx. 8 to 10 pages, inutes) ffered: When and how o	date, for modules with time to complete: 1 to ften assessment will der observance of Sec	h less than 4 ECTS cr 9 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 p	olaces			
Additio	nal info	ormation			
Worklo					
Teachi	ig cycl	d	_		
Dachale ²	with a me	or Mathomatical Dhusies		generated 26-Aug-2024 • ex	am rog da
2012)	with 1 md	or Mathematical Physics	-	or (180 ECTS) Mathematische	

Module appears in

Module				_	Abbreviation
Theory	of Rela	ativity			11-RTT-092-m01
Module	e coord	linator		Module offered by	<u> </u>
			of Theoretical Physics	Faculty of Physics a	and Astronomy
and As					,
ECTS		od of grading	Only after succ. con	npl. of module(s)	
6	nume	rical grade			
Duratio		Module level	Other prerequisites		
ments genera Intendo	ts matical of diffe l relativ ed lear	rential geometry; ele vity; stellar models; i ning outcomes	sessment. The lecture at the beginning of sidered a declaration dents have obtained the course of the set sessment into effect ted to assessment it sessment at a later admission to asses theory of relativity; differe ectrodynamics as an example introduction to cosmology	urer will inform stude the course. Registrat on of will to seek adm d the qualification for emester, the lecturer at. Students who meet in the current or in th date, students will h sment anew.	alify for admission to as- 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- nave to obtain the qualification fo mmary of special relativity; ele- gauge theory; field equations of alation
able to	apply	the acquired knowle	e formulation of general ı dge to problems of Astrop contact hours, language –	physics and cosmolo	
R + V (r	no infoi	mation on SWS (wee	ekly contact hours) and co	ourse language avail	able)
Metho	d of as	sessment (type, scor		an German, examina	ation offered — if not every seme-
groups project (appro: Assess and wil examin	(appro report x. 30 m ment o Il be an ation r	ox. 30 minutes per ca (approx. 8 to 10 pag linutes) offered: When and ho	andidate, for modules wit ges, time to complete: 1 to ow often assessment will n under observance of Se	h less than 4 ECTS cr 9 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				
T i - i		<u>ــــــــــــــــــــــــــــــــــــ</u>			
Teachi	ing cyci	.c			

Module appears in

Modu	le title			-	Abbreviation		
Statis	tics, Da	ta Analysis and Com	puter Physics	_	11-SDC-092-m01		
Modu	le coord	inator		Module offered by			
Managing Director of the Institute of Applied I		of Applied Physics	Faculty of Physics a	and Astronomy			
ECTS		od of grading	<u> </u>	Only after succ. compl. of module(s)			
4	_	rical grade					
Durati		Module level	Other prerequisites	5			
1 sem		graduate	1 1 1		alify for admission to as-		
		0			nts about the respective details		
			at the beginning of	the course. Registrat	ion for the course will be con-		
			sidered a declaration	on of will to seek adn	nission to assessment. If stu-		
			dents have obtaine	ed the qualification fo	or admission to assessment over		
			the course of the se	emester, the lecturer	will put their registration for as-		
			sessment into effe	ct. Students who mee	et all prerequisites will be admit-		
					e subsequent semester. For as-		
					ave to obtain the qualification for		
			admission to asses	ssment anew.			
Conte	nts						
Statist	tics, dat	a analysis and comp	uter physics.				
Intend	ded lear	ning outcomes					
The st Physic		have specific and ad	vanced knowledge in the	e field of statistics, da	ata analysis and Computational		
Cours	es (type	, number of weekly c	ontact hours, language -	— if other than Germa	in)		
R + V ((no info	rmation on SWS (wee	ekly contact hours) and c	ourse language avail	able)		
			pe, language — if other th lle can be chosen to earr		tion offered — if not every seme-		
group projec (appro Asses and w exami	s (appro ct report ox. 30 m sment o ill be an nation r	ox. 30 minutes per ca (approx. 8 to 10 pag inutes) Iffered: When and ho	ndidate, for modules wit es, time to complete: 1 to w often assessment will n under observance of Se	th less than 4 ECTS cr o 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		
Alloca	tion of	places					
	onal inf	ormation					
	Unatini	ormation					
Workl	oad						
 Teach	ing cycl	A	<u>.</u>				
	ing cyce						
Referr	red to in	LPOI (examination	regulations for teaching	degree programmes)			
Modu	le appea	ars in					
		ree (1 major) Physics	(2010)				
	-	ree (1 major) Physics					
Bachelor'		jor Mathematical Physics	JMU Würzburg	• generated 26-Aug-2024 • ex			
(2012)			ta record Bachel	or (180 ECTS) Mathematische	PNYSIK - 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) 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) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2010)

