

# Module Catalogue

for the Subject

# Physics

as a Master's with 1 major with the degree "Master of Science" (120 ECTS credits)

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

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Master Thesis Physics

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## The subject is divided into

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Solid State Physics and Nanostructures	40	54
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### **Content and Objectives of the Programme**

The Master of Science programme prepares the students for their later scientific work in the field of experimental or theoretical physics. Qualified graduates may pursue doctoral work (degree Dr. rer. nat.) at doctorate-granting institutions. The objective of the education is to impart deepened knowledge of physical principles and of scientific working in research and applied physics. By training physical and analytical thinking skills the students are enabled to use their knowledge self-consistently and to transfer it to new challenges. Completing their Master thesis the graduates demonstrate their ability to solve an experimental or theoretical assignment within limited time using known scientific methods.

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### 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:

### ASPO2007

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

### 21-Sep-2010 (2010-59)

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.

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## **Compulsory Courses**

(40 ECTS credits)

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	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation		
Advanced Seminar Experimental/Theoretical Physics			11-OSP-072-m01		
Module	coord	inator		Module offered by	
Managi the Inst	ng Dire titute o	ectors of the Institute of A f Theoretical Physics and	pplied Physics and Astrophysics	Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
4	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts				
Semina	ir on cu	rrent issues of Theoretica	al or Experimental Ph	ysics.	
Intende	ed learr	ning outcomes			
The stu are able a profe	dents ł e to ext ssional	nave advanced knowledg ract knowledge from prof audience.	e of a current special fessional publication	ist field of Experime s and to summarise	ntal or Theoretical Physics. They this knowledge and present it to
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
S (no ir	format	ion on SWS (weekly cont	act hours) and cours	e language available	2)
Methoo module is	<b>d of ass</b> creditab	s <b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
talk wit	h discu	ission (approx. 30 to 45 r	ninutes)		
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
Teachir	ng cycl	9			
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	
Module	e appea	irs in			
Master	's degre	ee (1 major) Physics (2010	o)		
Master's degree (1 major) Physics (2011)					
Master	's degre	ee (1 major) FOKUS Physic	cs (2010)		
Master'	Master's degree (1 major) FORUS Physics (2011) Master's degree (1 major) FORUS Physics (2006)				
master	Jucgi		(2000)		

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 10 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title				Abbreviation		
Advanc	ed Pra	ctical Course Master			11-PFM-072-m01	
Module coordinator				Module offered by		
Managi	ing Dire	ector of the Institute of	Applied Physics	Faculty of Physics a	and Astronomy	
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)		
6	(not) s	successfully completed	11-E1, 11-E2			
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate	11-A3			
Conten	ts					
Princip stems, tic reso superco	les of N proper nance onduct	luclear, Atomic and Mc ties of solids, surfaces (NMR) - quantum Hall ( ivity - laser - solid-state	lecular Physics, experi and interfaces. Experir effect - optical pumping optics	ments on cryogenic t nents on the followin ; and spectroscopy in	temperatures and co ng topics: X-rays - nu n the field of optics -	rrelated sy- clear magne- Hall effect -
Intende						
Knowle suing s ons and	dge of cientifi d acqui	conducting experimen c publications, applica ring practical experime	ts, analysing and docu tion of modern evaluat ental methods.	nenting experimenta ion systems, workin	al results, basic know g on a task based or	vledge of is- i publicati-
Course	<b>S</b> (type, r	umber of weekly contact hour	s, language — if other than Gei	man)		
Fortges man or Fortges man or	chritte Englis chritte Englis	nen-Praktikum Master า nen-Praktikum Master า	(Advanced Practical Co (Advanced Practical Co	urse Master) Part 1:   urse Master) Part 2:	P (3 weekly contact ł P (3 weekly contact l	iours), Ger- nours), Ger-
Method module is	<b>d of ass</b> creditab	<b>eessment</b> (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	ot every semester, informati	on on whether
1. Lab of ring t prior ted if 2. Lab of ring t prior ted if	odule h course the exp to the f a test course the exp to the f a test	as the following asses in part 1 (Fortgeschritte eriment will be conside experiment. b) Perform is passed. Students m in part 2 (Fortgeschritte eriment will be conside experiment. b) Perform is passed. Students m	sment components enen-Praktikum Master, ered successfully comp ing and evaluating the ust prepare an experim enen-Praktikum Master ered successfully comp ing and evaluating the ust prepare an experim	Advanced Practical leted if an oral test ( experiment will be o ent log (approx. 8 pa /Advanced Practical leted if an oral test ( experiment will be o ent log (approx. 8 pa	Course Master Part 1 (approx. 30 minutes) considered successfu ages). Course Master Part : (approx. 30 minutes) considered successfu ages).	<ul> <li>.): a) Prepa- is passed ally comple-</li> <li>2): a) Prepa- is passed ally comple-</li> </ul>
Language of assessment: German or English Students must register for assessment components 1 and 2 online (details to be announced). Students will be offered one opportunity to retake element a) and/or element b) in the respective semester. To pass an assessment component, they must pass both elements (a and b) in the same semester. To pass this module, students must pass both assessment component 1 and assessment component 2.						
Allocation of places						
Additional information						
Workload						
Teaching cycle						
Master's wi	ith 1 majo	Physics (2010)	JMU Würzbu reg. data rec	rg • generated 26-Aug-2024 ord Master (120 ECTS) Physil	• exam. k - 2010	page 11 / 280

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

#### Module appears in

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

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 - Nanostructuring Technology (2006)

Master's degree (1 major) FOKUS Physics (2006)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 12 / 280
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Module title				Abbreviation		
Professional Specialization Physics					11-FS-P-072-m01	
Module coordinator				Module offered by		
chairpe	erson of	f examination committee		Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)		
15	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Introdu to the p on.	ction to planned	o current experimental or I topic of the Master's the	theoretical question esis. Summary of the	s of a subdiscipline required fundament	of Physics with special relevance cal topics in a seminar presentati-	
Intende	ed learr	ning outcomes				
The stu a speci area an	dents l al relev id are a	nave advanced knowledg vance to the intended top ble to summarise their k	e of a current experir ic of the Master's the nowledge in an oral p	nental or theoretical esis. They know the c presentation.	subdiscipline of Physics with current state of research in this	
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
S (no in	format	ion on SWS (weekly cont	act hours) and cours	e language available	2)	
Methoo module is	<b>l of ass</b> creditab	s <b>essment</b> (type, scope, langua <sub>)</sub> le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
talk (ap	prox. 3	o to 45 minutes) with dis	scussion			
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	Module appears in					
Master	s degre	ee (1 major) Physics (2010	o)			
Master's degree (1 major) Physics (2011)						

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 13 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title				Abbreviation		
Scientific Methods and Project Management Physics					11-MP-P-072-m01	
Module coordinator				Module offered by		
chairpe	erson o	f examination committee	_	Faculty of Physics a	and Astronomy	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
15	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Introdu theoret thesis.	ction to	o the methods of scientif d experimental questions	ic work, taking into a s of Physics, writing o	ccount methods of p f a scientific project	project planning. Application to plan for the planned Master's	
Intende	ed lear	ning outcomes				
The stu thods of topic of experin	dents   of a cur f the M nental	have knowledge of scient rent experimental and the aster's thesis. They are a or theoretical work. They	ific methods and me eoretical subdisciplir ble to draft a project are able to describe t	thodological work, in ne of Physics with sp plan for the Master's their projects in oral	ncluding project planning me- ecial relevance to the intended s thesis and to plan the required presentations.	
Course	<b>S</b> (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)		
R (no ir	format	ion on SWS (weekly cont	act hours) and cours	e language available	2)	
Method module is	<b>d of ass</b> creditab	<b>sessment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
talk (ap	prox. 3	30 to 45 minutes) with dis	scussion			
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	e appea	ars in				
Master	Master's degree (1 major) Physics (2010)					
Master's degree (1 major) Physics (2011)						



## **Compulsory Electives**

(50 ECTS credits)

The area of mandatory electives (50 ECTS credits) comprises: mandatory electives area SP ("Spezialausbildung Physik" ("Special Training Physics")): 40 ECTS credits, mandatory electives area NP ("Nebenfächer Physik" ("Minors Physics")): 10 ECTS credits. Within the area SP, modules are grouped together by subject. Students may select modules worth a maximum of 40 ECTS credits from one of these module groups. Students also have the option to select modules from different module groups and worth different numbers of credits (total number of credits achieved must be 40). The Faculty will specify whether a specific module belongs to group "Theoretische Physik" ("Theoretical Physics") or group "Experimentelle Physik" ("Experimental Physics") (for the purpose of calculating the overall grade).

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 15 / 280
	reg. data record Master (120 ECTS) Physik - 2010	1



# **Compulsory Electives Specialisation Physics**

(40 ECTS credits)

Master's with 1 major Physics (2010)	JMU Würzburg ● generated 26-Aug-2024 ● exam.	page 16 / 280
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# **Applied Physics and Metrology**

(40 ECTS credits)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 17 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title				Abbreviation		
Opto-e	Opto-electronic Material Properties				11-MOE-092-m01	
Module	e coord	inator		Module offered by		
Managi	ing Dire	ector of the Institute of	Applied Physics	plied Physics Faculty of Physics and Astronomy		
ECTS Method of grading			Only after succ. con	npl. of module(s)		
5	nume	rical grade		•		
Duration Module level Other prerequisites						
1 semester graduate		Admission prerequi 50% of exercises. C sion to assessment ve details at the beg be considered a dec students have obtai over the course of th assessment into eff mitted to assessme assessment at a late	Admission prerequisite to assessment: successful completion of approx. 50% of exercises. Certain prerequisites must be met to qualify for admis- sion to assessment. The lecturer will inform students about the respecti- ve details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be ad- mitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification			
			for admission to as	sessment anew.		
Conten	ts					
Physica	al princ	iples of optoelectronic	material properties an	d applications.		
Intende	ed lear	ning outcomes				
The stu	dents l	know the principles of	optoelectronic material	characteristics.		
Course	<b>S</b> (type, r	number of weekly contact hou	rs, language — if other than Ge	rman)		
V + Ü (r	no infoi	mation on SWS (week	ly contact hours) and co	ourse language avail	able)	
<b>Methoo</b> module is	<b>d of ass</b> creditab	<b>sessment</b> (type, scope, lan le for bonus)	guage — if other than German,	examination offered — if no	t every semester, informati	on on whether
a) writte groups project prox. 30	en exaı (appro report o minu	mination (approx. 90 n x. 30 minutes per cand (approx. 10 pages, tim tes)	ninutes) or b) oral exam didate, for modules with e to complete: 1 to 4 we	ination of one candi n less than 4 ECTS cr eeks) or d) presentat	date each or oral exa edits approx. 20 mir ion/seminar present	amination in utes) or c) tation (ap-
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Poferred to in LPO L (manipulations for teaching demonstrate)						
Module appears in						
Bachelor' degree (1 major) Physics (2010)						
Master's degree (1 major) Physics (2010)						
Master's degree (1 major) Technology of Functional Materials (2010)						
Master's degree (1 major) Technology of Functional Materials (2009)						
Master	Master's degree (1 major) Nanostructure Technology (2010)					
Master	Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)					
Master's wi	ith 1 majo	1 major Physics (2010)     JMU Würzburg • generated 26-Aug-2024 • exam. reg. data record Master (120 ECTS) Physik - 2010     page 18 /				page 18 / 280





Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) Functional Materials (2012)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 19 / 280
	reg. data record Master (120 ECTS) Physik - 2010	1

Module title				Abbreviation		
Organi	Organic Semiconductor				11-OHL-092-m01	
Module	e coord	inator		Module offered by	Module offered by	
Managing Director of the Institute of Ap			Applied Physics	plied Physics Faculty of Physics and Astronomy		
ECTS Method of grading			Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Duration Module level Other prerequisites						
1 semester graduate		Admission prerequi 50% of exercises. Co sion to assessment. ve details at the beg be considered a dec students have obtai over the course of th assessment into eff mitted to assessme assessment at a late for admission to assess	Admission prerequisite to assessment: successful completion of approx. 50% of exercises. Certain prerequisites must be met to qualify for admis- sion to assessment. The lecturer will inform students about the respecti- ve details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be ad- mitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew			
Conten	ts					
Physica cations	al princ	iples of organic semico	onductors, molecular a	nd polymer electroni	cs and sensor techn	ology, appli-
Intende	ed lear	ning outcomes				
The stu	dents l	nave advanced knowle	dge of organic semicor	ductors.		
Course	<b>S</b> (type, r	umber of weekly contact hou	s, language — if other than Gei	rman)		
V + Ü (r	no infor	mation on SWS (week	ly contact hours) and co	ourse language avail	able)	
Methoo module is	<b>d of ass</b> creditab	<b>essment</b> (type, scope, lang le for bonus)	guage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
a) writt groups project prox. 30	en exai (appro report o minu	nination (approx. 90 n x. 30 minutes per cano (approx. 10 pages, tim tes)	ninutes) or b) oral exam lidate, for modules with e to complete: 1 to 4 we	ination of one candi n less than 4 ECTS cr eeks) or d) presentat	date each or oral exa edits approx. 20 mir ion/seminar presen	amination in 1utes) or c) tation (ap-
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teaching cycle						
Peferred to in IPO I (eveningtion convlotions for teaching degree programmed)						
Module appears in						
Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Technology of Functional Materials (2010)						
Master's wi	ith 1 majo	Physics (2010)	JMU Würzbu reg. data red	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 20 / 280

