

Subdivided Module Catalogue for the Subject

Physics

as a minor in a Bachelor's degree programme (60 ECTS credits)

Examination regulations version: 2010 Responsible: Faculty of Physics and Astronomy

JMU Würzburg • generated 26-Aug-2024 • exam. reg. data record B1|128|-|-|N|2010



Course of Studies - Contents and Objectives

The goal of the studies is it to mediate knowledge on the most important subsections of physics and to make the students familiar with the methods of physical scientific and physical thinking and working. By training of analytic thinking abilities the students acquire the ability to deal later with the various fields of applications and to compile the basic knowledge in particular necessary for a consecutive Bachelor and Master course of studies. Therefore the main emphasis is put on the understanding of the fundamental experimental and theoretical physical terms and laws as well as on basic scientific methods and the development of the typical scientific thinking and working structures. During the Bachelor thesis the student should work on a thematic and temporally limited experimental or theoretical engineering-scientific task in the field of experimental or theoretical physics using well-known procedures and scientific criteria under guidance to a large extent independently.



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)):

19-Jan-2011 (2011-8)

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		Method of grading	page				
Compulsory Courses (40 ECTS credits)								
40 ECTS credits must be achieved in mandatory courses.								
11-KP-092-m01	Classical Physics (Mechanics, Thermodynamics, Waves, Oscil-	16	NUM	23				
	lations, Electricity, Magnetism and Optics)							
11-TQM-092-m01	Theoretical Mechanics and Quantum Mechanics	16	NUM	41				
11-P-PB-NF-092-m01	Basic Practical Course B (Minor Studies)	3	B/NB	30				
11-P-PA-092-m01	Practical Course A	5	B/NB	28				
Compulsory Electives (20 EC	CTS credits)							
11-A3-072-m01	Laboratory and Measurement Technology	6	NUM	9				
11-A4-072-m01	Astrophysics	6	NUM	11				
44 KM 000 mot	Condensed Matter (Quanta, Atoms, Molecules, Solid State		NUM	21				
11-KW-092-1101	Physics)	10						
11-KET-092-m01	Nuclear and Elementary Particle Physics	4	NUM	20				
11-STE-092-m01	Statistical Mechanics, Thermodynamics and Electrodynamics	16	NUM	37				
11-A2-092-m01	Electronics	6	NUM	7				
11-HS-092-m01	Advanced Seminar Experimental/Theoretical Physics	4	NUM	19				
11-P-MR-092-m01	Mathematical Methods of Physics	6	B/NB	26				
11-A1-092-m01	Computational Physics	6	NUM	5				
11-EIN-092-m01	Introduction to Nanoscience	6	NUM	15				
11-FON-092-m01	Advanced Nano Sciences	6	NUM	18				
11-N2-092-m01	Principles of Electronics (with Practical Course)	6	NUM	25				
11-ED-092-m01	Theoretical Electrodynamics	8	NUM	13				
11-FKP-092-m01	Solid State Physics 1	8	NUM	16				
11-TM-092-m01	Theoretical Mechanics	8	NUM	39				
11-QAM-092-m01	Quanta, Atoms, Molecules	8	NUM	31				
11-QM-092-m01	Quantum Mechanics	8	NUM	33				
11-ST-092-m01	Statistical Mechanics and Thermodynamics	8	NUM	35				

(2010)

Module title					Abbreviation	
Comput	Computational Physics 11-A1-092-m01					
Module coordinator				Module offered by		
Managir and Astı	ng Dire rophys	ector of the Institute of sics	Theoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duration	n	Module level	Other prerequisites			
1 semes	iter	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			o as- ctive details ill be con- nt. If stu- ssment over ation for as- ill be admit- ster. For as- valification for
			admission to asses	sment anew.		
 Introdu numeri simula genera randon many-r 	uction ical so tion o ition o n walk	to programming on the lution of differential ec f chaotic systems f random numbers	basis of C++ / Java /N Juations	lathematica		
Intende	d lean	ning outcomes				
The stuc They have solution	dents l ve kno	have knowledge of two wledge of numerical si vsical problems, e.g. a	major programming la andard methods and a gorithms for solving n	nguages and know a are able to apply com umerical problems of	lgorithms important puter-assisted proc f Physics.	for Physics. esses to the
Courses	; (type	number of weekly con	tact hours, language –	- if other than Germa	n)	
V + Ü (n	o infoi	mation on SWS (week	v contact hours) and co	ourse language avail	able)	
Method ster, info	of ass ormati	essment (type, scope,	language — if other th can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-
written examination (approx. 120 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) 2000						
Allocati	on of p	olaces				
Only as	part o	f pool of general key sk		laces will be allocate	ed by lot.	
Additional information						
Workload						
Reterred to in LPO I (examination regulations for teaching-degree programmes)						
minor in a Ba (2010)	achelor's	degree programme Physics	JMU Würzbu reg. data rec	irg • generated 26-Aug-2024 ord Bachelor (60 ECTS) Physi	• exam. k - 2010	page 5 / 42

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 title				Abbreviation	
Electronics	Electronics 11-A2-092-m01				
Module coord	linator		Module offered by		
Managing Dir	Managing Director of the Institute of Applied Physics Faculty of Physics and Astronomy				
ECTS Meth	FCTS Method of grading Only after succ. compl. of module(s)				
6 nume	erical grade		<u> </u>		
Duration	Module level	Other prerequisites			
1 semester	undergraduate	Certain prerequisite	s must be met to qua	alify for admission to) as-
		sessment. The lectu	rer will inform stude	nts about the respec	tive details:
		at the beginning of t	the course. Registrat	ion for the course wi	ll be con-
		sidered a declaratio	n of will to seek adm	ission to assessme	nt. If stu-
		dents have obtained	d the qualification fo	r admission to asses	ssment over
		the course of the se	mester, the lecturer	will put their registra	ition for as-
		tod to assossment into enec	n the current or in the	a subsequent server	tor For ac-
		sessment at a later	date_students will h	ave to obtain the qu	alification for
		admission to assess	sment anew.	ave to obtain the qu	
Contents	1				
Principles of e	electronic components	and circuits Analogous	s circuit technology.	Passive (resistors c	anacitors
coils and dio	des) and active components	nents (bipolar and field-	effect transistors, or	perational amplifiers	b). Digital cir-
cuits: differer	nt types of gates and Cl	MOS circuits. Microcont	roller	•	
Intended lear	ning outcomes				
The students	have knowledge of the	practical setup of elect	ronic circuits from th	e field of analogous	and digital
circuit techno	logy.				
Courses (type	e, number of weekly co	ntact hours, language –	- if other than Germa	n)	
V + Ü (no info	rmation on SWS (week	ly contact hours) and co	ourse language avail	able)	
Method of as ster, informat	sessment (type, scope ion on whether module	, language — if other tha e can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-
written exami	nation (approx. 90 mir	iutes)			
Assessment of	offered: When and how	often assessment will h	pe offered depends o	on the method of ass	sessment
examination	regulations) 2009.	inder observance of Sec	ction 32 Subsection	3 ASPO (general aca	demic and
Allocation of	places				
Only as part o	of pool of general key s	kills (ASQ): 15 places. P	laces will be allocate	ed by lot.	
Additional inf	formation				
Workload					
Teaching cycle					
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module appears in					
Bachelor' degree (1 major) Physics (2010)					
Bachelor' degree (1 major) Physics (2012)					
Bachelor' deg	gree (1 major) Nanostru	cture Technology (2012))		
minor in a Bachelor' (2010)	s degree programme Physics	JMU Würzbu reg. data rec	rg • generated 26-Aug-2024 ord Bachelor (60 ECTS) Physi	• exam. k - 2010	page 7 / 42