Julius-Maxi

UNIVERSITÄT

WÜRZBURG

Modul	e title				Abbreviation
Semin	ar Math	ematical Physics			11-SMP-092-m01
Modul	e coord	inator		Module offered by	<u> </u>
•		f examination commi ematical Physics)	ttee Mathematische	Faculty of Physics a	and Astronomy
ECTS	Meth	od of grading	Only after succ. co	mpl. of module(s)	
4	nume	rical grade			
Duratio	on	Module level	Other prerequisite	S	
1 seme	ester	undergraduate		isite to assessment: 1 of seminar presenta	regular attendance and suc- tion.
Conter	nts				
A seled	cted top	oic of Mathematical Pl	nysics.		
Intend	ed lear	ning outcomes			
sion of		n topic on the basis of			olves the development and divi- ell as the ability to actively partici-
Course	es (type	, number of weekly co	ontact hours, language	– if other than Germa	an)
S (no i	nforma	tion on SWS (weekly o	contact hours) and cour	se language available	e)
			e, language — if other th le can be chosen to ear		ation offered — if not every seme-
Assess and wi examir	sment o Il be an nation r	nounced in due form egulations) 2009.	v often assessment will	ection 32 Subsection	on the method of assessment 3 ASPO (general academic and
Allocat	tion of _l	places			
Additio	onal inf	ormation			
Worklo	bad				
Teachi	ng cycl	e			
Referre	ed to in	LPOI (examination r	egulations for teaching	degree programmes)	
Modul	e appea	ars in			
Bachel	lor' deg	ree (1 major) Mathem	, . ,		
васпе	ior deg	ree (1 major) Mathem	atical Physics (2012)		

Module					Abbreviation	
Statistical Mechanics, Thermodynamics and Electrody				ics	11-STE-092-m01	
Module coordinator				Module offered by		
-	ing Dire trophys	ector of the Institute of T	heoretical Physics	Faculty of Physics	10	
ECTS	<u> </u>	od of grading	Only after succ. cor	npl. of module(s)		
16		rical grade				
Duratio	on .	Module level	Other prerequisites			
2 seme	-	undergraduate	10-M1-PHY and 10-M		T and 10-M2-NST	
Conten	Its		4			
ticles,	critical	itatistical Physics: Ideal phenomena, Maxwell ec tromagnetic fields. Spe	uations, electrostatio			
Intend	ed lear	ning outcomes				
trodyna method	amics, ds and	have advanced knowled thermodynamics and sta are able to independent	atistical mechanics. T ly apply them to the c	hey are familiar with lescription and solu	h the corresponding ution of problems in	calculation
Course	s (type	, number of weekly cont	act hours, language –	- if other than Germ	ian)	
hours) Theore hours),	+ Ü (2 v tische l , once a	lechanik und Thermodyr weekly contact hours), o Elektrodynamik (Theoret year (summer semeste	nce a year (winter ser ical Electrodynamics) r)	nester) : V (4 weekly contac	ct hours) + Ü (2 wee	kly contact
		essment (type, scope, l on on whether module o			ation offered — if n	ot every seme
char 2. Topi mics 3. Topi	nics and cs cove 5)): writi cs cove	red in lectures and exer I Thermodynamics)): wri red in lectures and exer ten examination (approx red in lectures and exer ually chosen) or written	tten examination (ap cises in part 2 (Theore . 120 minutes). cises in parts 1 and 2:	orox. 120 minutes). etische Elektrodyna oral examination o	mik (Theoretical Ele	ctrodyna-
Succes		omponent 3 will be offer mpletion of approx. 50%				essment com
Studen cal Mee discus: Studen To pas: compo	nts are h chanics sed in t nts mus s this m nent 3.	nighly recommended to and Thermodynamics) hese two courses will be t register for assessmen nodule, students must fi ieved in assessment col	and Theoretische Elel e covered in assessme t components 1 throu rst pass assessment o	xtrodynamik (Theor ent component 3. gh 3 online (details component 1 or 2 ar	etical Electrodynam to be announced). nd must then pass a	ics). The topic
compo	nent 3	will each count 50% tow				11 4356551161
Allocat	ion of _l	olaces				
-						
Additio	onal inf	ormation				
Worklo	ad					
achelor's 2012)	with 1 ma	or Mathematical Physics		generated 26-Aug-2024 • e or (180 ECTS) Mathematisch		page 83 / 98