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Master's degree (1 major) Technology of Functional Materials (2009) 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 (2011) Master's degree (1 major) FOKUS Physics (2012)

Module title				Abbreviation		
Electronics					11-A2-081-m01	
Module coordinator				Module offered by		
Managi	ng Dire	ector of the Institute of Ap	plied Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	undergraduate				
Conten	ts					
Princip technol	les of p logy.	assive and active electro	nic components and	their application in a	analogous and digital circuit	
Intende	ed learr	ning outcomes				
The stu circuit t	dents ł cechnol	nave knowledge of the pr ogy.	actical setup of elect	ronic circuits from th	e field of analogous and digital	
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V + Ü (r	no infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)	
Methoo module is	<b>d of ass</b> creditab	e <b>ssment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
written	examir	nation (approx. 90 minut	es)			
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachir	ng cycl	e				
Referre	d to in	LPOI (examination regulations	s for teaching-degree progra	mmes)		
Module appears in						
Bachelor' degree (1 major) Physics (2009)						
Bachelor' degree (1 major) Physics (2008)						
Master	Master's degree (1 major) Physics (2010)					
Master	's degre	ee (1 major) Nanostructur	e Technology (2010)			
Master	Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)					
Bachel	s aegre	ee (1 major) FUKUS Physic	(2010)			
No fina	l exami	nation Special study offe	ering (2010)			

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam. reg. data record Master (120 ECTS) Physik - 2010	page 22 / 280
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Module title	Module title Abbreviation				
Reproducing Sensors in Infrared     11-ASI-092-m01					
Module coo	rdinator		Module offered by		
Managing D	irector of the Institute of	Applied Physics	Faculty of Physics a	nd Astronomy	
ECTS Met	hod of grading	Only after succ. con	npl. of module(s)		
3 nun	nerical grade				
Duration	Module level	Other prerequisites	;		
1 semester	undergraduate	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 asses	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment anew.		
Contents					
range of infi up to microv from bodies sical optics types of sen of neurophy	Infrared cameras are important experimental and technical tools, e.g. for measuring temperatures. The spectral range of infrared ranges from the visible spectrum, where the Sun is dominating as the natural source of light, up to microwaves and radiowaves with artificial emitters. There is distinct and sometimes dominating emission from bodies with ambient temperature in the infrared spectrum. The lecture provides an introduction to the physical optics of this spectral range and discusses: Peculiarities of infrared cameras and thermal images, different types of sensors (bolometer, quantum well, superlattice) as well as the evaluation of such sensors on the basis of neurophysiological aspects.				
Intended lea	arning outcomes				
The student technologie	s have specific and adva s and detector structures	nced knowledge in the as well as their applic	field of infrared spec ation areas.	ctral imaging. They k	now various
Courses (type	e, number of weekly contact hours	s, language — if other than Ge	rman)		
V + R (no inf	ormation on SWS (weekly	y contact hours) and co	ourse language avail	able)	
Method of a module is credit	<b>ssessment</b> (type, scope, lang able for bonus)	uage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.					
Allocation o	f places				
Additional information					
Workload					
Teaching cycle					
Master's with 1 ma	ijor Physics (2010)	JMU Würzbu reg. data re	ırg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 23 / 280

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)

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

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 with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 24 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation			
Applied Superconduction					11-ASL-092-m01	
Module	e coord	inator		Module offered by	<u> </u>	
Managi	ng Dire	ector of the Institute of A	Applied Physics	plied Physics Faculty of Physics and Astronomy		
ECTS Method of grading		Only after succ. con	Only after succ. compl. of module(s)			
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		Certain prerequisite sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the se sessment into effect ted to assessment i sessment at a later admission to assess	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					
Physica thods o	al princ of mate	iples of superconductiv rials sciences for the ca	ity. Application in ene lculation of temperatu	rgy engineering. Inst re profiles in superc	rumental developme onductors.	ents. Me-
Intende	ed learı	ning outcomes				
The stu are able able to energy	dents l e to eva discus techno	nave a basic understand aluate the contributions s questions on superco logy. Furthermore, they	ding of superconductive of materials sciences nductivity in a scientif can deal with practica	vity as a macroscopic to the development ic manner and to crit Il mathematical ques	c quantum phenome of superconductivity cically question deve stions.	non. They /. They are lopments of
	S (type, n	umber of weekly contact hours	, language — If other than Ger	rman)	abla)	
R + V (n		mation on SWS (weekly		ourse language availa		1.4
module is	creditab	le for bonus)	lage — If other than German,	examination offered — if no	t every semester, informati	on on whether
a) writte in grou c) proje prox. 30 Assess Langua	en exar ps (app ect repo o minu ment o ge of a	mination (approx. 90 mi prox. 30 minutes per car ort (approx. 8 pages, tim tes) ffered: once a year, win ssessment: German, En	inutes) or b) oral exam ndidate, for modules w ne to complete: 1 to 4 v ter semester glish	ination of one candi vith less than 4 ECTS veeks) or d) presenta	date each or oral exa credits approx. 20 n ation/seminar prese	amination ninutes) or ntation (ap-
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teaching cycle						
Referred to III LPOT (examination regulations for teaching-degree programmes)						
Module appears in						
Bachelor' degree (1 major) Physics (2010)						
Master's wi	th 1 majoı	Physics (2010)	JMU Würzbu reg. data reg	rg • generated 26-Aug-2024	• exam.	page 25 / 280

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Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Nanostructure Technology (2010) Bachelor' degree (1 major) Nanostructure Technology (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 with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 26 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation			
Principles of Image Processing					11-EBV-092-m01	
Module coordinator				Module offered by		
Managing Director of the Institute of Ap		Applied Physics	Faculty of Physics a	nd Astronomy		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
3	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 semester undergraduate		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	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					
Introdu transfo tic ima trackin	orm. His ge reco g). Thre	o image processing. Pietogram equalisation (egination) stogram equalisation (eginition: Segmentation ee-dimensional images	ctures as two-dimensio .g. image brightening) , classification. Techno	nal signals; digitalis and pixel connectivi logical image genera	ation. Two-dimensio ty (e.g. noise reducti tion. Applications (e	nal Fourier on). Automa- e.g. motion
Intend	ed lear	ning outcomes				
The stu and the le to in al softw	idents eory of depend vare an	have specific and adva signal processing for ir dently work with literati d are able to process i	nced knowledge in the nages and have corres ure, they understand th mages for the analysis	field of image proce conding knowledge of e characteristics of i of experiments with	ssing. They know the of image generation. mage processing wi imaging measuring i	e principles They are ab- th commerci- methods.
V + R (r	o infor	mation on SWS (week)	v contact hours) and co	nian) Nurse language avail:	ahle)	
Metho module is	<b>d of ass</b> s creditab	sessment (type, scope, lang	guage — if other than German,	examination offered — if no	t every semester, informati	on on whether
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.						
Allocat	ion of <sub>l</sub>	olaces				
Additional information						
Workload						
Teaching cycle						
Master's w	ith 1 majo	r Physics (2010)	JMU Würzbu reg. data reg	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 27 / 280

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)

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

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 with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 28 / 280
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Master's with 1 major Physics (2010)

Module title			Abbreviation			
Princip	Principles of Energy Technologies				11-ENT-092-m01	
Module	e coord	inator		Module offered by		
Manag	ing Dire	ector of the Institute of Ap	oplied Physics	plied Physics Faculty of Physics and Astronomy		
ECTS	Metho	od of grading	Only after succ. com	Only after succ. compl. 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				
Conten	ts	L	<u> </u>			
as rene ting ma studen verters Electric	ewable aterials ts. Ene . Nucle city. Bic	resources of energy. We , selective layers, highly rgy conservation via ther ar power plants. Hydroeld mass. Geothermal energ	also discuss aspects activated carbons). The mal insulation. Therm ectricity. Wind turbine y. Energy storage. En	of optimising materi he course is especia hodynamic energy ef es. Photovoltaics. So ergy transport	als (e.g. nanostructured insula- lly suitable for teaching degree ficiency. Fossil fired energy con- lar thermal: Heat. Solar thermal:	
The stu port an	idents id stora	know the principles of dif ge. They understand the	ferent methods of en structures of corresp	ergy technology, esp onding installations	pecially energy conversion, trans- and are able to compare them.	
Course	<b>S</b> (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)		
R + V (r	no infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)	
module is	<b>d of ass</b> s creditab	<b>eessment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.						
Allocat	ion of <sub>l</sub>	olaces				
Additio	Additional information					
Worklo	Workload					
Teachi	Teaching cycle					

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

#### Module appears in

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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)
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 (2011)
Master's degree (1 major) Functional Materials (2012)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 30 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title				Abbreviation		
Introdu	Introduction to Plasmaphysics				11-EPP-092-m01	
Module coordinator				Module offered by		
Managing Director of the Institute of Th and Astrophysics		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				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		Certain prerequisite sessment. The lectur at the beginning of the sidered a declaration dents have obtained the course of the se sessment into effect ted to assessment i sessment at a later admission to assess	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 anow.			
Content	ts		-			
Plasma Transpo thin the celerati	Astrop ort equ solar on and	hysics: Dynamics of ch ations for energetic par wind, Particle accelerat transport in galaxies a	arged particles in elec ticles, Properties of ma ion via shock waves ar nd other astrophysica	tric and magnetic fie agnetic turbulence, F nd via interaction wit objects, Cosmic rad	lds, Magnetohydrod Propagation of solar h plasma turbulence iation.	ynamics, particles wi- e, Particle ac-
Intende	ed learr	ning outcomes				
The stu ma. The	dents l ey are a	know the principles of F ble to solve basic prob	Plasma Physics, especi lems of Plasma Physic	ally the description of and to apply this k	of transport phenom nowledge to Astroph	ena in plas- iysics.
Courses	<b>5</b> (type, n	umber of weekly contact hours	, language — if other than Ger	rman)		
V + R (n	o infor	mation on SWS (weekly	contact hours) and co	ourse language availa	able)	
Method module is	<b>l of ass</b> creditab	e <b>essment</b> (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informati	on on whether
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.					amination in utes) or c) esentation sessment demic and	
Allocati	ion of p	olaces				
Additio	nal info	ormation				
Workload						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Master's wit	th 1 major	Physics (2010)	JMU Würzbu reg. data reg	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physik	• exam. < - 2010	page 31 / 280





### 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)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 32 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation			
Semiconductor Lasers - Principles and Current Research				11-HLF-092-m01		
Module coordinator				Module offered by		
Managing Director of the Institute of Ap			oplied Physics	Faculty of Physics and Astronomy		
ECTS	Metho	od of grading	Only after succ. com	ompl. of module(s)		
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate	Certain prerequisite sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the set sessment into effect ted to assessment in sessment at a later of admission to assess	s must be met to qua rer will inform stude the course. Registrat n of will to seek adm d the qualification fo mester, the lecturer t. Students who mee n the current or in th date, students will h sment anew.	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	
Conten	ts					
This lecture discusses the principles of laser physics, based on the example of semiconductor lasers, and cur- rent developments regarding components. The principles of lasers are described on the basis of a general laser model, which will then be extended to special aspects of semiconductor lasers. Basic concepts such as thres- hold condition, characteristic curve and laser efficiency are derived from coupled rate equations for charge car- riers and photons. Other topics of the lecture are optical processes in semiconductors, layer and ridge wavegui- des, laser resonators, mode selection, dynamic properties as well as technology for the generation of semicon- ductor lasers. The lecture closes with current topics of laser research such as quantum dot lasers, quantum cas- cade lasers, terahertz lasers or high-performance lasers.						
Intende	ed learr	ning outcomes				
The stu knowle	dents ł dge to	nave advanced knowledg modern questions and k	e of the principles of now the applications	semiconductor-lase in the current devel	er physics. They can apply their opment of components.	
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
R + V (n	o infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)	
Methoo module is	<b>l of ass</b> creditab	s <b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009. Language of assessment: German, English						
Allocat	Allocation of places					
Additio	Additional information					
Workload						

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 33 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

#### Teaching cycle

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**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) Physics (2010)			
Bachelor' degree (1 major) Physics (2012)			
Bachelor' degree (1 major) Nanostructure Technology (2010)			
Bachelor' degree (1 major) Nanostructure Technology (2012)			
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) 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 (2011)			
Master's degree (1 major) Computational Mathematics (2012)			
Master's degree (1 major) Functional Materials (2012)			

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 34 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title				Abbreviation			
Principles of Classification of Patterns				11-KVM-092-m01			
Module coordinator				Module offered by	Module offered by		
Managing Director of the Institute of Ar		Applied Physics	oplied Physics Faculty of Physics and Astronomy				
ECTS Method of grading		Only after succ. con	Only after succ. compl. of module(s)				
3	nume	merical grade					
Duratio	n	Module level	Other prerequisites	Other prerequisites			
1 semester		undergraduate	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment anew.				
Conten	ts						
Signals such as images, but also acoustic records, spectra, electrical measurements often contain recurring pat- terns. These patterns are often classified and analysed by observers, e.g. by a doctor when analysing an ECG. More and more automatic procedures are adopted to take on these tasks and classify patterns. The lecture will discuss principles of different classifiers such as "minimum distance" and "maximum likelihood".							
Intende	ed lear	ning outcomes					
The students have specific and advanced knowledge in the field of pattern recognition. They know methods of classifying patterns in measuring data as well as ways to automatise these processes. They are able to apply these methods to practical problems.							
Course	<b>S</b> (type, r	umber of weekly contact hour	s, language — if other than Ge	rman)			
V + R (n	o infor	mation on SWS (weekl	y contact hours) and co	ourse language avail	able)		
Methoo module is	<b>d of ass</b> creditab	<b>essment</b> (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informati	on on whether	
a) written examination (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							
examin Langua	ation r	egulations) 2009. ssessment: German. E	nglish		3 ASFO (general aca		
Allocat	ion of p	olaces	_				
Additio	nal inf	ormation					
Workload							
Teachir	Teaching cycle						
Referre	d to in	LPO I (examination regulati	ons for teaching-degree progra	ammes)			
Master's wi	aster's with 1 major Physics (2010) JMU Würzburg • generated 26-Aug-2024 • exam. page 35 / 2 reg. data record Master (120 ECTS) Physik - 2010				page 35 / 280		