Julius-Maximilians-UNIVERSITÄT WÜRZBURG

Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) FOKUS Physics (2011) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2010)

Module title				Abbreviation		
Laboratory and Measurement Technology					11-A3-072-m01	
Modul	e coord	inator		Module offered by		
Manag	ing Dire	ector of the Institute of	Applied Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade		£		
Duratio	on	Module level	Other prerequisites	;		
1 seme	ester	undergraduate	Admission prerequi	site to assessment:	successful completion	on of approx.
50% of exercises. Certain prerequisites must be m			must be met to quali	ify for admis-		
sion to assessment. The lecturer will inform students about the					the respecti-	
			ve details at the beg	ginning of the course	. Registration for the	e course will
			be considered a dec	claration of will to se	ek admission to ass	essment. If
			students have obtain	ined the qualification	n for admission to as	sessment
			over the course of the	ne semester, the lect	urer will put their reg	gistration for
			assessment into err	ect. Students who m	eet all prerequisites	Will be ad-
				or data, students will	I the subsequent set	nuester. FOI
			for admission to as	er uale, sluuenis wil sessment anew	t have to obtain the	qualification
Conter	nts			jessment unew.		
Introdu	iction to	electronic and ontica	l measuring methods o	f physical metrology	vacuum technology	, and cryoge
nics, ci	ryogeni	cs, light sources, spec	troscopic methods and	measured value acq	uisition.	
Intend	ed lear	ning outcomes				
The stu	udents l	have acquired the follo	wing transferable skills	s: Electronic and opti	cal measuring meth	ods in physi-
cal me	trology, He accu	cryogenics and vacuu	im technology, cryogeni	ics, light sources, sp	ectroscopic methods	s and measu-
Course	es (type	, number of weekly cor	ntact hours, language –	- if other than Germa	n)	
V + Ü (no infoi	mation on SWS (week	ly contact hours) and co	ourse language avail	able)	
Metho	d of ass formati	sessment (type, scope	, language — if other the	an German, examina a bonus)	tion offered — if not	every seme-
written	exami	nation (approx, 120 mi	nutes)			
Allocat	tion of p	olaces				
Only as	s part o	f pool of general key sl	kills (ASO): 15 places. P	laces will be allocate	ed by lot.	
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 (2007) Bachelor' degree (1 major) Physics (2010)						
Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2000)						
Bachelor' degree (1 major) Physics (2009)						
Bachel	or' deg	ree (1 major) Physics (2	2008)			
minor in a	Bachelor's	degree programme Physics	JMU Würzbu	irg • generated 26-Aug-2024 ord Bachelor (60 FCTS) Physi	• exam. k - 2010	page 9 / 42

Julius-Maximilians-UNIVERSITÄT WÜRZBURG

Subdivided Module Catalogue for the Subject Physics minor in a Bachelor's degree programme, 60 ECTS credits

Bachelor' degree (1 major) Nanostructure Technology (2010) Bachelor' degree (1 major) Nanostructure Technology (2012) Bachelor' degree (1 major) Nanostructure Technology (2008) Bachelor' degree (1 major) Nanostructure Technology (2007) Master's degree (1 major) Technology of Functional Materials (2010) Master's degree (1 major) Technology of Functional Materials (2009) Master's degree (1 major) Functional Materials (2012) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2008) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2010)

minor in a Bachelor's degree programme Physics (2010)

Module title				Abbreviation		
Astrop	Astrophysics 11-A4-072-m01					
Modul	e coord	inator		Module offered by		
Manag and As	ing Dire trophys	ector of the Institute of sics	Theoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
Duration Module level Other prerequisites 1 semester undergraduate Admission prerequisite to assessment: successful completion of a 50% of exercises. Certain prerequisites must be met to qualify for a sion to assessment. The lecturer will inform students about the res ve details at the beginning of the course. Registration for the cours be considered a declaration of will to seek admission to assessme students have obtained the qualification for admission to assessme over the course of the semester, the lecturer will put their registratia assessment into effect. Students who meet all prerequisites will be mitted to assessment at a later date, students will have to obtain the qualifier for admission to assessment anew.				on of approx. Ify for admis- the respecti- ecourse will essment. If sessment gistration for will be ad- mester. For qualification		
Conten	nts		1			
stellar large-s nucleo Intende The stu physica ons. Th lopmer	mediur cale str synthe ed lear udents al obse ney kno nt.	n, structure of the Milk ructure of the universe, sis, cosmic microwave ning outcomes are familiar with the me rvations and evaluatio w the structure of the u	y Way, local universe, e Friedmann World Mod background radiation, odern world view of Ast ns. They are able to use universe, e.g. of stars an	expanding space-tim els, thermodynamics structure formation, rophysics. They know e these methods to p nd galaxies and unde	w methods and tools lan and analyse owr erstand the process	alactic nuclei, e, primordial for astro- n observati- of their deve-
Course	es (type	, number of weekly cor	ntact hours, language –	- if other than Germa	n)	
V + S (r	no infoi	mation on SWS (week	v contact hours) and co	ourse language availa	able)	
Metho ster, in	d of as format	sessment (type, scope, ion on whether module	language — if other the can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-
written	exami	nation (approx. 120 mi	nutes)			
Allocat	ion of	places				
Only as	s part o	t pool ot general key sl	(IIIs (ASQ): 15 places. P	laces will be allocate	ed by lot.	
Additio	onal inf	ormation				
Workload						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
minor in a (2010)	Bachelor's	s degree programme Physics	JMU Würzbu reg. data rec	ord Bachelor (60 ECTS) Physi	• exam. k - 2010	page 11 / 42