Teaching cycle

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

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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	e title				Abbreviation	
Supers	ymmet	ry I and II			11-SUS-092-m01	
Module coordinator				Module offered by		
Managing Director of the Institute of Th and Astrophysics		neoretical Physics	Faculty of Physics a	and Astronomy		
ECTS	<u> </u>	od of grading	Only after succ. con	npl. of module(s)		
6		rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester gradua		graduate	Certain 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. If		nts about the respective details ion for the course will be con-	
			the course of the se sessment into effec ted to assessment i	mester, the lecturer t. Students who mee n the current or in th date, students will h	will put their registration for as- et all prerequisites will be admit- e subsequent semester. For as- ave to obtain the qualification for	
Conten	ts					
Supers ticles. F Intende The stu tric mo	ymmet Phenon ed learn Idents I dels. Th	nenology of LEP, Tevatron ning outcomes nave knowledge of the m	netric standard mode n and LHC, supersym athematical and phy ry's formalism and re	l. Higgs sector. The s metric neutrino mass sical principles of su	spectrum of supersymmetric par- s models. Violation of R-parity. persymmetry and supersymme- ons to other models as well as its	
Course	s (type	, number of weekly conta	act hours, language –	- if other than Germa	an)	
V + R (n	no infor	mation on SWS (weekly	contact hours) and co	ourse language avail	able)	
Method	d of ass	· · · · · ·	anguage — if other th	an German, examina	tion offered — if not every seme-	
groups project (appro» Assess and wil examin	(appro report x. 30 m ment o Il be an aation 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 l der 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 p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
WOIKU	au					
 Tec -! !		-				
Teachiı	ng cycl	e				
Bachelor's 2012)	with 1 ma	or Mathematical Physics		generated 26-Aug-2024 • ex r (180 ECTS) Mathematische		