### Module appears in

Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Master's degree (1 major) Physics (2010) 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 with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 36 / 280			
	reg. data record Master (120 ECTS) Physik - 2010				
Module	e title				Abbreviation
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Introduction to LabVIEW					11-LVW-092-m01
Module coordinator				Module offered by	
Managing Director of the Institute of A			oplied Physics	Faculty of Physics a	and Astronomy
ECTS Method of grading			Only after succ. con	pl. of module(s)	
6	nume	rical grade			
Duration Module level		Other prerequisites			
1 semester graduate Certain sessm at the sidere dents the co sessm ted to sessm		sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the se sessment into effect ted to assessment i sessment at a later admission to assess	rer will inform stude the course. Registrat n 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 sment anew.	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	
Conten	ts		•		
The module comprises basic and advanced courses. The basic course "NI LabVIEW Basic 1" is the first level of each LabVIEW learning phase. LabVIEW Basic provides a systematic introduction to the functions and application fields of the development environment of LabVIEW. The students become acquainted with dataflow programming and with common LabVIEW architectures. They learn to develop LabVIEW applications for various application fields, from assessment and measurement applications up to data collection, device control, data recording and measurement analysis. In the advanced course "NI LabVIEW Core 2", the students learn to develop comprehensive standalone applications, including the graphical development environment LabVIEW. The course builds upon LabVIEW Basic 1 and provides an introduction to the most common development technologies, in order to enable the students to successfully implement and distribute LabVIEW applications for different application fields. Course topics include techniques and procedures for the optimisation of application performance, e.g. through an optimised reuse of existing codes, usage of file I/O functions, principles of data management, event computing and methods of error handling. After finishing the course, the students have the ability to apply Lab-VIEW functions according to individual requirements, which enables a fast and productive application develop					
Intende	ed lear	ning outcomes			
The students have specific and advanced knowledge in the application field of LabVIEW. They know the princip- les of working with LabVIEW and are able to develop applications, e.g. for recording and analysing measuring da- ta.					
Courses	<b>S</b> (type, r	number of weekly contact hours, I	anguage — if other than Gei	man)	
V + Ü (r	no info	mation on SWS (weekly	contact hours) and co	ourse language avail	lable)
Methoo module is	<b>d of ass</b> creditab	<b>sessment</b> (type, scope, langua le for bonus)	ge — if other than German,	examination offered — if no	ot every semester, information on whether
a) writte	en exa	mination (approx. 90 mir	utes) or b) oral exam	ination of one cand	idate each or oral examination in

groups (approx. 30 minutes) or e) project (approx. 60 minutes) or b) or at examination of one candidate each of or at 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) or e) project (approx. 60 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Language of assessment: German, English

#### Allocation of places

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Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 37 / 280
	reg. data record Master (120 ECTS) Physik - 2010	



### Additional information

Workload

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Teaching cycle

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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) Nanostructure Technology (2010)

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

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 with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 38 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module	e title				Abbreviation	
Thermo	Thermodynamics and Economics     11-TDO-092-m01					
Module	e coord	inator		Module offered by		
Managing Director of the Institute of Theo and Astrophysics			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				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		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	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			
Conton	tc			Sincht unew.		
sion in thermo ecologi fine the capital, nomic g system tors lea discuss compri gramm	the dev dynam cal dar techn work, growth. of taxe ds to ju ses how ses the e deecc	velopment of the university of the entropy production and resource compological and ecological energy and creativity productive power est and social security cobb cuts, waste of resourt factor income taxation techniques of rational production of the production of the productive power est and social security cobb cuts.	erse, the evolution of lif ction density shows the sumption. Energy conv l boundaries of industri- oroduce the goods and of cheap energy by far ontributions, this discr urces, impoverishment n can counteract this d l energy use and non-fo ission and Cost Optimi	e and the unfolding of e relevance of the sec rersion, entropy prod ial economic growth. services of a nationa exceeds that of expe epancy between pow of nations and growi evelopment. Part 3 in ossil energy use, and zation).	of civilisation. In nor cond law of thermod uction and natural re Part 2 analyses how I economy and dete ensive labour. Withir ver and costs of proc ng social tensions. T ncludes seminar pre introduces the optin	n-equilibrium ynamics for esources de- v the factors rmine eco- n the current duction fac- The course sentations, misation pro-
Intende	ed leari	ning outcomes				
The students understand that energy conversion and entropy production are going to play an important role in the world's economic and social development. As an extension of economic theory, the students know the connections between thermodynamics and economy as well as the productive physical basis of modern econo- mies. They are able to apply the acquired knowledge to particular problems. NOTE: this is the module that was run by Prof. Dr. R. Kümmel, who has now retired. As the module was tailored to his own theory of economy, it has yet to be decided whether we will continue to offer this module.				tant role know the dern econo- as tailored to		
Course	<b>S</b> (type, n	umber of weekly contact hour	rs, language — if other than Ge	rman)		
R + V (n	io infor	mation on SWS (weekl	y contact hours) and co	ourse language availa	able)	
Methoo module is	<b>d of ass</b> creditab	essment (type, scope, lang le for bonus)	guage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009. Language of assessment: German, English						
Master's wi	ith 1 majoi	Physics (2010)	JMU Würzbu reg. data ree	rrg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 39 / 280

### Allocation of places

#### Additional information

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## Workload

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## 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) Nanostructure Technology (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) 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 with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 40 / 28
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation			
Princip	les of t	wo- and threedimension	onal Röntgen imaging		11-ZDR-111-m01	
Module	e coord	inator		Module offered by		
Managi	ing Dire	ector of the Institute of	Applied Physics	plied Physics Faculty of Physics and Astronomy		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 semester graduate		Certain prerequisite sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the se sessment into effect ted to assessment i sessment at a later admission to assess	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					
Physics ton abs project tractior charact Intende The stu technic	s of X-ra sorption ion, Fo n, visua terisati ed learn idents l ques us s (type, r	ay generation (X-ray tub n, scattering), physics urier reconstruction, ite lisation,). Applicatio on, metrology, biology, <b>hing outcomes</b> know the principles of ing X-rays and method number of weekly contact hour	bes, synchrotron). Phys of X-ray detection. Matherative methods). Image ons of X-ray imaging in t ). Radiation protection generating X-rays and c s of image processing a s, language — if other than Gen	ics of the interaction nematics of reconstru- e processing (image the industrial sector on and biological rac of their interactions w as well as application rman)	between X-rays and uction algorithms (fil data pre-processing (component testing, diation effect (dose, with matter. They kno n areas of these met	matter (pho- tered rear , feature ex- material ). ww imaging hods.
V + R (n	no infor	mation on SWS (weekl	v contact hours) and co	ourse language avail	able)	
Methoo module is	<b>d of ass</b> s creditab	essment (type, scope, lang	guage — if other than German,	examination offered — if no	t every semester, informati	on on whether
a) writt groups project (approx Assess and wil examin	a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and oramination regulations) approx				amination in iutes) or c) esentation sessment demic and	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Workload						
Teaching cycle						
Referre	d to in	LPO I (examination regulation	ons for teaching-degree progra	mmes)		
Master's wi	ith 1 majo	Physics (2010)	JMU Würzbu reg. data red	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 41 / 280



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) 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) Nanostructure Technology (2010) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) FURUS Physics (2012) Master's degree (1 major) FOKUS Physics (2006)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 42 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation			
Thermo	dynam	ics and Economics			11-TDOE-141-m01	
Module	coord	inator		Module offered by		
Managi and Ast	ng Dire rophys	ector of the Institute of <sup>-</sup> sics	Theoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
3	(not) s	successfully completed				
Duratio	n	Module level	Other prerequisites			
1 semes	ster	graduate				
Content	ts					
Energy and economic growth, entropy production, emission reduction. Part I describes the role of energy conversion in the development of the universe, the evolution of life and the un- folding of civilisation. The entropy production density of non-equilibrium thermodynamics shows the relevance of the second law of thermodynamics for ecological damage and resource consumption. Energy conversion, ent- ropy production and natural resources define the technological and ecological boundaries of industrial econo- mic growth. Part 2 analyses how the factors capital, work, energy and creativity produce the goods and services of a national economy and determine economic growth. The productive power of cheap energy by far exceeds that of expensi- ve labour. Within the current system of taxes and social security contributions, this discrepancy between power and costs of production factors leads to job cuts, waste of resources, impoverishment of nations and growing so- cial tensions. The course discusses how factor income taxation can counteract this development. Part 3 includes seminar presentations, comprises the techniques of rational energy use and non-fossil energy use, and introduces the optimisation programme deeco (Dynamic Energy, Emission and Cost Optimization). Intended learning outcomes The students understand that energy conversion and entropy production are going to play an important role in the world's economic and social development. As an extension of economic theory, the students know the connections between thermodynamics and economy as well as the productive physical basis of modern econo- mies. They are able to apply the acquired knowledge to particular problems.				e and the un- e relevance version, ent- rial econo- of a national t of expensi- veen power d growing so- sil energy zation). ant role know the dern econo- as tailored to		
Courses	<b>5</b> (type, n	umber of weekly contact hours	, language — if other than Ger	rman)		
V (no in	format	ion on SWS (weekly co	ntact hours) and cours	e language available	<u>.)</u>	
Method module is	l of ass creditab	e <b>essment</b> (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informati	on on whether
a) writte in group weeks)	en exar ps (app or d) p	nination (approx. 90 m prox. 30 minutes per ca resentation/seminar pi	inutes) or b) oral exam ndidate) or c) project r esentation (approx. 30	ination of one candi eport (approx. 8 to 10 o minutes)	date each or oral exa o pages, time to com	amination Iplete: 1 to 4
Allocati	ion of p	olaces				
Additio	nal info	ormation				
Workload						
Teaching cycle						
Referre	d to in	LPO I (examination regulation	ns for teaching-degree progra	mmes)		
Master's wit	th 1 major	Physics (2010)	JMU Würzbu reg. data rec	rg • generated 26-Aug-2024 • cord Master (120 ECTS) Physik	• exam. < - 2010	page 43 / 280



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) 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 (2010) Master's degree (1 major) FOKUS Physics (2011)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 44 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title					Abbreviation		
Image	and Sig	nal Processing in Phy	sics		11-BSV-122-m01		
Module	e coord	inator		Module offered by			
Managi	ing Dire	ector of the Institute of	Applied Physics	plied Physics Faculty of Physics and Astronomy			
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)			
6	nume	rical grade					
Duratio	on	Module level	Other prerequisites				
1 semester graduate		Certain prerequisite sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the se sessment into effect ted to assessment in sessment at a later admission to assess	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						
Periodi and ima convolu getic ol transfo	c and a age pro ution pl bservat rmation	periodic signals; princ ocessing; discretisatior roduct; tapering function ion; statistical signals n. <b>ning outcomes</b>	iples of discreet and ex of signals/sampling th ons and interpolation o image noise, moments	act Fourier transforn neorem (Shannon); h f images; the Parsiva s, stationary signals;	nation; principles of nomogeneous and lin al theorem, correlatio tomography: Hanke	digital signal near filters, on and ener- el and Radon	
The stu	dents l	nave advanced knowle	dge of digital image an	d signal processing	They know the phys	ical princip-	
les of ir ferent r	mage p nethod	rocessing and are fam s and to implement th	liar with different meth em, especially in the fie	ods of signal proces eld of tomography.	sing. They are able t	o explain dif-	
Course	<b>S</b> (type, n	umber of weekly contact hour	s, language — if other than Ger	man)			
V + R (n	no infor	mation on SWS (weekl	y contact hours) and co	ourse language availa	able)		
Methoo module is	<b>d of ass</b> creditab	s <b>essment</b> (type, scope, lang le for bonus)	guage — if other than German, o	examination offered — if no	t every semester, informati	on on whether	
a) written examination (90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate) 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.					on in groups o 4 weeks) or sessment demic and		
Allocat	ion of p	olaces					
Additio	nal inf	ormation					
Workload							
Teaching cycle							
Referre	d to in	LPOI (examination regulati	ons for teaching-degree progra	mmes)			
Master's wi	ith 1 major	Physics (2010)	JMU Würzbu reg. data rec	rg • generated 26-Aug-2024 ord Master (120 ECTS) Physil	• exam. < - 2010	page 45 / 280	