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 title				Abbreviation	
Theore	Theoretical Electrodynamics 11-ED-092-m01				
Module	e coord	inator		Module offered by	
Managi and Ast	ing Dire trophys	ector of the Institute of Th sics	eoretical Physics	Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)	
8	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 semesterundergraduateCertain prerequisites must be met to qualify for admission to assessment. 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 dents have obtained the qualification for admission to assessment the course of the semester, the lecturer will put their registration sessment into effect. Students who meet all prerequisites will be ted to assessment in the current or in the subsequent semester.			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 for		
			admission to assess	sment anew.	
Conten	ts				
Princip matter	les of e	lectrostatics, magnetost	atics, Maxwell equati	ons, covariant formu	llation, electrodynamics and
Intende	ed lear	ning outcomes			
The stu thods.	dents l	have knowledge of the pr	inciples of classical o	electrodynamics and	the required calculation me-
Course	s (type	, number of weekly conta	ct hours, language –	- if other than Germa	n)
V + Ü (r	no infoi	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)
Methoo ster, int	l of ass formati	sessment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-
written otherwi Assess and wil examin	examii ise spe ment o l be an ation r	nation (approx. 120 minu cified) ffered: When and how of nounced in due form unc egulations) 2009.	tes, for modules with ten assessment will l ler observance of Sec	n less than 4 ECTS cre be offered depends o ction 32 Subsection	edits approx. 90 minutes; unless on the method of assessment 3 ASPO (general academic and
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Workload					
Teaching cycle					
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module appears in					
Bachel	or' deg	ree (1 major) Mathematic	s (2012)		
Bachelor' degree (1 major) Mathematics (2013)					

minor in a Bachelor's degree programme Physics	
(2010)	



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

Module title				Abbreviation	
Introduction to Nanoscience 11-EIN-092-m01				11-EIN-092-m01	
Module	coord	inator		Module offered by	
Managir	ng Dire	ector of the Institute of Ap	plied Physics	Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
6	nume	rical grade			
Duration	n	Module level	Other prerequisites		
2 semester undergraduate 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 dents have obtained the qualification for admission to assessment the course of the semester, the lecturer will put their registration sessment into effect. Students who meet all prerequisites will be ted to assessment in the current or in the subsequent semester. sessment at a later date, students will have to obtain the qualifi-			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 for		
Content	<u></u>				
Introduc	tion to	the principles of produc	ing characterising a	nd applying papostr	uctures
Intende	d lear	ning outcomes			
The stuc ons of n	lents l anost	nave knowledge of the fu ructures.	ndamental propertie:	s, technologies, chai	racterising methods and functi-
Courses	(type	, number of weekly conta	ct hours, language —	- if other than Germa	n)
V + S (no	o infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)
Method ster, info	of ass ormati	essment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-
written e otherwis	examii se spe	nation (approx. 120 minu cified)	tes, for modules with	less than 4 ECTS cre	edits approx. 90 minutes; unless
Allocati	on of p	olaces			
Only as	part o	f pool of general key skill	s (ASQ): 15 places. Pl	laces will be allocate	ed by lot.
Additior	nal inf	ormation			
Workloa	nd				
Teachin	g cycl	e			
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module appears in					
Bachelor' degree (1 major) Nanostructure Technology (2010) Bachelor' degree (1 major) Nanostructure Technology (2012) Bachelor' degree (1 major) Functional Materials (2012) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2010) No final examination Special study offering (2010)					

Module title				Abbreviation		
Solid S	Solid State Physics 1 11-FKP-092-m01					
Module coordinator				Module offered by		
Managing Director of the Institute of Applied Physics			plied Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
8	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate	Certain prerequisite	s must be met to qua rer will inform stude	ality for admission to as-	
			at the beginning of t	he course. Registrat	ion for the course will be con-	
			sidered a declaratio	n of will to seek adm	ission to assessment. If stu-	
			dents have obtained	d the qualification fo	r admission to assessment over	
			the course of the se	mester, the lecturer v	will put their registration for as-	
			sessment into effect	t. Students who mee	t all prerequisites will be admit-	
			ted to assessment in	n the current or in the	e subsequent semester. For as-	
			sessment at a later	date, students will h	ave to obtain the qualification for	
			admission to assess	sment anew.		
Conten	its					
Physica perties	al laws (free e	of solids: Bonding and st lectron gas).	ructure, lattice dynar	nics, thermal proper	ties, principles of electronic pro-	
Intend	ed lear	ning outcomes				
The stu therma	idents i Il prope	understand the basic con rties, principles of electro	texts and principles on ic properties (free o	of solids (bonding ar electron gas).	nd structure, lattice dynamics,	
Course	s (type	, number of weekly conta	ct hours, language —	- if other than Germa	n)	
V + Ü (I	no infoi	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)	
Metho ster, in	d of ass formati	s essment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
written	exami	nation (approx. 120 minu	tes, for modules with	less than 4 ECTS cre	edits approx. 90 minutes; unless	
otherw	ise spe	cified)				
Assess	ment o	ffered: When and how of	ten assessment will t lor obsorvance of Soc	be offered depends of the section of	on the method of assessment	
examir	nation r	egulations) 2009.			SASI O (general academic and	
Allocat	ion of p	olaces				
Additio	onal inf	ormation				
Workload						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Bachelor' degree (1 major) Mathematics (2012)						
Bachel	or deg	ree (1 major) Mathematic ree (1 major) Mathematic	5 (2013) al Physics (2000)			
שמנוופוטר שפצופפ (1 ווומוטר) ואמנוופווומנוכמו דוועצוכא (2009)						



Subdivided Module Catalogue for the Subject Physics minor in a Bachelor's degree programme, 60 ECTS credits

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

Module title				Abbreviation	
Advanced Nano Sciences					11-FON-092-m01
Module	e coord	inator		Module offered by	
Manag	ing Dire	ector of the Institute of Ap	plied Physics Faculty of Physics and Astronomy		nd Astronomy
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
6	nume	rical grade	11-EIN		
Duratio	on	Module level	Other prerequisites		
1 seme	ster	undergraduate	Certain prerequisite	s must be met to qua	alify for admission to as-
			sessment. The lectu	rer will inform stude	nts about the respective details
			at the beginning of t	ne course. Registrat	ion for the course will be con-
			sidered a declaratio	n of Will to seek adm	radmission to assessment. If stu-
			the course of the se	n the qualification to mostor, the lecturery	will put their registration for as-
			sessment into effect	Students who mee	t all prerequisites will be admit-
			ted to assessment in	n the current or in th	e subsequent semester. For as-
			sessment at a later of	date, students will h	ave to obtain the gualification for
			admission to assess	sment anew.	
Conten	its		<u> </u>		
Advanc	ced top	ics of producing, charact	erising and applying	nanostructures.	
Intende	ed lear	ning outcomes			
The stu	idents l	have advanced knowledg	e of the specific prop	erties, production te	echnologies, characterising me-
thods a	and fun	ctions of nanostructures.	· · ·		
Course	s (type	, number of weekly conta	ct hours, language —	if other than Germa	n)
V + S (r	no infor	mation on SWS (weekly o	contact hours) and co	urse language availa	able)
Metho ster, in	d of ass formati	sessment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-
written or oral	examiı examin	nation (approx. 90 to 120 ation in groups (groups (minutes) or oral exa of 2, approx. 30 minu	mination of one cano tes)	didate each (approx. 20 minutes)
Allocat	ion of p	olaces			
Additio	onal inf	ormation			
Worklo	ad				
Teaching cycle					
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module appears in					
Bachel	or' deg	ree (1 major) Nanostructu	re Technology (2010))	
Bachel	Bachelor's degree (1 major, 1 minor) Physics (Minor, 2010)				