Module appears in

Module	e title				Abbreviation
Theore	tical El	ementary Particle Physic	CS		11-TEP-092-m01
Module	e coord	inator		Module offered by	
Managi and As	-	ector of the Institute of Tl sics	neoretical Physics	Faculty of Physics a	and Astronomy
ECTS	<u> </u>	od of grading	Only after succ. con	npl. of module(s)	
8		rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate	Certain prerequisite	s must be met to qu	alify for admission to as-
			sessment. The lectu	rer will inform stude	nts about the respective details
			at the beginning of	the course. Registrat	ion for the course will be con-
			sidered a declaration	n of will to seek adn	nission to assessment. If stu-
			dents have obtained	d the qualification fo	or admission to assessment over
			the course of the se	mester, the lecturer	will put their registration for as-
			sessment into effec	t. Students who mee	et all prerequisites will be admit-
			ted to assessment i	n the current or in th	e subsequent semester. For as-
			sessment at a later	date, students will h	ave to obtain the qualification for
			admission to asses	sment anew.	
Conten	ts				
Gauge	theorie				ples of quantum field theory. . Quantum chrome dynamics. Ex-
		ning outcomes	-		
structu lation r	re of th nethod	e standard model based	l on symmetry princip imple problems and p	les and experimenta processes of Elemen	Physics. They understand the al observations. They know calcu- tary Particle Physics. Furthermo- aded theories.
Course	s (type	, number of weekly conta	act hours, language –	- if other than Germa	in)
R + V (r	no infor	mation on SWS (weekly	contact hours) and co	ourse language avail	able)
		sessment (type, scope, la ion on whether module c			tion offered — if not every seme-
groups project (approx Assess and wil examin	(appro report x. 30 m ment o Il be an action r	x. 30 minutes per candia (approx. 8 to 10 pages, t inutes) ffered: When and how o	date, for modules with time to complete: 1 to ften assessment will der 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					
Additio	nal inf	ormation			
Worklo					
WUIKLO	au				
Teachi	ng cycl	e			
Bachelor's (2012)	with 1 ma	jor Mathematical Physics		generated 26-Aug-2024 • ex r (180 ECTS) Mathematische	

Module appears in

Module title Abbreviation					
Theoret	tical So	olid State Physics			11-TFK-092-m01
Module	Module coordinator			Module offered by	
Managing Director of the Institute of Theoretical Ph and Astrophysics			neoretical Physics	Faculty of Physics a	nd Astronomy
		od of grading	Only after succ. con	npl. of module(s)	
8		rical grade			
Duratio	n	Module level	Other prerequisites		
Duration Module level 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			
Conten Principl		heoretical Solid-State Ph	admission to assess		on interaction. Variational me-
		tism. Superconductivity.			
Intende	ed leari	ning outcomes			
respond theory a	ding m and to	athematical or theoretica	al methods and are al ons to experimental r	ble to apply them to results. The individua	phenomena. They know the cor- basic problems of solid-state al students have elaborated on nar presentation.
Courses	s (type	, number of weekly conta	act hours, language –	- if other than Germa	n)
R + V (n	o infor	mation on SWS (weekly	contact hours) and co	ourse language availa	able)
Method	l of ass		anguage — if other th	an German, examina	tion offered — if not every seme-
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					
Allocati	ion of p	olaces			
Allocal					
	nal inf	ormation			
	nal inf	ormation			
		ormation			
 Additio 		ormation			
 Additio Workloa	ad				
 Additio 	ad				

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
Particle	e Physi	cs (Standard Model)			11-TPS-092-m01
Module	coord	inator		Module offered by	
		ectors of the Institute of A	Applied Physics and	Faculty of Physics a	and Astronomy
		f Theoretical Physics and			and Astronomy
ECTS		od of grading	Only after succ. con	npl. of module(s)	
8	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate		•	alify for admission to as-
					nts about the respective details
					ion for the course will be con-
					nission to assessment. If stu-
				•	r admission to assessment over
					will put their registration for as-
					t all prerequisites will be admit-
					e subsequent semester. For as-
					ave to obtain the qualification fo
_			admission to assess	sment anew.	
Conten					
		o the theory of electrowe el and determination of l		ontaneous symmetr	y breaking. Experiments on the
Intende	ed learı	ning outcomes			
perime theoret	nts tha ical res	t have established and c sults in the framework of	onfirmed the standar the standard model a	d model. They are al and know its validity	
		, number of weekly conta			
		mation on SWS (weekly			•
		s essment (type, scope, la on on whether module c			ition offered — if not every seme
groups project (approx Assess and wil examin	(appro report k. 30 m ment o l be an ation 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	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 p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
 Teachiı	ng cycl	6			
	3 59 51	-			
Referre	d to in	LPO I (examination regu	llations for teaching-	degree programmes)	
Bachelor's	with 1 mai	or Mathematical Physics	IM∐ Würzhurg ●	generated 26-Aug-2024 • ex	am. reg. da- page 91 / 98
(2012)				r (180 ECTS) Mathematische	