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

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 46 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title					Abbreviation	
Imagin	g Meth	ods at the Synchrotro	n		11-BMS-121-m01	
Module	e coord	inator		Module offered by		
Managi	ng Dire	ector of the Institute of	Applied Physics	pplied Physics Faculty of Physics and Astronomy		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
4	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		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	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					
Overvie ter Pr crystall	ew of sy inciple ine ma	vnchrotron radiation ar s of X-ray optics, X-ray terials.	nd its generation Prind lens Synchroton dete	ciples of the interacti ector technique X-ray	ion between radiatic diffractometry (diffr	on and mat- action) of
Intende	ed lear	ning outcomes				
The stu ciples o als. The pret sin	dents l of imag ey unde nple im	have advanced knowle ing techniques at the s erstand the principles o nages.	dge of synchrotron rad synchrotron and their a of image generation and	iation and X-ray optic pplication for crystal d are able to explain	cs. They know the ph line materials and of different techniques	iysical prin- ther materi- s and inter-
Course	<b>S</b> (type, r	number of weekly contact hour	rs, language — if other than Ge	rman)		
V + R (n	o infor	mation on SWS (week	y contact hours) and co	ourse language avail	able)	
Methoo module is	<b>d of ass</b> creditab	<b>sessment</b> (type, scope, lang le for bonus)	guage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
a) writt (approx d) pres Assess and wil examin	en exai k. 30 m entatio ment o l be an ation r	mination (90 minutes) inutes per candidate) n/seminar presentatic ffered: When and how nounced in due form u egulations) 2009.	or b) oral examination or c) project report (app on (approx. 30 minutes) often assessment will l under observance of Sec	of one candidate eac rox. 8 to 10 pages, ti be offered depends o ction 32 Subsection 3	th or oral examination me to complete: 1 to on the method of ass 3 ASPO (general aca	on in groups o 4 weeks) or sessment demic and
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teaching cycle						
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)					
Module	e appea	ars in				
Master's wi	th 1 majo	r Physics (2010)	JMU Würzbu reg. data rec	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 47 / 280



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 (2010)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 48 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation			
Imagin	Imaging Methods at the Synchrotron   11-BMS-131-m01					
Module	e coord	inator		Module offered by		
Managi	ng Dire	ector of the Institute of A	pplied Physics	plied Physics Faculty of Physics and Astronomy		
ECTS	Metho	od of grading	Only after succ. con	Only after succ. compl. of module(s)		
4	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme:	ster	graduate	Certain prerequisite sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the se sessment into effect ted to assessment i	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semesters.		
Conten	ts					
Overvie ter Pr crystall	w of sy inciple ine ma	nchrotron radiation and s of X-ray optics, X-ray le terials.	its generation Princ ns Synchroton dete	ciples of the interacti ctor technique X-ray	on between radiatio diffractometry (diffra	n and mat- action) of
Intende	ed leari	ning outcomes				
The stu ciples o als. The pret sin	dents l of imag ey unde nple im	nave advanced knowled ing techniques at the sy erstand the principles of ages.	ge of synchrotron radi nchrotron and their a image generation and	ation and X-ray optic oplication for crystall d are able to explain	cs. They know the ph line materials and ot different techniques	nysical prin- ther materi- and inter-
	o infor	mation on SWS (wookly	contact hours) and as			
Methoo module is	d of ass	eessment (type, scope, langu- le for bonus)	age — if other than German,	examination offered — if no	t every semester, informati	on on whether
a) writte in grou weeks) Assess and wil examin Langua	en exar ps (app or d) p ment o l be an ation r ge of a	mination (approx. 90 min prox. 30 minutes per can resentation/seminar pre ffered: When and how o nounced in due form un egulations) 2009. ssessment: German, Eng	nutes) or b) oral exam didate) or c) project re esentation (approx. 30 ften assessment will b der observance of Sec glish	ination of one candi eport (approx. 8 to 10 o minutes) pe offered depends o ction 32 Subsection 3	date each or oral exa p pages, time to com on the method of ass 3 ASPO (general aca	amination iplete: 1 to 4 sessment demic 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						
Master	's degr	ee (1 major) Physics (201	10)			
Master's wi	th 1 majoi	Physics (2010)	JMU Würzbu reg. data reg	rg • generated 26-Aug-2024 ( ord Master (120 ECTS) Physik	• exam.	page 49 / 280

## Julius-Maximilians-UNIVERSITÄT WÜRZBURG



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 (2010)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 50 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation			
Image a	Image and Signal Processing in Physics			11-BSV-131-m01		
Module	coord	inator		Module offered by		
Managi	ng Dire	ector of the Institute of	Applied Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	Only after succ. compl. of module(s)		
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme:	ster	graduate	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	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-		
Conten	ts					
Periodi and ima convolu getic ob transfo	c and a age pro ution pro oservat rmatior	periodic signals; princ ocessing; discretisatior roduct; tapering functio ion; statistical signals, n.	iples of discreet and ex of signals/sampling to ons and interpolation o image noise, moment	kact Fourier transform heorem (Shannon); h f images; the Parsiva s, stationary signals;	nation; principles of nomogeneous and lin al theorem, correlation tomography: Hanke	digital signal near filters, on and ener- el and Radon
Intende	ed learr	ning outcomes				
The stu les of ir ferent r	dents ł nage p nethod	nave advanced knowle rocessing and are fami s and to implement the	dge of digital image an liar with different meth em, especially in the fig	d signal processing. ods of signal proces eld of tomography.	They know the phys sing. They are able t	ical princip- o explain dif-
Course	<b>S</b> (type, n	umber of weekly contact hour	s, language — if other than Ge	rman)		
V + R (n	o infor	mation on SWS (weekl	y contact hours) and co	ourse language avail	able)	
Methoo module is	l of ass creditab	<b>eessment</b> (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informati	on on whether
a) writte in grou weeks) Assess and wil examin Langua	en exar ps (app or d) p ment o l be an ation re ge of a	mination (approx. 90 m prox. 30 minutes per ca resentation/seminar p ffered: When and how nounced in due form u egulations) 2009. ssessment: German, E	inutes) or b) oral exam ndidate) or c) project r resentation (approx. 30 often assessment will nder observance of Sen nglish	ination of one candi eport (approx. 8 to 1 o minutes) be offered depends o ction 32 Subsection	date each or oral exa o pages, time to com on the method of ass 3 ASPO (general aca	amination iplete: 1 to 4 sessment demic and
Allocat	ion of p	olaces	<u> </u>			
Additio	nal inf	ormation				
Workload						
Teaching cycle						
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)						
 Module appears in						
module	appea	115 III				
Master's wi	th 1 major	Physics (2010)	JMU Würzbu reg. data re	rrg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 51 / 280



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) 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 (2010)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 52 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation		
Quantum Information Technology				11-QUI-132-m01	
Module coordinator				Module offered by	
Managi	ng Dire	ector of the Institute of Ap	plied Physics	Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
6	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts	5.444446			
Basic co proache and qua	oncept es towa antum	s of quantum mechanics ards quantum computing noise, quantum informat	, quantum bits and a (on the basis of pho ion and communicat	lgorithms, quantal m tons, ions and nucle ion.	neasurements, experimental ap- ar spins), quantum operations
Intende	ed learr	ning outcomes			
The stu know e mation.	dents a xperim	are familiar with the basic ental approaches for the	c quantum mechanica realisation of quantu	al terms of quantum Im computers and fo	information technology. They or the transfer of quantum infor-
Courses	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V + R (n	o infor	mation on SWS (weekly o	contact hours) and co	urse language availa	able)
Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus)       a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)       Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.       Language of assessment: German, English       Allocation of places					
Teachir	ng cycl	e			
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)					
Module appears in					
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 (2010) Master's degree (1 major) FOKUS Physics (2011)					



# Solid State Physics and Nanostructures

(40 ECTS credits)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 54 / 280
	reg. data record Master (120 ECTS) Physik - 2010	i i

Module title			Abbreviation				
Opto-electronic Material Properties				11-MOE-092-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	Metho	od of grading	Only after succ. con	Only after succ. compl. of module(s)			
5	nume	rical grade		•			
Duratio	n	Module level	Other prerequisites				
Duration     Module level     Other prerequisites       1 semester     graduate     Admission prerequisite to assessment: successful completion of 50% of exercises. Certain prerequisites must be met to qualify for sion to assessment. The lecturer will inform students about the ve details at the beginning of the course. Registration for the course be considered a declaration of will to seek admission to assess students have obtained the qualification for admission to assess over the course of the semester, the lecturer will put their regist assessment into effect. Students who meet all prerequisites wi mitted to assessment in the current or in the subsequent seme assessment at a later date, students will have to obtain the quality of the semester.		on of approx. fy for admis- the respecti- course will essment. If isessment gistration for will be ad- mester. For qualification					
			for admission to ass	sessment anew.			
Conten	ts			1 11			
Physica	al princ	iples of optoelectronic	material properties an	d applications.			
Intende	ed lear	ning outcomes					
The stu	dents l	know the principles of	optoelectronic material	characteristics.			
Course	<b>S</b> (type, r	number of weekly contact hou	rs, language — if other than Ge	rman)			
V + Ü (n	no infor	mation on SWS (week	ly contact hours) and co	ourse language avail	able)		
<b>Methoc</b> module is	<b>d of ass</b> creditab	<b>sessment</b> (type, scope, lan le for bonus)	guage — if other than German,	examination offered — if no	t every semester, informati	on on whether	
a) writte groups project prox. 30	en exai (appro report o minu	mination (approx. 90 n x. 30 minutes per cand (approx. 10 pages, tim tes)	ninutes) or b) oral exam didate, for modules with e to complete: 1 to 4 we	ination of one candi n less than 4 ECTS cr eeks) or d) presentat	date each or oral exa edits approx. 20 mir ion/seminar present	amination in utes) or c) tation (ap-	
Allocat	ion of p	olaces					
Additio	nal inf	ormation					
		-	· · · · · · · · · · · · · · · · · · ·				
Worklo	ad						
Toachir							
Teacini	ig cyci	C					
Referred to In LPOT (examination regulations for teaching-degree programmes)							
Mourie appears in Rachalar' dagraa (a major) Physics (2010)							
Master's degree (1 major) Physics (2010)							
Master's degree (1 major) Technology of Functional Materials (2010)							
Master's degree (1 major) Technology of Functional Materials (2009)							
Master'	Master's degree (1 major) Nanostructure Technology (2010)						
Master'	's degr	ee (1 major) FOKUS Ph	/sics - Nanostructuring	Technology (2010)			
Master's wi	th 1 major	r Physics (2010)	JMU Würzbu reg. data reg	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 55 / 280	





Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) Functional Materials (2012)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 56 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation			
Critical	Pheno	mena			11-CRP-131-m01	
Module	coord	inator		Module offered by		
Managi and Ast	ng Dire rophys	ector of the Institute of ics	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				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		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	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for			
Conten	ts		1			
In Statis transition plays and and to r scaling tempera	In Statistical Physics, critical phenomena refer to the universal behaviour in the proximity of continuous phase transitions. The theory, which can be explained through critical phenomena, is called renormalisation group and plays an important role in many areas of Physics. The lecture serves as an introduction to critical phenomena and to renormalisation group theory and discusses selected applications. Basic phenomenology: Universality, scaling relationships, critical exponents. Mean field theory. Renormalisation group theory. Duality and high-/low-					ous phase on group and enomena niversality, nd high-/low-
Intende	d learr	ning outcomes				
The stu thods to	dents l o simp	know the principles of t le problems.	he theory of critical ph	enomena and are ab	le to apply the calcu	ılation me-
Courses	<b>5</b> (type, n	umber of weekly contact hours	s, language — if other than Ge	rman)		
V + R (n	o infor	mation on SWS (weekly	/ contact hours) and co	ourse language availa	able)	
<b>Method</b> module is	<b>l of ass</b> creditab	s <b>essment</b> (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informati	on on whether
a) writte nar pres Assessi and wil examin Langua	a) written examination project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks), presentation/semi- nar 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.					tation/semi- sessment demic and
Allocati	ion of p	olaces				
Additio	nal inf	ormation				
Workload						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Master's wi	th 1 major	Physics (2010)	JMU Würzbu reg. data ree	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physik	• exam. < - 2010	page 57 / 280



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 with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 58 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation				
Applied Superconduction				11-ASL-092-m01			
Module	e coord	inator		Module offered by	<u> </u>		
Managi	ing Dire	ector of the Institute of A	Applied Physics	Faculty of Physics a	nd Astronomy		
ECTS	Metho	od of grading	Only after succ. con	Only after succ. compl. of module(s)			
6	nume	rical grade					
Duratio	n	Module level	Other prerequisites				
1 semester graduate		Certain prerequisite sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the se sessment into effect ted to assessment i sessment at a later admission to assess	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						
Physica thods o	al princ of mate	iples of superconductiv rials sciences for the ca	ity. Application in ene lculation of temperatu	rgy engineering. Inst re profiles in superc	rumental developme onductors.	ents. Me-	
Intende	ed learı	ning outcomes					
The stu are able able to energy	dents l e to eva discus techno	nave a basic understand aluate the contributions s questions on superco logy. Furthermore, they	ding of superconductive of materials sciences nductivity in a scientife can deal with practica	vity as a macroscopic to the development ic manner and to crit Il mathematical ques	c quantum phenome of superconductivity cically question deve stions.	non. They /. They are lopments of	
Course	<b>S</b> (type, n	umber of weekly contact hours	, language — if other than Ger	rman)			
R + V (n	io infor	mation on SWS (weekly	contact hours) and co	ourse language availa	able)		
Method module is	creditab	s <b>essment</b> (type, scope, langu le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informati	on on whether	
a) writte in grou c) proje prox. 30 Assess Langua	en exar ps (app ect repo o minu ment o ge of a	mination (approx. 90 m prox. 30 minutes per ca ort (approx. 8 pages, tin tes) ffered: once a year, win ssessment: German, Er	inutes) or b) oral exam ndidate, for modules w ne to complete: 1 to 4 v ter semester nglish	ination of one candi vith less than 4 ECTS veeks) or d) presenta	date each or oral exa credits approx. 20 n ation/seminar prese	amination ninutes) or ntation (ap-	
Allocat	ion of p	olaces					
Additio	nal inf	ormation					
Worklo	ad						
Teaching cycle							
Referred to in LPO I (examination regulations for teaching-degree programmes)							
 Modulo appears in							
Bachole	appea	IIS IN	010)				
	or deg	ree (1 major) Physics (2	010)				
Master's wi	th 1 major	Physics (2010)	JMU Würzbu reg. data reg	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam.	page 59 / 280	