Module title			Abbreviation		
Advanced Seminar Experimental/Theoretical Physics				11-HS-092-m01	
Modul	e coord	inator		Module offered by	
Manag the Ins	ing Dire titute o	ectors of the Institute of A f Theoretical Physics and	opplied Physics and Astrophysics	Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)	
4	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ester	undergraduate	Admission prerequing cessful preparation	site to assessment: r of seminar presenta	regular attendance and suc- tion.
Conter	nts				
Curren	t issues	of Theoretical/Experime	ntal Physics.		
Intend	ed lear	ning outcomes			
The stu to inde	udents l pender	have advanced knowledg htly acquire this knowledg	e of a specialist field ge and to summarise	of Experimental or T it in an oral present	Theoretical Physics. They are able ation.
Course	s (type	, number of weekly conta	ct hours, language –	- if other than Germa	n)
S (no i	nformat	tion on SWS (weekly cont	act hours) and cours	e language available	2)
Metho ster, in	d of ass formati	sessment (type, scope, la ion on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-
talk (a Assess and wi examir	oprox. 3 sment o Il be an nation r	30 to 45 minutes) with dis ffered: When and how of nounced in due form unc egulations) 2009.	scussion ten assessment will b ler observance of Sec	be offered depends of the section 32 Subsection 3	on the method of assessment 3 ASPO (general academic and
Allocat	tion of p	olaces			
Additio	onal inf	ormation			
Worklo	bad				
Teachi	ng cycl	e			
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module appears in					
Bachelor' degree (1 major) Physics (2010)					
Bachel	Bachelor' degree (1 major) Physics (2012)				
Bachel	or' deg	ree (1 major) Mathematic	al Physics (2009)		
Bachelor's degree (1 major, 1 minor) Physics (Minor, 2010)					

Module title				Abbreviation		
Nuclea	Nuclear and Elementary Particle Physics 11-KET-092-m01					
Modul	e coord	inator		Module offered by		
Manag	ing Dire	ector of the Institute of Ap	plied Physics	Faculty of Physics a	nd Astronomy	
ECTS Method of grading On			Only after succ. con	npl. of module(s)		
4	nume	rical grade				
Duratio	on	Module level	Other prerequisites	•		
1 seme	ester	undergraduate	Certain prerequisite	s must be met to qua	alify for admission to as-	
			at the beginning of t	the course Registrat	ion for the course will be con-	
			sidered a declaratio	in of will to seek adm	ission to assessment If stu-	
			dents have obtained	d the qualification fo	r admission to assessment over	
			the course of the se	mester, the lecturer	will put their registration for as-	
			sessment into effect	t. Students who mee	t all prerequisites will be admit-	
			ted to assessment i	n the current or in the	e subsequent semester. For as-	
			sessment at a later	date, students will h	ave to obtain the qualification for	
			admission to assess	sment anew.		
Conter	nts					
Physic Nuclea ticles. model	al laws Ir mode Symme . Curren	of Nuclear and Elementa ls. Radioactive decay. Sti tries. Particle accelerator t results.	ry Particle Physics. H ructure of nuclei. Nuc s and detectors. Wea	istorical introduction clear energy. Quantui ak interaction. Strong	. Scattering and spectroscopy. m theoretical description of par- g interaction, quarks. Standard	
Intend	ed learı	ning outcomes				
The stu They h scribe	udents u ave an o them.	understand the basic con overview of the experime	nections between fu ntal observations of	ndamental Nuclear a Particle Physics and	nd Elementary Particle Physics. the theoretical models which de-	
Course	s (type	, number of weekly conta	ct hours, language –	- if other than Germa	n)	
V + Ü (no infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)	
Metho ster, in	d of ass formati	s essment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
written otherw	examii vise spe	nation (approx. 120 minu cified)	tes, for modules with	n less than 4 ECTS cre	edits approx. 90 minutes; unless	
Allocat	tion of p	olaces				
Additio	onal inf	ormation				
Worklo	ad					
Teaching cycle						
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module appears in						
Bachel Bachel Bachel	or' deg or' deg or's deg	ree (1 major) Physics (20: ree (1 major) Mathematic gree (1 major, 1 minor) Ph	10) al Physics (2009) nysics (Minor, 2010)			

minor in a Bachelor's degree programme Physics	JMU Würzburg • generated 26-Aug-2024 • exam.	page 20 / 42
(2010)	reg. data record Bachelor (60 ECTS) Physik - 2010	

Module	Module title			Abbreviation		
Conder	nsed Ma	atter (Quanta, Atoms,	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	and Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
16	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
2 seme	ester	undergraduate				
Conten	its					
Quantu 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 chemical bonding. Molecule rotations and vibrations. Bonding in crystals. Mechanical properties. Free electron gas (FEG). Crystal structure. The reciprocal lattice. Structure determination. Lattice vibrations (phonons). Thermal					
Intend	ed learr	ning outcomes				
The stu ding ar They ar apply t	idents nd struc re able heir kno	know the basic contex ture, lattice dynamics to apply mathematical pwledge to the solutio	ts and principles of qua , thermal properties, pri methods to the formul n of mathematical-phys	ntum phenomena, A inciples of electronic ation of modern phy iical tasks.	Atomic Physics and s properties (free ele sical contexts and a	olids (bon- ctron gas)). utonomously
Course	s (type,	number of weekly co	ntact hours, language –	- if other than Germa	an)	
Konder kly con Konder hours)	nsierte Itact ho nsierte + Ü (2 v	Materie 1 (Quanten, At urs) + Ü (2 weekly con Materie 2 (Festkörperp veekly contact hours),	ome, Moleküle) (Conde tact hours), once a year bhysik 1) (Condensed M once a year (summer s	nsed Matter 1 (Quar (winter semester) atter 2 (Solid State F emester)	nta, Atoms, Molecule Physics)): V (4 weekly	s)): V (4 wee- y contact
Metho ster, in	d of ass formati	essment (type, scope on on whether module	, language — if other the can be chosen to earn	an German, examina a bonus)	ition offered — if not	every seme-
This me 1. Topic amir 2. Topic amir 3. Topic minu	 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- : written ex- (approx. 30
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						
Additio	onal info	ormation				
minor in a (2010)	Bachelor's	degree programme Physics	JMU Würzbu reg. data rec	rg • generated 26-Aug-2024 ord Bachelor (60 ECTS) Physi	• exam. ik - 2010	page 21 / 42