Module appears in

Module title			Abbreviation			
Theoretical Mechanics and Quantum Mechanics				11-TQM-092-m01		
Module coordinator			Module offered by			
Managing Director of the Institute of Theoretic and Astrophysics		neoretical Physics	Faculty of Physics and Astronomy			
		Only after succ. con	mpl. of module(s)			
16 nume	16 numerical grade					
Duration	Module level	Other prerequisites				
2 semester undergraduate 10-M1-PHY, 10-M2-PHY and 11-MPI-3 or 10-M1-NST, 10-M2-NST and MPI-3					T and MPI-3	
Contents						
Newtonian mechanics. Lagrangian and Hamiltonian formalism. Symmetries and conservation laws. Applications: Problems of central forces, minor vibrations, rigid body, motion in electromagnetic fields. Relativistic dynamics. Limits of classical physics. Schrödinger equation, mathematical principles of quantum mechanics, harmonic os- cillator. Angular momentum and spin. Hydrogen atom. Methods of approximation. Motion in electric fields. Ma- ny-particle systems.						
Intended lear	ning outcomes					
The students have gained first experiences concerning the working methods of Theoretical Physics. They are fa- miliar with the principles of theoretical mechanics and their different formulations and understand the principles of quantum theory. They are able to apply the acquired calculation methods and techniques to simple problems of Theoretical Physics and to interpret the results. They have especially acquired knowledge of basic mathemati- cal concepts.						
Courses (type	, number of weekly conta	act hours, language –	- if other than Germa	n)		
Theoretische Mechanik (Theoretical Mechanics): V (4 weekly contact hours) + Ü (2 weekly contact hours), once a year (winter semester) Quantenmechanik (Quantum Mechanics): V (4 weekly contact hours) + Ü (2 weekly contact hours), once a year (summer semester)						
Method of assessment (type, scope, language — if other than German, examination offered — if not every seme- ster, information on whether module can be chosen to earn a bonus)						
 This module has the following assessment components 1. Topics covered in lectures and exercises in part 1 (Theoretische Mechanik (Theoretical Mechanics)): written examination (approx. 120 minutes). 2. Topics covered in lectures and exercises in part 2 (Quantenmechanik (Quantum Mechanics)): 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). 						
Successful completion of approx. 50% of practice work each is a prerequisite for admission to assessment components 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 Theoretische Mechanik (Theoretical Mechanics) and Quantenmechanik (Quantum Mechanics). 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.						
component 3 will each count 50% towards the overall grade awarded for the module. Allocation of places						
Additional information						
	ior Mothematical Dhusing	1841134/20b	concreted of Aug	am rog da		
Bachelor's with 1 ma	jor Mathematical Physics		generated 26-Aug-2024 • exact states of the second		page 93 / 98	

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) 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)