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Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Nanostructure Technology (2010) Bachelor' degree (1 major) Nanostructure Technology (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 with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 60 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title A		Abbreviation			
Semiconductor Lasers - Principles and Current Research		11-HLF-092-m01			
Module coordinator Module c		Module offered by			
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy			
ECTS       Method of grading       Only after succ. compl. of module(s)					
6 numerical grade					
Duratio	Duration Module level Other prerequisites				
1 seme:	ster	graduate	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment 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		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
Conten	ts				
This lecture discusses the principles of laser physics, based on the example of semiconductor lasers, and cur- rent developments regarding components. The principles of lasers are described on the basis of a general laser model, which will then be extended to special aspects of semiconductor lasers. Basic concepts such as thres- hold condition, characteristic curve and laser efficiency are derived from coupled rate equations for charge car- riers and photons. Other topics of the lecture are optical processes in semiconductors, layer and ridge wavegui- des, laser resonators, mode selection, dynamic properties as well as technology for the generation of semicon- ductor lasers. The lecture closes with current topics of laser research such as quantum dot lasers, quantum cas- cade lasers.			d on the basis of a general laser Basic concepts such as thres- d rate equations for charge car- uctors, layer and ridge wavegui- / for the generation of semicon- tantum dot lasers, quantum cas-		
Intended learning outcomes					
The stu knowle	The students have advanced knowledge of the principles of semiconductor-laser physics. They can apply their knowledge to modern questions and know the applications in the current development of components.		r physics. They can apply their opment of components.		
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
R + V (n	io infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)
Methoo module is	<b>d of ass</b> creditab	s <b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009. Language of assessment: German, English					
Allocation of places					
Additio	nal inf	ormation			
Worklo	ad				

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	
	reg. data record Master (120 ECTS) Physik - 2010	

## Teaching cycle

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**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) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Nanostructure Technology (2010)
Bachelor' degree (1 major) Nanostructure Technology (2012)
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) 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 (2011)
Master's degree (1 major) Computational Mathematics (2012)
Master's degree (1 major) Functional Materials (2012)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 62 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title Abbreviation		Abbreviation			
Applied Semiconductor Physics   11-AHL-092-m01		11-AHL-092-m01			
Module coordinator Module of		Module offered by			
Managing Director of the Institute of Applie		oplied Physics	Faculty of Physics and Astronomy		
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
6 numerical grade					
Duration Module level Other prerequisites					
1 seme	ster	graduate	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective detai at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment ov the course of the semester, the lecturer will put their registration for as sessment into effect. Students who meet all prerequisites will be adm ted to assessment in the current or in the subsequent semester. For as sessment at a later date, students will have to obtain the qualification		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
Conten	its			inent unew.	
The lec compo	ture dis nents c	scusses the principles of of electronics, optoelectro	Semiconductor Phys onics and photonics.	ics and provides an	exemplary overview of the main
Intende	ed lear	ning outcomes			
phonor ties. Th the sol miliar v ding of electro patt, Ba injectic of semi compo	phonon band structures of important semiconductors, they have gamed an overview of the electronic and phonon band structures of important semiconductors and the resulting electronic, optical and thermal proper- ties. They know the principles of charge transport as well as the Poisson, Boltzmann and continuity equation for the solution of questions. They have gained insights into the methods of semiconductor production and are fa- miliar with the theories of planar technology and recent developments in this field, they have a basic understan- ding of component production. They understand the structure and way of functioning of the main components o electronics (diode, transistor, field-effect transistor, thyristor, diac, triac), of microwave applications (tunnel, Im- patt, Baritt or Gunn diode) and of optoelectronics (photo diode, solar cell, light-emitting diode, semiconductor injection laser), they know the realisation possibilities of low-dimensional charge carrier systems on the basis of semiconductors and their technological relevance, they are familiar with current developments in the field of		ic, optical and thermal proper- nann and continuity equation for onductor production and are fa- eld, they have a basic understan- oning of the main components of rowave applications (tunnel, Im- emitting diode, semiconductor ge carrier systems on the basis ent developments in the field of		
Course	<b>S</b> (type, r	number of weekly contact hours, l	language — if other than Ger	man)	
R + V (r	no infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)
Metho module is	<b>d of ass</b> s creditab	<b>sessment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
a) writt groups project (approz Assess and wil examin Langua	en exan (appro report x. 30 m ment o Il be an nation r age of a	mination (approx. 90 min x. 30 minutes per candid (approx. 8 to 10 pages, t inutes) ffered: When and how of nounced in due form und egulations) 2009. ssessment: German, Eng	nutes) or b) oral exam late, for modules with ime to complete: 1 to ten assessment will b der observance of Sec glish	ination of one candi n less than 4 ECTS cr 4 weeks) or d) prese pe offered depends o ction 32 Subsection	date each or oral examination in edits approx. 20 minutes) or c) entation/seminar presentation on the method of assessment 3 ASPO (general academic and
Allocat	ion of p	olaces			
Additio	onal inf	ormation			

## Workload

Teaching cycle

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

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## Module appears in

Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Physics (2010) 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 with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	
	reg. data record Master (120 ECTS) Physik - 2010	

Module	Module title		Abbreviation			
Solid State Physics 2 11-FK2-092-m01						
Module coordinator Module offered by						
Managing Director of the Institute of Applied Physics Faculty of Physics and Astronomy						
ECTS Method of grading Only after succ. compl. of module(s)						
8	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective deta at the beginning of the course. Registration for the course will be cor sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment of the course of the semester, the lecturer will put their registration for sessment into effect. Students who meet all prerequisites will be add ted to assessment in the current or in the subsequent semester. For sessment at a later date, students will have to obtain the qualification admission to assessment and		o as- ctive details ill be con- nt. If stu- ssment over ation for as- ill be admit- ster. For as- alification for	
Conten	ts					
Advanc cal moo citation	ed Soli del. Die is and o	id-State Physics. Electr lectric properties and optical properties [opti	ons in periodic potenti ferroelectrics. Semicon onal]	al - the band structur ductors. Magnetism.	re. Dynamics in the s Superconductivity.	semi-classi- Coupled ex-
Intende	ed leari	ning outcomes				
The students have specific and advanced knowledge in the field of Solid-State Physics. They are theoretically ab- le to specialise in a sub-discipline of Solid-State Physics.						
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)						
R + V (n	no infor	mation on SWS (weekl	y contact hours) and co	ourse language avail	able)	
<b>Method of assessment</b> (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)						
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.			amination in nutes) or c) esentation sessment demic and			
Allocat	ion of r	olaces				
			_			
Additional information						
Worklo	ad					
Teachir	ng cycl	<u>م</u>				
		-				
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)						
Module appears in						
Master's wi	ith 1 majoi	Physics (2010)	JMU Würzbu reg. data re	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 65 / 280



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

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 66 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title		Abbreviation				
Solid State Spectroscopy		11-FKS-092-m01				
Module coordinator Module offered by						
Managing Director of the Institute of Applied Physics Faculty of Physics and Astronomy						
ECTS	5 Method of grading Only after succ. compl. of module(s)					
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate	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 asses	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 f		) as- tive details Il be con- nt. If stu- ssment over tion for as- till be admit- ster. For as- alification for
Conten	ts					
Single- spectro	and mascopy.	any-particle picture of X-ray spectroscopies.	electrons in solids. Ligi	nt-matter interaction.	. Optical spectroscop	oy. Electron
Intende	ed learı	ning outcomes				
The students have specific and advanced knowledge in the field of solid-state spectroscopy. They know different types of spectroscopy and their fields of application. They understand the theoretical principles and the current developments in research.						
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)						
R + V (no information on SWS (weekly contact hours) and course language available)						
<b>Method of assessment</b> (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)						
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.			amination in iutes) or c) esentation sessment demic and			
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachir	ng cycl	e				
Referred to in LPO I (examination regulations for teaching-degree programmes)						
 Module appears in						
module						
Master's wi	ith 1 majoi	Physics (2010)	JMU Würzbu reg. data re	rrg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 67 / 280

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Nanostructure Technology (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 (2011)
Master's degree (1 major) Computational Mathematics (2012)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 68 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation			
Transport Phenomena in Solids			11-FKT-092-m01			
Module	Module coordinator			Module offered by		
Managing Director of the Institute of The and Astrophysics		Theoretical Physics	Faculty of Physics and Astronomy			
ECTS	Metho	od of grading	Only after succ. con	Only after succ. compl. of module(s)		
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semes	nester 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 dents have obtained the qualification for admission to assessme 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. I sessment at a later date, students will have to obtain the qualific admission to assessment anew.		o as- tive details ll be con- nt. If stu- ssment over tion for as- ill be admit- ster. For as- alification for			
Conten	ts					
Transpo	ort phe	nomena in solids.				
Intende	ed learı	ning outcomes				
The stu	dents l	nave specific and adva	nced knowledge in the	field of transport ph	enomena in solids.	
Courses	<b>5</b> (type, n	umber of weekly contact hours	s, language — if other than Ger	rman)		
R + V (n	o infor	mation on SWS (weekly	y contact hours) and co	ourse language availa	able)	
<b>Method of assessment</b> (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)				ion on whether		
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009. Language of assessment: German, English						
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Workload						
leacning cycle						
KEIEIIEU LO III LPO I (examination regulations for teaching-degree programmes)						
 Module appears in						
Bachelor' degree (1 major) Physics (2010)						
Bachelo	or' deg	ree (1 major) Physics (2	012)			
Master's wi	th 1 major	Physics (2010)	JMU Würzbu reg. data rec	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physik	• exam. <- 2010	page 69 / 280

### Julius-Maximilians-UNIVERSITÄT WÜRZBURG



Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Physics (2010) 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 with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 70 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation				
Semiconductor Physics			11-HLP-092-m01				
Module coordinator			Module offered by				
Managi	ing Dire	ector of the Institute of	Applied Physics	Faculty of Physics a	nd Astronomy		
ECTS Method of grading		Only after succ. con	Only after succ. compl. of module(s)				
6	nume	rical grade					
Duratio	n	Module level	Other prerequisites	Other prerequisites			
1 semester graduate		Certain prerequisite sessment. The lectur at the beginning of t sidered a declaration dents have obtained the course of the se sessment into effect ted to assessment i sessment at a later admission to assess	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						
Advanced examination of crystal bonding and the electronic band structure of semiconductors. Optical excitati- ons and their coupling effects. Electron-phonon coupling. Temperature-dependent transport properties. Quanti- sation effects of semiconductors with reduced dimensions. (Semi-)magnetic semiconductors.							
Intende	ed learı	ning outcomes					
The students have specific and advanced knowledge in the field of Semiconductor Physics. They know the physi- cal principles of semiconductors and have gained an overview of the important characteristics of semiconductor materials.							
Course	<b>S</b> (type, n	umber of weekly contact hour	s, language — if other than Gei	rman)			
R + V (n	infor	mation on SWS (weekl	y contact hours) and co	ourse language avail	able)		
<b>Method</b> module is	<b>d of ass</b> creditab	s <b>essment</b> (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informati	on on whether	
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.							
Allocation of places							
Additional information							
Workload							
Teaching cycle							
Referred to in LPO I (examination regulations for teaching-degree programmes)							
Master's wi	ith 1 majoi	Physics (2010)	JMU Würzbu reg. data red	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 71 / 280	





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

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.				
	reg. data record Master (120 ECTS) Physik - 2010				
Module title				Abbreviation	
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Semiconductor Nanostructures				11-HNS-092-m01	
Module coordinator			Module offered by		
Managing Dire	ector of the Institute of A	pplied Physics	Faculty of Physics a	nd Astronomy	
ECTS Metho	od of grading	Only after succ. com	ly after succ. compl. of module(s)		
6 nume	rical grade				
Duration	Module level	Other prerequisites			
1 semestergraduateCertain prerequisites must be met to qualify for admission to sessment. The lecturer will inform students about the respend at the beginning of the course. Registration for the course will sidered a declaration of will to seek admission to assessme dents have obtained the qualification for admission to asses the course of the semester, the lecturer will put their registra sessment into effect. Students who meet all prerequisites wi ted to assessment at a later date, students will have to obtain the qualification of the 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		
Contents		•			
or macroscopi ging their size tures of varyin with a focus o of novel optoe for quantum c	or nanostructures are free ic crystals, their electron of The lecture addresses t og dimensions (2D, 1D, ol n optical properties and electronic and quantum p ommunication and quan	quently referred to as ic, optical and magne echnological challens D). It provides the bas light-matter coupling photonic devices base tum computing archit	"artificial materials" tic properties can be ges in the preparatio sic theoretical conce . Moreover, it discus ed on such nanostru- tectures.	. In contrast to atoms, molecules e systematically tailored by chan- on of semiconductor nanostruc- pts to describe their properties, ses the challenges and concepts ctures, including building blocks	
Intended lear	ning outcomes				
The students I knowledge of devices. They	know the theoretical prin the technological metho are able to apply their kr	ciples and characteri ds to fabricate such s nowledge to problems	stics of semiconduct tructures, and of the in this field of resea	tor nanostructures. They have eir applications to novel photonic arch.	
Courses (type, r	number of weekly contact hours,	language — if other than Ger	man)		
R + V (no infor	mation on SWS (weekly	contact hours) and co	ourse language avail	able)	
Method of ass module is creditab	<b>sessment</b> (type, scope, langua le for bonus)	age — if other than German, e	examination offered — if no	t every semester, information on whether	
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009. Language of assessment: German, English					
Allocation of p	olaces				
Additional inf	ormation				
Workload					