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) 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 title					Abbreviation			
Classic	al Phy:	sics (Mechanics, Thern	scillations, Electrici-	11-KP-092-m01				
ty, Mag	gnetisn	n and Optics)						
Module	e coord	inator		Module offered by				
Manag	ing Dire	ector of the Institute of	Applied Physics	lied Physics Faculty of Physics and Astronomy				
ECTS	Metho	od of grading	Only after succ. con	Only after succ. compl. of module(s)				
16	Inume							
Duratio	on stor	Module level	Other prerequisites	omatischo Pochonm	othodon dor Physik (Mathomati		
2 50110	SICI	undergraduate	cal Methods of Phys	sics) for first-semeste	er students	inaliteittali-		
Conton	to				l'students.			
Physica gnetic tion. In Non-lin rent. M ternatin	Physical laws of mechanics, thermodynamics, vibrations, waves, science of electricity, magnetism, electroma- gnetic vibrations and waves, radiation and wave optics. Time, room and motion. Physical values. Force and mo- tion. Interactions and central forces. General relativity. Mechanics of rigid bodies. Friction. Vibration and waves. Non-linearity and chaos. Mechanics of non-rigid bodies. Gasses. Thermodynamics. Electrostatics. Electric cur- rent. Mechanisms of conduction. Magnetostatics. Electromagnetic induction. Maxwell equations. Science of al- ternating current. Electromagnetic waves. Geometric optics. Wave optics.							
Intend	ed lear	ning outcomes						
The stu ves, sc are abl knowle	idents ience o e to ap edge to	understand the basic p f electricity, magnetisr ply mathematical meth the solution of mather	rinciples and connection, electromagnetic vibr n, electromagnetic vibr ods to the formulation natical-physical tasks.	ons of mechanics, th ations and waves, ra of physical contexts	ermodynamics, vibradiation and wave op and autonomously	ations, wa- itics. They apply their		
Course	s (type	, number of weekly cor	itact hours, language –	- if other than Germa	ın)			
Klassis tact ho Klassis contact	che Ph urs) + l che Ph t hours	ysik 1 (Mechanik, Well J (2 weekly contact hou ysik 2 (Elektromagneti:) + Ü (2 weekly contact	en, Warme) (Classical F irs), once a year (winte smus, Optik) (Classical hours), once a year (su	nysics 1 (Mechanics r semester) Physics 2 (Electroma immer semester)	, Waves, Heat)): V (4 agnetism, Optics)): \	/ (4 weekly con-		
Metho ster, in	d of ass formati	sessment (type, scope, ion on whether module	language — if other the can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-		
This mo 1. Topic on (a 2. Topic tion 3. Topic minu	 This module has the following assessment components 1. Topics covered in lectures and exercises in part 1 (Klassische Physik 1 (Classical Physics 1)): written examination (approx. 120 minutes). 2. Topics covered in lectures and exercises in part 2 (Klassische Physik 2 (Classical Physics 2)): written examination (approx. 120 minutes). 3. Topics covered in lectures and exercises in parts 1 and 2: oral examination of one candidate each (approx. 30 minutes, usually chosen) or written examination (approx. 120 minutes). 							
Assessment component 3 will be offered in German; English if agreed upon with examiner(s). Successful completion of approx. 50% of practice work each is a prerequisite for admission to assessment com- ponents 1 and 2. To qualify for admission to assessment component 3, students must pass assessment component 1 and/or 2. Students are highly recommended to attend both courses Klassische Physik 1 (Classical Physics 1) and Klassi- sche Physik 2 (Classical Physics 2). The topics discussed in these two courses will be covered in assessment component 3. Students must register for assessment components 1 through 3 online (details to be announced). To pass this module, students must first pass assessment component 1 or 2 and must then pass assessment component 3. The grade achieved in assessment component 1 or 2 (whichever is better) and the grade achieved in assessment component 3 will each count 50% towards the overall grade awarded for the module.								
Allocation of places								
minor in a (2010)	Bachelor's	degree programme Physics	JMU Würzbu reg. data rec	rg • generated 26-Aug-2024 ord Bachelor (60 ECTS) Physi	• exam. k - 2010	page 23 / 42		

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 title				Abbreviation	
Principles of Electronics (with Practical Course) 11-N2-092-m01					
Module coor	dinator		Module offered by		
Managing Dir	rector of the Institute of A	pplied Physics	Faculty of Physics a	nd Astronomy	
ECTS Meth	od of grading	Only after succ. con	npl. of module(s)		
6 nume	erical grade				
Duration	Module level	Other prerequisites			
1 semester	undergraduate	sessment. The lecture at the beginning of the sidered a declaration	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 as the course of the semester, the lecturer will put their regis sessment into effect. Students who meet all prerequisites ted to assessment in the current or in the subsequent sem		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 for			
		admission to assess	sment anew.		
Contents	<u> </u>				
Principles of coils and dio Digital circuit Intended lea	electronic components ar des) and active compone s: different types of gates rning outcomes	nd circuits. Analogous nts (bipolar and field- and CMOS circuits. N	s circuit technology: effect transistors as Microcontroller	Passive (resistors, capacitors, well as operational amplifiers).	
The students	have knowledge of the p	ractical setup of elect	ronic circuits from th	ne field of analogous and digital	
circuit techno	ology.	ч 		5 5	
Courses (type	e, number of weekly conta	act hours, language –	- if other than Germa	n)	
V + P (no info	rmation on SWS (weekly	contact hours) and co	ourse language availa	able)	
Method of as ster, informat	s essment (type, scope, la tion on whether module c	anguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
written exam Assessment and will be a examination	ination (approx. 90 minut offered: When and how of nnounced in due form und regulations) 2009.	es) ten assessment will b der observance of Sec	be offered depends of the section 32 Subsection 3	on the method of assessment 3 ASPO (general academic and	
Allocation of	places				
Only as part of	of pool of general key skil	ls (ASQ): 15 places. P	laces will be allocate	ed by lot.	
Additional in	formation				
		_			
Workload					
Teaching cycle					
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module appears in					
Bachelor' deg Bachelor's de	gree (1 major) Nanostructi egree (1 major, 1 minor) Pl	ure Technology (2010) hysics (Minor, 2010))		