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					Abbreviation			
Theore	etical M	echanics and Quantum	Mechanics for FOKUS	Students	11-TQM-F-092-m01			
Module coordinator				Module offered by	e offered by			
Manag	ing Dire	ector of the Institute of 1	heoretical Physics	Faculty of Physics	and Astronomy			
-	trophys		,,	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	,			
ECTS	Metho	od of grading	Only after succ. cor	npl. of module(s)				
16	numerical grade 10-M-PHY1 and 10-M-PHY2 or 10-M-NST1 and 10-M-NST2 and 11-TQM		Г1 and 10-M-NST2 and 11-TQM-1,					
			11-КР					
Duratio	on	Module level	Other prerequisites	Other prerequisites				
2 semester undergraduate								
Conten	nts							
Probler Limits cillator	ms of co of class	entral forces, minor vibr ical physics. Schröding ar momentum and spin	ations, rigid body, mo er equation, mathema	tion in electromagr atical principles of c	nd conservation laws. Applications netic fields. Relativistic dynamics. quantum mechanics, harmonic os- ion. Motion in electric fields. Ma-			
Intend	ed lear	ning outcomes						
of quar of Theo cal con	ntum th pretical icepts.	eory. They are able to a Physics and to interpre	pply the acquired calc t the results. They hav	ulation methods ar e especially acquire	ions and understand the principle nd techniques to simple problems ed knowledge of basic mathemati			
Course	s (type	, number of weekly cont	act hours, language –	– if other than Germ	nan)			
year (w	/inter se	emester)			Ü (2 weekly contact hours), once a idents): V (4 weekly contact hours)			
ween s	ummer	and winter semester)	-		ight during semester break bet-			
		essment (type, scope, on on whether module			nation offered — if not every seme-			
1. Topi amir	cs cove nation (approx. 120 minutes).	rcises in part 1 (Theore		heoretical Mechanics)): written ex			
char	nics for	FOKUS Students)): writt	en examination (appr	ox. 120 minutes).	KUS-Studierende (Quantum Me- of one candidate each (approx. 30			
		ually chosen) or written			o one candidate each (approx. 30			
ponent	ts 1 and	2.			for admission to assessment com- essment component 1 and/or 2.			
Studer	nts are h	nighly recommended to	attend both courses 1	heoretische Mecha	inik (Theoretical Mechanics) and idents). The topics discussed in			
		rses will be covered in a	•					
To pas					to be announced). nd must then pass assessment			
The gra	ade ach				the grade achieved in assessmen nodule.			
Allocat	tion of p	olaces						
Daak - L		av Mathamatical Disc. 1	184111400 1	- an analysis of a second				
Bachelor's [2012)	with 1 ma	jor Mathematical Physics		generated 26-Aug-2024 • 6 or (180 ECTS) Mathematisch				

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)

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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)

Module title Abbreviation						
Theory of Superconduction				11-TSL-092-m01		
Module coordinator				Module offered by		
Managi	ing Dire	ector of the Institute of T	neoretical Physics		Faculty of Physics and Astronomy	
and As			, 1		•	
ECTS	1	od of grading	Only after succ. con	:. compl. of module(s)		
5	I	rical grade				
		Other prerequisites				
Phenor vity (An elemen	its ints.	gical theory of supercon scattering, Bobolioubov-	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 it sessment at a later admission to assess uperconductivity. Mich ductivity (Ginzburg-Later	arer will inform stude the course. Registrat on of will to seek adm d the qualification for mester, the lecturer t. Students who mee n the current or in th date, students will h sment anew.	alify for admission to as- nts about the respective of ion for the course will be hission to assessment. If so or admission to assessment will put their registration for at all prerequisites will be e subsequent semester. F ave to obtain the qualification uperconductivity (BCS theo scopic aspects of supercon- computing with supercon-	con- stu- nt over for as- admit- For as- ation fo ory).
Intende	ed lear	ning outcomes				
					n of superconductivity. Th ulation methods to simple	
Course	s (type	, number of weekly conta	act hours, language –	- if other than Germa	ın)	
R + V (r	no infor	rmation on SWS (weekly	contact hours) and co	ourse language avail	able)	
		s essment (type, scope, la ion on whether module c			tion offered — if not every	/ seme-
groups project (approx Assess and wil examin	(appro report x. 30 m ment o Il be an	ox. 30 minutes per candio (approx. 8 to 10 pages, 1 inutes) ffered: When and how o	date, for modules with time to complete: 1 to ften assessment will l der observance of Sec	h less than 4 ECTS cr 4 weeks) or d) prese be offered depends o	date each or oral examina redits approx. 20 minutes) entation/seminar presenta on the method of assessm 3 ASPO (general academic) or c) ation nent
Allocat	ion of _l	olaces				
Additio	onal inf	ormation				
Worklo	ad					
Teachi	ng cycl	e				
		,				
achelor's	with 1 ma	jor Mathematical Physics		generated 26-Aug-2024 • ex		e 97 / 98
2012)			ta record Bachelo	or (180 ECTS) Mathematische	Physik - 2012	

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)