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 73 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

# Teaching cycle

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

<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)
Module appears in
Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Nanostructure Technology (2010)
Bachelor' degree (1 major) Nanostructure Technology (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) Technology of Functional Materials (2010)
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 (2011)
Master's degree (1 major) Computational Mathematics (2012)
Master's degree (1 major) Functional Materials (2012)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 74 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module	e title				Abbreviation		
Lithography in Semiconductor Technology and Theory of Quantum Transport				uantum Transport	11-LHQ-092-m01		
Module coordinator				Module offered by			
Managi	ng Dire	ector of the Institute of A	Applied Physics	plied Physics Faculty of Physics and Astronomy			
ECTS	Metho	od of grading	Only after succ. con	Only after succ. compl. of module(s)			
6	nume	rical grade					
Duratio	n	Module level	Other prerequisites				
1 semester graduate		Certain prerequisite sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the se sessment into effect ted to assessment in sessment at a later admission to assess	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						
Introdu on qua	ction to ntum tr	o the lithographic techn ansport.	iques of semiconducto	or technology and di	scussion of the required theory		
Intende	ed learı	ning outcomes					
The stu transpo	dents l ort.	nave specific and advar	nced knowledge of sen	niconductor lithogra	bhy and of the theory of quantum		
Course	<b>S</b> (type, n	umber of weekly contact hours	, language — if other than Ger	rman)			
R + V (n	o infor	mation on SWS (weekly	contact hours) and co	ourse language availa	able)		
Methoo module is	d of ass creditab	e <b>essment</b> (type, scope, lang le for bonus)	uage — if other than German, o	examination offered — if no	t every semester, information on whether		
a) writte groups project (approx Assess and wil examin Langua	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.						
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							
Bachel	or' deg	ree (1 major) Physics (2	010)				
Master's wi	th 1 majoı	Physics (2010)	JMU Würzbu	rg • generated 26-Aug-2024	• exam. page 75 / 280		

### Julius-Maximilians-UNIVERSITÄT WÜRZBURG

Bachelor' degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Physics (2010) 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 with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 76 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title				Abbreviation		
Magnetism			11-MAG-092-m01			
Module coordinator				Module offered by	Module offered by	
Managing Director of the Institute of Ap		oplied Physics	Faculty of Physics a	nd Astronomy		
ECTS Method of grading		Only after succ. compl. of module(s)				
6	nume	rical grade				
Duratio	n	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 an aver.				
Conten	ts		•			
Dia- and ture, na fect.	d parar anomag	nagnetism, exchange inf gnetism, superparamagn	eraction, ferromagne etism, experimental ı	tism, antiferromagne methods to measure	etism, anisotropy, de magnetic properties	omain struc- s, Kondo ef-
Intende	ed learı	ning outcomes				
The stu experin ches ar on prob	dents   nents; f nd are a olems o	know basic terms, conce they are skilled in simple able to apply them to tas of these areas; they are a	pts and phenomena of model building and ks in the stated areas ble to evaluate the ac	of magnetism and m in the formulation of s; they have compete ccuracy of observatio	easuring methods for mathematical-phys encies in independer ons and analyses.	or magnetic ical approa- ntly working
Courses	S (type, n	umber of weekly contact hours,	language — if other than Ger	rman)	11.	
R + V (n		mation on SWS (weekly	contact hours) and co	ourse language availa	able)	
method module is	creditab	<b>ESSMENT</b> (type, scope, langua le for bonus)	ige — if other than German, (	examination offered — if no	t every semester, informati	ion on whether
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.						
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Workload						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Master's wi	th 1 major	Physics (2010)	JMU Würzbu reg. data rec	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 77 / 280



## Module appears in

Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Nanostructure Technology (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 with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 78 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module	Module title			Abbreviation		
Magnetism and Spin Transport     11-MST-092-m01					11-MST-092-m01	
Module coordinator				Module offered by		
Managing Director of the Institute of Ap		plied Physics	plied Physics Faculty of Physics and Astronomy			
ECTS	Metho	od of grading	Only after succ. con	Only after succ. compl. of module(s)		
6	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
2 semester graduate Certain prerequisites must be met to qualify fo sessment. The lecturer will inform students abo at the beginning of the course. Registration for sidered a declaration of will to seek admission dents have obtained the qualification for admi the course of the semester, the lecturer will pur sessment into effect. Students who meet all pr ted to assessment in the current or in the subs sessment at a later date, students will have to			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			
Conten	its					
les of n to char tallic sy tion in rent-ind Intende The stu tic expe an over mulatic	Ine module spans two semesters. During the winter semester, the students become acquainted with the princip- les of magnetism (ranging from atoms to solids), properties of magnetic material (individual usage) and methods to characterise magnetic properties. During the summer semester, the students learn about spin transport in me- tallic systems in due consideration of giant magnetoresistance and tunnel magnetoresistance and its applica- tion in magnetic memory. As a last point, we discuss new phenomena from the field of spin dynamics and cur- rent-induced spin phenomena. Intended learning outcomes The students know the basic terms, concepts and phenomena of magnetism and measuring methods for magne- tic experiments; they are familiar with spin transport applications of information technologies and have gained an overview of modern findings in this area (GMR, TMR). They are skilled in simple model building and in the for-					
Course	<b>S</b> (type, n	number of weekly contact hours, l	anguage — if other than Ger	rman)		
V + R +	V (no i	nformation on SWS (wee	kly contact hours) an	d course language a	vailable)	
Method module is	<b>d of ass</b> s creditab	<b>sessment</b> (type, scope, langua le for bonus)	ge — if other than German, o	examination offered — if no	t every semester, information on whether	
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009. Language of assessment: German, English						
Allocat	ion of p	olaces				
Additio	Additional information					
Worklo	ad					

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 79 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

## 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)

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

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 with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.		
	reg. data record Master (120 ECTS) Physik - 2010		

Module title			Abbreviation			
Nanoanalytics				11-NAN-092-m01		
Module coordinator				Module offered by		
Managing Director of the Institute of Applied			oplied Physics	Faculty of Physics and Astronomy		
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites	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				
Conten	ts			sment anew.		
Principles of analytic procedures in the field of nanostructure physics, imaging techniques from a microscopic level up to an atomic level, examination of chemical composition, spectroscopy of electronic properties, usage of X-ray methods Physics and material systems on the nanoscale Scanning probes: Atomic force microsco- py. Scanning tunneling microscopy Electron probes: Scanning electron microscope. Transmission electron mi- croscope Secondary ions - mass spectrometry - X-ray methods: Synchrotron spectroscopy. Photoemission. X- ray absorption Intended learning outcomes The students have basic knowledge of modern research methods for different nanostructures up to an atomic le- vel. They know microscoping procedures that are used in practice in labs and the industry as well as spectrosco- pic methods for the determination of electronic properties. They are able to evaluate the efficiency of different re- search methods. <b>Courses</b> (type, number of weekly contact hours, language – if other than German)						
Methoo module is	<b>d of ass</b> creditab	<b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009. Language of assessment: German, English						
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 81 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

# Teaching cycle

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

<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)
Module appears in
Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Nanostructure Technology (2010)
Bachelor' degree (1 major) Nanostructure Technology (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) 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) Functional Materials (2012)

Master's with 1 major Physics (2010)	JMU Würzburg ● generated 26-Aug-2024 ● exam.	page 82 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title Abbreviation			Abbreviation		
Low-Dimensional Structures				11-NDS-092-m01	
Module coordinator			Module offered by		
Manag	ing Dire	ector of the Institute of Ap	oplied Physics	Faculty of Physics a	and Astronomy
ECTS	Methe	od of grading	Only after succ. con	npl. of module(s)	
4	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	graduate	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective detail 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 admi 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		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
Conten	ts				
Contents         Low-dimensional structures: Crystal lattice symmetry. Lattice dynamics and growth techniques of low-dimensional structures. Comparison between these structures and volume solids. X-ray diffractometry. Molecular beam epitaxy.         Intended learning outcomes         The students have knowledge of the theoretical principles of the growth of low dimensional structures. They know methods of producing and analysing such structures. They know the bandstructures of the most important semiconductors as well as the fabrication and characteristics of semiconductor heterostructures and MOS-diodes. They are familiar with the subband structure of semiconductor heterostructures and MOS-diodes and can evaluate the importance of many-particle effects. They are able to solve problems related to potentials in one dimension by applying Poisson's equation. They know the k*p perturbation theory and can deduce the 2D subband structure from the bulk band structure. They have knowledge of the meaning of modulation doping and are familiar with the 2D hydrogen atom. They understand how an external magnetic field acts on the properties of a free electron gas in 2D. They have basic knowledge of the meaning of gauging, Landau-quantisation, filling factor, and are able to solve implicit problems via numerical methods. They are familiar with elementary excitations in two dimensions in two dimensions in the solve implicit problems via numerical methods. They are familiar with elementary excitations in the solve implicit problems via numerical methods. They are familiar with elementary excitations in two dimensions in two dimensions in the solve implicit problems via numerical methods. They are familiar with elementary excitations in two dimensions are able to solve implicit problems via numerical methods. They are familiar with elementary excitations in two dimensions in the solve implicit problems via numerical meth					
Course	<b>S</b> (type, r	number of weekly contact hours, l	anguage — if other than Gei	man)	
R + V (r	no infoi	mation on SWS (weekly o	contact hours) and co	urse language avail	able)
<b>Method of assessment</b> (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)					
<ul> <li>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)</li> <li>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.</li> <li>Language of assessment: German, English</li> </ul>					

Allocation of places

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## Additional information

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Master's with 1 major Physics (2010)	IMU Würzburg • generated 26-Aug-2024 • exam.	page 83 / 280
	,	p=3==97, ===
	reg, data record Master (120 ECTS) Physik - 2010	

### Workload

Teaching cycle

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

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## Module appears in

Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) 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 with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 84 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Master's with 1 major Physics (2010)

Module title		Abbreviation			
Nanoelectronics			11-NEL-092-m01		
Module coordinator Mo		Module offered by			
Managing Director of the Institute of Applied Physics		oplied Physics	Faculty of Physics and Astronomy		
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
6	nume	rical grade			
Duration Module level Other prerequisites					
1 seme:	ster	graduate	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective detail 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 admi 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		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
Conten	ts				
Afterwa function of nance the ope	The lecture and the corresponding exercises convey basic concepts of electronics of nanostructures. First, we discuss terms such as Fermi distribution, density of states and carrier concentration in view of small structures. Afterwards, we talk about application potentials of nanostructures in electronics. We examine the limits of the function of common switches and storages through miniaturisation and compare them to electronic properties of nanostructures. We gain an overview of nanoelectric amplifiers, rectifier, logic lattices and circuits and discuss the operating principle of quantum computers.			tion in view of small structures. We examine the limits of the them to electronic properties that and circuits and discuss	
Intended learning outcomes					
The stu ons and	dents l d applie	nave mastered the basics cations of respective com	s of electronics of nar ponents.	ostructures in theor	y and practice. They know functi-
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
R + V (n	o infor	mation on SWS (weekly o	contact hours) and co	urse language availa	able)
Methoo module is	<b>d of ass</b> creditab	<b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.					
Additional information					
Worklo	Workload				
Teachir	ng cycl	9			

JMU Würzburg • generated 26-Aug-2024 • exam. reg. data record Master (120 ECTS) Physik - 2010

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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) Nanostructure Technology (2010)

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

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 with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 86 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title		Abbreviation				
Nano-Optics		11-NOP-092-m01				
Module coordinator Module offered b		Module offered by				
Managing Director of the Institute of Applied Physics Faculty of Ph		Faculty of Physics a	nd Astronomy			
ECTS Method of grading Only after succ. compl. of module(s)						
4	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme:	ster	graduate	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as sessment into effect. Students who meet all prerequisites will be admit ted to assessment in the current or in the subsequent semester. For as sessment at a later date, students will have to obtain the qualification admission to assessment anow.		as- tive details ll be con- nt. If stu- sment over tion for as- ill be admit- ster. For as- alification for	
Conten	ts					
Theoret quantu	tical pri m emit	inciples. Focussing of lig ters. Light emission in n	ght. Microscopy. Optic ano-tailored environn	al nearfield probes. 1ents. Plasmons. Op	Nearfield microscop tical antennas.	y. Single
Intende	ed learı	ning outcomes				
The stu retical p	dents l princip	nave specific and advan les and application area	ced knowledge in the s of nano-optics and v	field of nano-optics. with current develop	They are familiar wi ments in this field.	th the theo-
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)						
R + V (no information on SWS (weekly contact hours) and course language available)						
<b>Method of assessment</b> (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)				on on whether		
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.			amination in iutes) or c) esentation sessment demic and			
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Workload						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Bachel	or' deg	us III ree (1 major) Physics (20	10)			
Mactor	thematic		(ALL 14/5. 1	ra a appointed of Autors	ovom	nogo 0= / - 0 -
master's Wi	un i majoi	FILYSICS (2010)	reg. data rec	cord Master (120 ECTS) Physik	- exam. ( - 2010	page 8/ / 280