Module title				Abbreviation	
Mathematica	Mathematical Methods of Physics 11-P-MR-092-m01				
Module coor	dinator		Module offered by		
Managing Di and Astrophy	rector of the Institute of ⁻ ysics	Theoretical Physics	Faculty of Physics a	ind Astronomy	
ECTS Met	nod of grading	Only after succ. cor	npl. of module(s)		
6 (not)	successfully completed				
Duration Module level Other prerequisites					
2 semester	2 semester undergraduate				
Contents	_				
Principles of duction to ar on of basic k other (delta	mathematics and basic nd preparation of the mo nowledge, functions of s distribution, Fourier trans	calculation methods b dules of Theoretical Ph several real variables, o sform).	eyond the school cu nysics and Classical differential equations	rriculum, especially f or Experimental Phys s, linear algebra, vec	for the intro- sics. Repetiti- tor analysis,
Intended lea	rning outcomes				
The students required in T especially in	have knowledge of the heoretical and Experime the field of Physics.	principles of mathema ntal Physics. They are	tics and elementary able to apply these r	calculation methods nethods to simple pr	which are roblems,
Courses (typ	e, number of weekly con	tact hours, language –	– if other than Germa	ın)	
Mathematise hour), once a Mathematise hour), once a	che Rechenmethoden 1 (/ a year (winter semester) che Rechenmethoden 2 (a year (summer semester	Mathematical Method Mathematical Method	s 1): V (2 weekly cont s 2): V (2 weekly con	act hours) + Ü (1 wee tact hours) + Ü (1 we	ekly contact ekly contact
Method of a	sessment (type, scope,	 language — if other th	an German, examina	tion offered — if not	everv seme-
ster, informa	tion on whether module	can be chosen to earn	a bonus)		
This module 1. Topics cov 1)): exercis 2. Topics cov 2)): exerci	has the following assess vered in lectures and exe ses or talk (approx. 15 mi vered in lectures and exe ses or talk (approx. 15 mi	ment components rcises in part 1 (Mathe nutes, usually chosen rcises in part 2 (Mathe nutes, usually chosen	matische Rechenme) or written examinat matische Rechenme) or written examinat	thoden 1 (Mathemati ion (approx. 60 minu thoden 2 (Mathemat tion (approx. 60 min	ical Methods utes) :ical Methods utes)
Successful c ponents 1 an	ompletion of approx. 509 Id 2.	% of practice work eac	h is a prerequisite fo	r admission to asses	ssment com-
Students mu To pass this	ist register for assessmer module, students must r	nt components 1 and 2 bass both assessment	component 1 and as	e announced). sessment componer	nt 2.
Allocation of	places				
Additional in	formation				
Workload					
Teaching cycle					
Peferred to in IPO I (examination regulations for teaching degree programmes)					
§ 53 (1) 1. a) Physik Mechanik, Wärmelehre, Elektrizitätslehre, Optik, der speziellen Relativitätstheorie					
	ars in				
Bachelor' de	gree (1 maior) Physics (2	010)			
		/			ا •
minor ín a Bachelo (2010)	r's degree programme Physics	JMU Würzbı reg. data red	urg • generated 26-Aug-2024 cord Bachelor (60 ECTS) Physi	• exam. k - 2010	page 26 / 42

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 title	Module title			Abbreviation	
Practical Course A				11-P-PA-092-m01	
Module coordi	nator		Module offered by		
Managing Dire	ctor of the Institute of	Applied Physics	Faculty of Physics a	nd Astronomy	
ECTS Metho	d of grading	Only after succ. con	npl. of module(s)		
5 (not) s	uccessfully completed				
Duration	Module level	Other prerequisites			
1 semester	undergraduate				
Contents					
Physical laws of pagation, grap tests, writing c	of mechanics, thermoo hs, linear regression, a f lab reports and publ	ynamics, science of el average values and sta cations.	ectricity, types of erro ndard deviation, dist	or, error approximati ribution functions, s	on and pro- significance
Intended learn	ing outcomes				
The students k le to independ measuring pro principles of s	now and have master ently plan and conduc tocol. They are able to tatistics and to draw, p	ed physical measuring t experiments, to coop evaluate the measurin resent and discuss the	methods and experir erate with others, an g results on the basi conclusions.	nenting techniques. d to document the ro s of error propagatic	They are ab- esults in a on and of the
Courses (type,	number of weekly cor	tact hours, language –	- if other than Germa	n)	
Auswertung vo Ü (1 weekly co Beispiele aus BAM): P (2 wee	on Messungen und Feh ntact hour), once a yea Mechanik, Wärmelehre ekly contact hours)	lerrechnung (Measurer r (winter semester) e und Elektrik (Example	nents and Data Anal	ysis): V (1 weekly con hermodynamics and	ntact hour) + Electricity,
Method of ass ster, information	essment (type, scope, on on whether module	language — if other th can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-
 This module has the following assessment components 1. Topics covered in lectures and exercises: written examination (approx. 120 minutes) 2. Lab course: a) Preparing, performing and evaluating the experiments will be considered successfully completed if a Testat (exam) is passed. b) Talk (with discussion) to test the students' understanding of the physics-related contents of the course (approx. 30 minutes). Successful completion of approx. 50% of practice work is a prerequisite for admission to assessment component 1. To pass assessment component 2, students must pass both elements a) and b). Students will be offered one opportunity to retake element a) and/or element b). Students must register for assessment components 1 and 2 online (details to be announced). Students must attend Auswertung von Messungen und Fehlerrechnung (Measurements and Data Analysis) before attending Beispiele aus Mechanik, Wärmelehre und Elektrik (Examples from Mechanics, Thermodynamics and 					
To pass this m	odule, students must	bass both assessment	component 1 and as	sessment componer	nt 2.
Allocation of p	laces				
Additional information					
Workload					
Teaching cycle					
Referred to in LPO L (examination regulations for teaching-degree programmes)					
§ 53 (1) 1 a) Pł	$\delta c_2(1) = 2$ Dhysik Machanik Wärmelehre Elektrizitätelehre Ontik der speziellen Polativitätetheorie				
minor in a Bachelor's	degree programme Physics	IMII Würzbu	rg • generated 26-Aug-2024	exam.	page 28 / 42
(2010)	5 · · · · · · · · · · · · · · · · · · ·	reg. data rec	ord Bachelor (60 ECTS) Physi	k - 2010	1

§ 53 (1) 1. c) Physik physikalische Grundpraktika § 77 (1) 1. d) Physik "physikalische Praktika"

Module appears in Bachelor' degree (1 major) Mathematics (2014)

Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Nanostructure Technology (2010) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Computational Mathematics (2014) Bachelor' degree (1 major) Aerospace Computer Science (2009) Bachelor' degree (1 major) Aerospace Computer Science (2014) Bachelor' degree (1 major) Aerospace Computer Science (2011) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2010) No final examination Special study offering (2010)

Module title		Abbreviation			
Basic Practical Course B (Minor Studies)				11-P-PB-NF-092-m01	
Module coord	inator		Module offered by		
Managing Dire	ector of the Institute of Ap	oplied Physics	Faculty of Physics a	nd Astronomy	
ECTS Metho	od of grading	Only after succ. com	pl. of module(s)		
3 (not) s	successfully completed	11-P-PA			
Duration	Module level	Other prerequisites			
1 semester	undergraduate				
Contents					
Physical laws	of optics, vibrations and	waves or science of e	electricity and circuit	s with electric components.	
Intended lear	ning outcomes				
The students are able to inc in a measuren	have knowledge and skill dependently plan and cor nent protocol.	ls of physical measur nduct experiments in	ing instruments and cooperation with oth	experimental techniques. They ners, and to document the results	
Courses (type	, number of weekly conta	ict hours, language —	If other than Germa	n)	
Klassische Ph Elektrizitätsle	ysik (Classical Physics, K hre und Schaltungen (Ele	LP): P (2 weekly conta ctricity and Circuits, I	act hours) ELS): P (2 weekly cor	ntact hours)	
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 • a) Preparing, performing and evaluating the experiments will be considered successfully completed if a Testat (exam) is passed. b) Talk (with discussion) to test the students' understanding of the physics-related contents of the course (approx. 30 minutes). Students must register for assessment online (registration deadline to be announced). Students must pass both elements a) and b). To pass this module, students must successfully complete one out of the two courses. To pass this module, students must pass the assessment components. Allocation of places Additional information					
worktoau					
Teaching cycl	e				
Referred to in	Referred to in LPO I (examination regulations for teaching-degree programmes)				
§ 53 (1) 1. a) P § 53 (1) 1. c) P § 77 (1) 1. d) P	§ 53 (1) 1. a) Physik Mechanik, Wärmelehre, Elektrizitätslehre, Optik, der speziellen Relativitätstheorie § 53 (1) 1. c) Physik physikalische Grundpraktika § 77 (1) 1. d) Physik "physikalische Praktika"				
Module appea	ars in				
Bachelor's de	gree (1 major, 1 minor) Pł	nysics (Minor, 2010)			

Module title				Abbreviation		
Quanta, Atoms, Molecules 11-QAM-092-m01						
Module	e coord	inator		Module offered by		
Manag	ing Dire	ector of the Institute of Ap	plied Physics Faculty of Physics and Astronomy		nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)		
8	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	undergraduate	certain prerequisite sessment. The lectu at the beginning of t	s must be met to qua rer will inform studer the course. Registrat	alify for admission to as- nts about the respective details ion for the course will be con-	
			dents have obtained the course of the set	d the qualification fo mester, the lecturer	r admission to assessment. If stu- r admission to assessment over will put their registration for as-	
			sessment into effect	t. Students who mee	t all prerequisites will be admit-	
			ted to assessment in	n the current or in the	e subsequent semester. For as-	
			sessment at a later of	date, students will ha	ave to obtain the qualification for	
<u> </u>			aumission to assess	sment anew.		
Conten						
Physica		of Atomic, Quantum and	Molecular Physics.			
Intende	ed leari	ning outcomes				
The stu Quantu well as	idents l im mec moleci	nave knowledge of the ba hanical atom model, one ules: Bonding models and	isic contexts and prin /multi-electron atom d elementary excitation	nciples of Atomic and s, electronic dipole t ons: rotations, vibra	d Molecular Physics (atoms: transitions, atoms in B field, as tions, electronic excitations)	
Course	s (type	, number of weekly conta	ct hours, language —	- if other than Germa	n)	
Ü + Ü (I	no infoi	rmation on SWS (weekly o	contact hours) and co	ourse language avail	able)	
Methor ster, in	d of ass formati	essment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
written otherw Assess and wil examin	examin ise spe ment o Il be an nation r	nation (approx. 120 minu cified) ffered: When and how off nounced in due form und egulations) 2009.	tes, for modules with ten assessment will b ler observance of Sec	l less than 4 ECTS cre be offered depends c ction 32 Subsection 3	edits approx. 90 minutes; unless on the method of assessment 3 ASPO (general academic and	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Bachelor' degree (1 major) Mathematics (2012)						
Bachel	or' degi	ree (1 major) Mathematic	s (2013)			
Bachelor degree (1 major) Mathematical Physics (2009)						

minor in a Bachelor's degree programme Physics	JMU Würzburg • generated 26-Aug-2024 • exam.	page 31 / 42
(2010)	reg. data record Bachelor (60 ECTS) Physik - 2010	



Subdivided Module Catalogue for the Subject Physics minor in a Bachelor's degree programme, 60 ECTS credits

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

Module	title				Abbreviation
Quantu	Quantum Mechanics 11-QM-092-m01				
Module	coord	inator		Module offered by	
Managi and Ast	ng Dire rophys	ector of the Institute of Th sics	eoretical Physics	Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. compl. of module(s)		
8	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 semester undergraduate		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 ha	ave to obtain the qualification for
			admission to assess	sment anew.	
Content	ts				
Limits o oscillat	of class or, ang	ical physics, Schrödinge ular momentum and spir	r equation, mathema n, hydrogen atom, ma	tical foundations of any-particle systems	quantum mechanics, harmonic
Intende	d learı	ning outcomes			
The stu	dents l	nave knowledge of the pr	inciples of quantum	mechanics and the r	equired calculation methods.
Courses	s (type	, number of weekly conta	ct hours, language –	· if other than Germa	n)
V + Ü (n	o infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)
Method ster, inf	l of ass ormati	essment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-
written otherwi Assessi and will examin	examiı se spe nent o l be an ation r	nation (approx. 120 minu cified) ffered: When and how off nounced in due form und egulations) 2009.	tes, for modules with ten assessment will k ler observance of Sec	less than 4 ECTS cre be offered depends o ction 32 Subsection 3	edits approx. 90 minutes; unless on the method of assessment 3 ASPO (general academic and
Allocati	ion of p	olaces			
Additio	nal inf	ormation			
Workloa	ad				
Teaching cycle					
Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module appears in					
Bachelo	Bachelor' degree (1 major) Mathematics (2012)				
Bachelo	or' deg	ree (1 major) Mathematic	s (2013)		
Bachelor' degree (1 major) Computational Mathematics (2012)					

minor in a Bachelor's degree programme Physics	JMU Würzburg • generated 26-Aug-2024 • exam.	page 33 / 42
(2010)	reg. data record Bachelor (60 ECTS) Physik - 2010	



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

Module title			Abbreviation			
Statistical Mechanics and Thermodynamics 11-ST-092-mo1					11-ST-092-m01	
Module coordinator				Module offered by		
Managing Director of the Institute of The			eoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
8	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
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 assess	sment anew.		
Conten	ts					
Princip chanics	les of t 5.	hermodynamics, fundam	ental theorems, ther	modynamic potentia	ls, principles of statistical me-	
Intende	ed lear	ning outcomes				
The stu calcula	dents l tion me	have knowledge of the pr ethods.	inciples of thermody	namics and statistic	al mechanics and the required	
Course	s (type	, number of weekly conta	ct hours, language –	- if other than Germa	n)	
V + Ü (r	no infoi	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)	
Methoo ster, int	l of ass formati	sessment (type, scope, la on on whether module ca	nguage — if other tha an be chosen to earn	an German, examina a bonus)	tion offered — if not every seme-	
written examination (approx. 120 minutes, for modules with less than 4 ECTS credits approx. 90 minutes; unless otherwise specified) 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) 2000						
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Workload						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module	e appea	urs in				
Bachel	or' deg	ree (1 major) Mathematic	s (2012)			
Bachelor' degree (1 major) Mathematics (2013)						