#### Julius-Maximilians-UNIVERSITÄT WÜRZBURG



Bachelor' degree (1 major) 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) 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)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 88 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

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Module	Abbreviation					
Quantu	uantum Mechanics II 11-QM2-092-m01					
Module coordinator		Module offered by				
Managi and Ast	anaging Director of the Institute of Theoretical Physics Faculty of Physics and Astronomy nd Astrophysics					
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
8	nume	rical grade				
Duratio	Duration Module level		Other prerequisites	;		
1 semester undergraduate		Certain prerequisite sessment. The lectu at the beginning of sidered a declaration dents have obtained the course of the set sessment into effect ted to assessment i sessment at a later admission to asses	rerequisites must be met to qualify for admission to as- t. The lecturer will inform students about the respective details ginning of the course. Registration for the course will be con- a declaration of will to seek admission to assessment. If stu- ve obtained the qualification for admission to assessment ove se of the semester, the lecturer will put their registration for as- t into effect. Students who meet all prerequisites will be admit sessment in the current or in the subsequent semester. For as- t 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- alification for	
Conten	ts					
Physics gree. W should 1. Seco 2. Banc 3. Angu 4. Scatt 5. Relat of atom 6. Quar 7. Canco Intende	s. It bui /hile th include nd qua d struct ular mo tering t tivistic nic spee ntum en onical for ed learn	Ids upon basics which e specific emphasis car e: ntisation: Fermions and ures of particles in a cr mentum, symmetry ope heory: Potential scatter quantum mechanics: K ctra ntanglement ormalism	are acquired in the lec n be adjusted individu d bosons ystal erators, Lie Algebras ring, partial wave expa lein-Gordon equation,	ture "Quantum mech ally, the core topics t nsion Dirac equation, Lore	tanics I" of the Bach that are supposed to tz group, fine structi	elor's de- be covered ure splitting
The students acquire in-depth knowledge of advanced quantum mechanics and have a thorough understanding of the mathematical and theoretical concepts of the listed topics. They are able to describe or model problems of modern theoretical Quantum Physics mathematically, to solve problems analytically, to use approximation me- thods and to interpret the results physically. The course is pivotal to subsequent theory courses in Astrophysics, High-Energy Physics and Condensed Matter/Solid-State Physics. The course is mandatory for all Master's stu- dents.						
Course	S (type, n	umber of weekly contact hours	s, language — if other than Ge	rman)		
R + V (n	no infor	mation on SWS (weekly	y contact hours) and co	ourse language availa	able)	
<b>Method of assessment</b> (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus)						
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009. Language of assessment: German, English						
Master's wi	ith 1 majoi	Physics (2010)	JMU Würzbu reg. data re	urg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. k - 2010	page 89 / 280

Allocation of places
Additional information
Workload
Teaching cycle
-
Referred to in LPO I (examination regulations for teaching-degree programmes)
Module appears in
Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Nanostructure Technology (2012)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Mathematics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Mathematical Physics (2012)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Computational Mathematics (2012)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 90 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title		Abbreviation				
Quantum Phenomena in electronic correlated Materials11-QPM-092-m01						
Module coordinator Module offered by						
Managing Director of the Institute of Applied Physics Faculty of Physics and Astronomy						
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duratio	on	Module level	Other prerequisites	i i		
1 semester graduate Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective of at the beginning of the course. Registration for the course will be of sidered a declaration of will to seek admission to assessment. If so dents have obtained the qualification for admission to assessment the course of the semester, the lecturer will put their registration for sessment into effect. Students who meet all prerequisites will be ted to assessment in the current or in the subsequent semester. F sessment at a later date, students will have to obtain the qualification admission to accessment anow.		as- tive details Il be con- nt. If stu- ssment over tion for as- til be admit- ster. For as- alification for				
Conten	ts					
Quantu Strongl	ım effe y corre	cts and phenomena in lated systems	current solid-state rese	earch. Correlations. F	ree electron gas and	l Fermi liquid.
Intende	ed lear	ning outcomes				
The stu quantu retical o	idents l m effeo descrip	nave specific, advance tts in strongly correlate tion of such systems a	d knowledge of the cur ed systems. They are ab nd the current experim	rent research on Soli le to understand the ental results.	d-State Physics, esp connections betwee	ecially on en the theo-
Course	<b>S</b> (type, r	umber of weekly contact hour	s, language — if other than Ge	rman)		
R + V (n	no infor	mation on SWS (week	y contact hours) and co	ourse language avail	able)	
Methoo module is	d of ass creditab	s <b>essment</b> (type, scope, lang le for bonus)	guage — if other than German,	examination offered — if no	it every semester, informat	on on whether
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.				amination in iutes) or c) esentation sessment demic and		
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teaching cycle						
Referre	a to in	LPU I (examination regulat	ons for teaching-degree progra	ummes)		
 Module		ore in				
module	- ahhea	115 III				
Master's wi	ith 1 majo	Physics (2010)	JMU Würzbu reg. data re	rrg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 91 / 280



Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) 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) FOKUS Physics - Nanostructuring Technology (2010) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2010)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 92 / 28
	reg. data record Master (120 ECTS) Physik - 2010	

Module title Abbreviation		Abbreviation				
Many B	Many Body Quantum Theory   11-QVTP-092-m01					
Module coordinator				Module offered by		
Managing Director of the Institute of Theoretical Physics and Astrophysics			Theoretical Physics	Faculty of Physics and Astronomy		
ECTS Method of grading Only after succ. compl. of module(s)						
8	nume	rical grade				
Duratio	n	Module level	Other prerequisites	;		
1 seme	ster	graduate	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective deta 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 of the course of the semester, the lecturer will put their registration for sessment into effect. Students who meet all prerequisites will be adr ted to assessment in the current or in the subsequent semester. For sessment at a later date, students will have to obtain the qualification			o as- ctive details ill be con- nt. If stu- ssment over ation for as- ill be admit- ster. For as- alification for
Conten	ts					
This will Green's An outl 1 Single 2 Revie 3 Diagr 4 Diagr 5 Landa 6 Supe 7 One-o	This will usually be a course on quantum many particle physics approached by the perturbative methods using Green's functions. An outline could be: 1 Single-particle Green's function 2 Review of second quantization 3 Diagrammatic method using many particle Green's functions at temperature T=0 4 Diagrammatic method for finite T 5 Landau theory of Fermi liquids 6 Superconductivity				hods using	
Intende	ed lear	ning outcomes				
The stu ply the	dents l acquir	have mastered the prir ed methods to current	nciples of quantum field problems of Theoretica	d theory in many-part Il Solid-State Physics	ticle systems. They a	ire able to ap-
Course	<b>S</b> (type, r	number of weekly contact hou	rs, language — if other than Ge	rman)		
R + V (n	infor	mation on SWS (week	y contact hours) and co	ourse language avail	able)	
Methoo module is	<b>d of ass</b> creditab	<b>essment</b> (type, scope, lan le for bonus)	guage — if other than German,	examination offered — if no	ot every semester, informat	ion on whether
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.						
Allocation of places						
Additional information						
Master's wi	ith 1 majo	r Physics (2010)	JMU Würzbu reg. data re	urg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. k - 2010	page 93 / 280

### Workload

Teaching cycle

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

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## Module appears in

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

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 94 / 28
	reg. data record Master (120 ECTS) Physik - 2010	

Module title		Abbreviation				
Relativi	Relativistic Effects in Mesoscopic Systems       11-RMS-092-m01					
Module coordinator			Module offered by			
Managing Director of the Institute of Theoretical Physics and Astrophysics			Theoretical Physics	Faculty of Physics and Astronomy		
ECTS	ECTS Method of grading Only after succ. compl. of module(s)					
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semes	ster	graduate	luate 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 f			o as- ctive details ill be con- nt. If stu- ssment over ation for as- ill be admit- ster. For as- alification for
Conten	ts					
Relativi logical	stic eff insulat	ects in mesoscopic sys ors Majorana fermio	stems Spin-orbit coup	oling Dirac equatio	n Quantum Hall ef	fect Topo-
Intende	ed learn	ning outcomes				
The stu especia	dents l ally in t	nave mastered the mat he field of mesoscopic	hematical methods for physics. They are able	the description of re to apply their knowl	lativistic quantum s edge to simple syste	ystems, ems.
Courses	<b>5</b> (type, n	umber of weekly contact hour	s, language — if other than Ge	rman)		
R + V (n	o infor	mation on SWS (weekl	y contact hours) and co	ourse language availa	able)	
Method module is	<b>l of ass</b> creditab	e <b>ssment</b> (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.				amination in nutes) or c) esentation sessment demic and		
Allocati	ion of p	olaces				
 Additional information						
Teaching cycle						
Kererre	a to in	LTUI (examination regulati	ons for teaching-degree progra	ammes)		
 Module appears in						
Master's wi	tn 1 major	Physics (2010)	JMU Würzbu reg. data red	irg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 95 / 280



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)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 96 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title Abbreviation							
Theoret	Theoretical Solid State Physics     11-TFK-092-m01						
Module coordinator			Module offered by				
Managi and Ast	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. compl. of module(s)				
8	nume	rical grade					
Duratio	n	Module level	Other prerequisites	i			
1 semestergraduateCertain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective de 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 the course of the semester, the lecturer will put their registration for sessment into effect. Students who meet all prerequisites will be acted to assessment at a later date, students will have to obtain the qualification		as- tive details ll be con- nt. If stu- sment over tion for as- ill be admit- ster. For as- alification for					
Conten	ts						
Principl thods. I	es of T Magne	heoretical Solid-State I tism. Superconductivit	Physics. Fermi liquid th y.	eory. Electron-electro	on interaction. Varia	tional me-	
Intende	ed learı	ning outcomes					
The students have basic knowledge of the theoretical description of solid-state phenomena. They know the cor- responding mathematical or theoretical methods and are able to apply them to basic problems of solid-state theory and to understand the connections to experimental results. The individual students have elaborated on				ow the cor- olid-state porated on			
Courses	<b>5</b> (type, n	umber of weekly contact hour		rman)	•		
R + V (n	o infor	mation on SWS (weekl	v contact hours) and co	ourse language availa	able)		
Method module is	<b>l of ass</b> creditab	essment (type, scope, lang	uage — if other than German,	examination offered — if no	t every semester, informati	on on whether	
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.							
Allocati	ion of p	olaces					
Additional information							
Workload							
Teachin	ng cycl	e					
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)							
Master's wit	th 1 majoi	Physics (2010)	JMU Würzbu reg. data red	rrg • generated 26-Aug-2024 cord Master (120 ECTS) Physik	• exam. < - 2010	page 97 / 280	





## 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)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 98 / 28
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation			
Theory of Superconduction				11-TSL-092-m01		
Module coordinator Modu			Module offered by			
Managing Director of the Institute of Theoretical Physics and Astrophysics			Theoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	CTS Method of grading Only after succ. compl. of module(s)					
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective deta 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 of the course of the semester, the lecturer will put their registration for a sessment into effect. Students who meet all prerequisites will be adm ted to assessment in the current or in the subsequent semester. For a sessment at a later date, students will have to obtain the qualification			) as- tive details ll be con- nt. If stu- ssment over tion for as- ill be admit- ster. For as- alification for
Conten	ts		•			
Introdu Phenon vity (An elemen	ction to nenolo dreev s ts.	o the phenomenom of gical theory of superco scattering, Bobolioubo	superconductivity. Mic nductivity (Ginzburg-La v-de Gennes equation,	roscopic theory of su andau theory). Mesos SQUIDS). Quantum o	perconductivity (BC scopic aspects of su computing with supe	S theory). perconducti- erconductive
Intende	ed learr	ning outcomes				
The students have basic knowledge of the theoretical models for the description of superconductivity. They know the properties and application areas of these models and are able to apply calculation methods to simple problems.						
Courses	<b>5</b> (type, n	umber of weekly contact hour	s, language — if other than Ge	rman)		
R + V (n	o infor	mation on SWS (weekl	y contact hours) and co	ourse language availa	able)	
Method module is	l of ass creditab	e <b>essment</b> (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informati	on on whether
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009. Language of assessment: German, English						
Allocati	ion of p	olaces				
Additional information						
Workload						
Teachir	ng cycl	9				
Master's wi	th 1 major	Physics (2010)	JMU Würzbu reg. data reg	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 99 / 280