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

Module title			Abbreviation			
Statistical Mechanics, Thermodynamics and Electrodynamics			11-STE-092-m01			
Module coordinator			Module offered by			
Managing Director of the Institute of Theoretical Physics and Astrophysics			Theoretical Physics	Faculty of Physics a	ind Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
16	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
2 seme	ster	undergraduate	10-M1-PHY and 10-M	12-PHY or 10-M1-NST	and 10-M2-NST	
Conten	ts					
Principl ticles, c namics	les of S critical of elec	itatistical Physics: Idea phenomena, Maxwell e tromagnetic fields. Sp	l systems. Thermodyna equations, electrostatic ecial relativity.	amics: Quantum stat s, magnetostatics, N	istics, systems of int Aaxwell equations in	eracting par- matter, dy-
Intende	ed leari	ning outcomes				
The stu trodyna method	dents l imics, t ls and	nave advanced knowle hermodynamics and s are able to independer	dge of the methods of ⁻ tatistical mechanics. Th htly apply them to the d	Theoretical Physics. They are familiar with Rescription and solut	They know the princi the corresponding c ion of problems in th	ples of elec- alculation nis area.
Course	s (type	number of weekly cor	itact hours, language –	- if other than Germa	.n)	
Statistische Mechanik und Thermodynamik (Statistical Mechanics and Thermodynamics): V (4 weekly contact hours) + Ü (2 weekly contact hours), once a year (winter semester) Theoretische Elektrodynamik (Theoretical Electrodynamics): V (4 weekly contact hours) + Ü (2 weekly contact hours), once a year (summer semester)						
Method ster, inf	l of ass formati	essment (type, scope, on on whether module	language — if other the can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-
 This module has the following assessment components 1. Topics covered in lectures and exercises in part 1 (Statistische Mechanik und Thermodynamik (Statistical Mechanics and Thermodynamics)): written examination (approx. 120 minutes). 2. Topics covered in lectures and exercises in part 2 (Theoretische Elektrodynamik (Theoretical Electrodynamics)): written examination (approx. 120 minutes). 3. Topics covered in lectures and exercises in parts 1 and 2: oral examination of one candidate each (approx. 30 minutes, usually chosen) or written examination (approx. 120 minutes). Assessment component 3 will be offered in German; English if agreed upon with examiner(s). Successful completion of approx. 50% of practice work each is a prerequisite for admission to assessment components 1 and 2. Students are highly recommended to attend both courses Statistische Mechanik und Thermodynamik (Statistical Mechanics and Thermodynamics) and Theoretische Elektrodynamik (Theoretical Electrodynamics). The topics discussed in these two courses will be covered in assessment component 3. Students must register for assessment components 1 through 3 online (details to be announced). To pass this module, students must first pass assessment component 1 or 2 and must then pass assessment component 3. The grade achieved in assessment component 1 or 2 (whichever is better) and the grade achieved in assessment component 3 will each court 50% towards the overall grade awarded for the module. 						
Additional information						
Workload						
L						
minor in a E (2010)	Bachelor's	degree programme Physics	JMU Würzbu reg. data rec	rg • generated 26-Aug-2024 ord Bachelor (60 ECTS) Physi	• exam. 'k - 2010	page 37 / 42

Teaching cycle

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

Module appears in

Bachelor' degree (1 major) Mathematics (2012)

Bachelor' degree (1 major) Mathematics (2013)

Bachelor' degree (1 major) Physics (2010)

Bachelor' degree (1 major) Physics (2012)

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

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

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

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

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

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

Module title				Abbreviation		
Theoretical Mechanics					11-TM-092-m01	
Module coordinator				Module offered by		
Managing Director of the Institute of Theore			Theoretical Physics	Faculty of Physics and Astronomy		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
8	nume	rical grade				
Duratio	on	Module level	evel Other prerequisites			
1 seme	ester	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.			
Conter	nts					
Newtor	nian me	chanics, Lagrangian a	nd Hamiltonian formali	sm, conservation law	vs, limits of classica	l physics.
Intend	ed lear	ning outcomes			,	,
The stu metho	udents ds.	nave knowledge of the	principles of classical	theoretical mechanic	cs and the required c	alculation
Course	s (type	, number of weekly cor	ntact hours, language –	- if other than Germa	n)	
V + Ü (I	no infoi	mation on SWS (week	y contact hours) and co	ourse language avail	able)	
Metho ster, in	d of ass formati	essment (type, scope, on on whether module	language — if other th can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-
written examination (approx. 120 minutes, for modules with less than 4 ECTS credits approx. 90 minutes; unless otherwise specified) 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 oxamination regulations) 2000					utes; unless sessment demic and	
Allocation of places						
Additio	onal inf	ormation				
Worklo	ad					
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) Nanostructure Technology (2012)						
minor in a (2010)	Bachelor's	degree programme Physics	JMU Würzbu reg. data rec	ırg • generated 26-Aug-2024 ord Bachelor (60 ECTS) Physi	• exam. k - 2010	page 39 / 42



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

Module title			Abbreviation			
Theoretical Mechanics and Quantum Mechanics			11-TQM-092-m01			
Module coordinator			Module offered by			
Managing Director of the Institute of Theoretical Dhysics			Theoretical Physics	Faculty of Physics a	and Astronomy	
and Astrophysics						
ECTS	Meth	od of grading	Only after succ. con	npl. of module(s)		
16	nume	rical grade		• • • •		
Duration Module level Other prerequisites						
2 seme	ester	undergraduate	10-M1-PHY, 10-M2-F	PHY and 11-MPI-3 or 1	0-M1-NST, 10-M2-NS	ST and MPI-3
Conten	ts					
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.						
Intende	ed 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						
Course	s (type	, number of weekly con	tact hours, language –	- if other than Germa	ın)	
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)						
Methor ster, in	d of as format	sessment (type, scope, ion on whether module	language — if other th can be chosen to earn	an German, examina a bonus)	tion offered — if not	every seme-
 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 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 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. 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						
Additio	nal inf	ormation				
minor in a l	Bachelor's	s degree programme Physics	JMU Würzbı	Irg • generated 26-Aug-2024	• exam.	page 41 / 42
(2010)			reg. data rec	ord Bachelor (60 ECTS) Physi	k - 2010	

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)