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

## Module appears in

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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 (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)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 100 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation			
Renormalization Group Methods in Field Theory       11-RMFT-102-m01						
Module coordinator				Module offered by		
Managing Director of the Institute of Theoretical Pl and Astrophysics		Theoretical Physics	Faculty of Physics and Astronomy			
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites	i		
1 semes	1 semestergraduateCertain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective deta 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 of the course of the semester, the lecturer will put their registration for a sessment into effect. Students who meet all prerequisites will be adrited to assessment at a later date, students will have to obtain the qualification			o as- tive details ll be con- nt. If stu- ssment over tion for as- ill be admit- ster. For as- alification for		
Conten	ts					
Renorm analyse	alisati d beha	on group methods for i aviour of cryogenic tem	non-linear partial differ peratures.	ential equations, fiel	d theoretical contex	ts and non-
Intende	ed learr	ning outcomes				
The stu of the re	dents រ្ enorma	gain an overview of nor alisation group methoc	n-linearities in partial d I.	ifferential equations	and their solution o	n the basis
Courses	<b>5</b> (type, n	umber of weekly contact hour	s, language — if other than Ge	rman)		
V + R (n	o infor	mation on SWS (weekl	y contact hours) and co	ourse language availa	able)	
Method module is	l of ass creditab	e <b>essment</b> (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
a) writte groups project (approx Assessi and wil examin Langua	en exar (appro report 3. 30 m ment o l be an ation re ge of a	nination (approx. 90 m x. 30 minutes per canc (approx. 8 to 10 pages inutes) ffered: When and how nounced in due form u egulations) 2009. ssessment: German, E	ninutes) or b) oral exam lidate, for modules with , time to complete: 1 to often assessment will I nder observance of Sec nglish	ination of one candi n less than 4 ECTS cr 4 weeks) or d) prese be offered depends o ction 32 Subsection	date each or oral exa edits approx. 20 mir entation/seminar pre on the method of ase 3 ASPO (general aca	amination in nutes) or c) esentation sessment demic and
Allocati	ion of p	olaces				
Additio	nal info	ormation				
Worklo	ad					
Teaching cycle						
Referre	d to in	LPO I (examination regulati	ons for teaching-degree progra	immes)		
Module appears in						
Master's wi	th 1 major	Physics (2010)	JMU Würzbu reg. data re	irg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 101 / 280



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 (2010) Master's degree (1 major) Mathematical Physics (2012) 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)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 102 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module	title				Abbreviation	
Spintronics				11-SPI-102-m01		
Module coordinator			Module offered by			
Managing Director of the Institute of Ap		Applied Physics	plied Physics Faculty of Physics and Astronomy			
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semes	1 semestergraduateCertain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective detaat 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 of the course of the semester, the lecturer will put their registration for sessment into effect. Students who meet all prerequisites will be addited to assessment in the current or in the subsequent semester. For sessment at a later date, students will have to obtain the qualification admission to accompany.			o as- ctive details ill be con- nt. If stu- ssment over ation for as- ill be admit- ster. For as- alification for		
Conten	ts					
This lec magnet spin dy	ture co oresist namics	overs the basic principle tance and tunnel magnes and current-induced s	es of spin transport, wi etoresistance. As a las pin phenomena.	th a particular emph t point, we discuss n	asis on the phenom ew phenomena fron	ena of giant n the field of
Intende	ed learn	ning outcomes				
The stu mation nel mag	dents   techno gnetore	know the basic principle plogy. They have gained esistance).	es of spin transport mo an overview of curren	odels and the applica t findings in this field	ations of spin transp d (giant magnetoresi	oort in infor- istance, tun-
Courses	<b>5</b> (type, n	umber of weekly contact hours	, language — if other than Gei	rman)		
V + R (no information on SWS (weekly contact hours) and course language available)						
Method module is	l of ass creditab	<b>essment</b> (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
a) writte groups project (approx Assessi and wil examin Langua	a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.					
Allocati	ion of p	olaces				
Additio	nal inf	ormation				
Workload						
Teaching cycle						
Referre	d to in	LPO I (examination regulation	ons for teaching-degree progra	mmes)		
Master's wi	th 1 major	Physics (2010)	JMU Würzbu reg. data red	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 103 / 280



## 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) 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) Nanostructure Technology (2010) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) FOKUS Physics (2010)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 104 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation			
Methods in Surface Spectroscopy				11-MSS-102-m01		
Module coordinator			Module offered by			
Managing Director of the Institute of Ar		Applied Physics	plied Physics Faculty of Physics and Astronomy			
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
4	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semestergraduateCertain prerequisites must be met to qualify for admisessment. The lecturer will inform students about the at the beginning of the course. Registration for the considered a declaration of will to seek admission to assidered a declaration of will to seek admission to assidents have obtained the qualification for admission the course of the semester, the lecturer will put their sessment into effect. Students who meet all prerequited to assessment at a later date, students will have to obtain admission to assign the course of the semester of the set		alify for admission to nts about the respec- ion for the course wi hission to assessment r admission to asses will put their registra t all prerequisites w e subsequent semest ave to obtain the qu	o as- ctive details ill be con- nt. If stu- ssment over ation for as- till be admit- ster. For as- alification for			
Conten	ts					
Bounda les of p shape, radiatic	ary con hotoel satellit on, rela	ditions of experiments ectron spectroscopy (P tes, Fermi liquid, quasi ted experimental meth	: Ultra-high vacuum, su ES), one-particle image particles, exemplary sy ods.	rface sensibility, ligh of PES, three step n stems and spectra, r	nt-matter-interaction nodel, many-particle neasurements with	, princip- effects, line synchrotron
Intende	ed leari	ning outcomes				
The stu conduc	dents l t, evalı	know the physical prinuate and interpret simp	ciples and experimenta	l methods of surface	e spectroscopy. They	are able to
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)						
V (no information on SWS (weekly contact hours) and course language available)						
Methoo module is	<b>of ass</b> creditab	s <b>essment</b> (type, scope, lang le for bonus)	guage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
a) writte groups project (approx Assessi and wil examin Langua	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.					amination in nutes) or c) esentation sessment demic and
Allocat	ion of p	olaces				
Additional information						
Worklo	ad					
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Master's wi	th 1 majoı	r Physics (2010)	JMU Würzbu reg. data red	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 105 / 280

## Module appears in

Bachelor' degree (1 major) Nanostructure Technology (2012) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) FOKUS Physics (2006)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 106 / 280
	reg. data record Master (120 ECTS) Physik - 2010	1

Module title Abbreviation						
Electron Electron Interaction 11-EEW-102-m01						
Module coordinator			Module offered by			
Managing Director of the Institute of Thand Astrophysics		eoretical Physics	Faculty of Physics a	nd Astronomy		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
4	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semes	graduate Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective deta 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 o the course of the semester, the lecturer will put their registration for a sessment into effect. Students who meet all prerequisites will be admited to assessment in the current or in the subsequent semester. For a sessment at a later date, students will have to obtain the qualification			as- tive details Il be con- nt. If stu- sment over tion for as- til be admit- ster. For as- alification for		
Conten	ts					
1. Introd teractio thod of dels. 10	ductior on). 4. l functio . Impu	n, systems, Landau theor ntroduction to boson pha onal integrals. 7. Renorm rities in Luttinger liquids	y2. Interacting electro ase fields and interac alisation groups.8. Co	on gas. 3. One-dimen tions. 5. Calculation onsideration of spin.	nsional electron gas of correlation functi 9. One-dimensiona	(without in- ons. 6. Me- l lattice mo-
Intende	d learı	ning outcomes				
The stu on.	dents l	know the principles of the	e theoretical descript	ion of electron-elect	ron interactions in o	ne dimensi-
Courses	<b>5</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V + R (n	o infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)	
Method module is	<b>l of ass</b> creditab	<b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, o	examination offered — if no	t every semester, informati	on on whether
a) writte groups project (approx Assessi and wil examin Langua	a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.					
Allocati	ion of p	olaces				
Additional information						
Worklo	ad					
Teachir	ıg cycl	e				
 Def-	-					
Keferre	a to in	LPUI (examination regulation:	s for teaching-degree progra	mmes)		
 Master's wi	Aster's with 1 major Physics (2010) JMU Würzburg • generated 26-Aug-2024 • exam. page 107 / 280 reg. data record Master (120 ECTS) Physik - 2010					



## Module appears in

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 (2006)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 108 / 280				
	reg. data record Master (120 ECTS) Physik - 2010					
Module	e title				Abbreviation	
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Theoretical Solid State Physics 2     11-TFK2-111-m01					11-TFK2-111-m01	
Module	e coord	inator		Module offered by		
Managi and Ast	ng 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 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	ts					
a) meta b) trans c) magr d) elect e) one-e Intende The stu mathen stand th solid-st	ar-insul sport p netic in cron-ph dimens ed learn dents l natical he con cate the	ators and topological ins henomena npurities in metals. Kond onon interaction sional conductors <b>hing outcomes</b> have advanced knowledg or theoretical methods a nections to experimental eory and have discussed	uiators o effect and heavy fe ge of the theoretical d ind are able to apply results. The individu this topic in a semina	rmions escription of solid-si them to problems of al students have ela ar presentation.	tate phenomena. They know the solid-state theory and under- borated on an advanced topic of	
Course	<b>S</b> (type, r	number of weekly contact hours, l	anguage — if other than Ger	rman)		
V + R (n	io infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)	
Methoo module is	<b>d of ass</b> creditab	sessment (type, scope, langua	ge — if other than German, o	examination offered — if no	t every semester, information on whether	
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.						
Allocat	Allocation of places					
Additional information						
Worklo	ad					

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 109 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

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

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## Module appears in

Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2010) 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 (2006)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 110 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module	e title				Abbreviation	
Introduction to Electron Microscopy					11-IEM-111-mo1	
Module coordinator				Module offered by		
Manag	ing Dire	ector of the Institute of Ap	oplied Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)		
4	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				
Conten	its					
(selected on tech formati image f 7. Cher spectro	ed-area inique) ion, ima formati nical ar oscopy)	a ED, convergent beam EI . 4. Transmission electro aging of microstructure). on, image simulation). 6 nalysis with the electron . 8. Sample preparation.	D, basics of electron on n microscopy (the ins 5. Can we see atoms Scanning electron m microscope (energy-on Electron microscopy	rystallography, com strument, contrast m High-resolution ele hicroscopy (the instru lispersive X-ray micr and complementary	parison with the X-ray diffracti- echanisms, principles of image ctron microscopy (principle of ument, contrast mechanisms). oanalysis, electron energy loss techniques.	
Intende	ed learı	ning outcomes				
The stu They kr copic n	idents l now mio nethod	have basic knowledge of croscoping procedures th s for chemical analysis. T	modern research me nat are used in practio hey are able to evalu	thods of electron mi ce in labs and the ind ate the efficiency of	croscopy up to an atomic level. dustry as well as electron-micros- different research methods.	
Course	<b>S</b> (type, n	number of weekly contact hours, l	anguage — if other than Ger	man)		
V + R (r	no infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)	
Metho module is	<b>d of ass</b> s creditab	<b>eessment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009. Language of assessment: German, English						
Allocat	Allocation of places					
Additio	Additional information					
Worklo	ad					

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 111 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

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

<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)
Module appears in
Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Nanostructure Technology (2010)
Bachelor' degree (1 major) Nanostructure Technology (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) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Functional Materials (2012)
Master's degree (1 major) FOKUS Physics (2006)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 112 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Master's with 1 major Physics (2010)

Module	title				Abbreviation
Field Th	neory i	n Solid State Physics			11-FTFK-112-m01
Module	Module coordinator			Module offered by	
Managi and Ast	ing Dire trophys	ector of the Institute of Th sics	neoretical 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	n	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			
Conten	ts		L		
outline 1 Coher 2 The fu 3 Pertur 4 Order 5 Green 6 The La 7 Furthe	could rent sta unction rbation param s func andau er deve	tes and review of second ates and review of second at integral formalism at f theory at T=0 teters and broken symme tions theory of Fermi liquids lopments	d quantization inite temperatures T etry		
Intende	ed lear	ning outcomes	-		
The stu ply the	dents l acquir	have mastered the princi ed methods to current pr	ples of quantum field oblems of Theoretica	theory in many-part Solid-State Physics	icle systems. They are able to ap-
Course	<b>S</b> (type, r	number of weekly contact hours,	anguage — if other than Ger	man)	
V + R (n	io infor	mation on SWS (weekly	contact hours) and co	ourse language availa	able)
Methoo module is	<b>d of ass</b> creditab	<b>sessment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and and will be approxed).					
Allocation of places					
Additio	nal inf	ormation			
Worklo	ad				

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

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## Module appears in

Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) Nanostructure Technology (2010) 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 (2006)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 114 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation			
Density Functional Theory and the Physics of Oxide Heterostructure			11-DFT-142-m01			
Module coordinator				Module offered by		
chairpe	erson o	f examination committe	ee	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
4	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts		-			
The stu of dens prograr theory.	idents a sity fun mmes s	are familiar with the ph ctional theory. They are such as Wien2k or VASF	ysical values of oxide h able to model problen P. They can make simpl	neterostructures and ns of Theoretical Phy le calculations with t	with the principles a sics with the help of he help of density fu	and methods important nctional
Intende	ed lear	ning outcomes				
The stu of dens prograr theory.	idents a sity fun mmes s	are familiar with the ph ctional theory. They are such as Wien2k or VASF	ysical values of oxide h able to model problen P. They can make simpl	neterostructures and ns of Theoretical Phy le calculations with t	with the principles a sics with the help of he help of density fu	and methods important inctional
Course	<b>S</b> (type, r	number of weekly contact hours	s, language — if other than Ger	rman)		
V + D (r	no infoi	mation on SWS (weekl	y contact hours) and co	ourse language avail	able)	
Methoo module is	<b>d of ass</b> creditab	<b>sessment</b> (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informati	on on whether
(approx report ( (approx Assess and wil gulatio Langua	a) written examination (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: approx. 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 ASPO (general academic and examination re- gulations) 2009.					r c) project esentation sessment amination re-
Allocat	ion of <sub>l</sub>	olaces				
Additio	nal inf	ormation				
 Worklo	ad					
 Taaabii		-				
reachin	ng cyci	e				
	d 6 - 1					
Keterred to In LPU I (examination regulations for teaching-degree programmes)						
Module	e appea		<u> </u>			
Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011)						
Master	's degr	ee (1 major) Nanostruct	ure Technology (2011)			
Master's degree (1 major) Nanostructure Technology (2010)						
Master	Master's degree (1 major) FOKUS Physics (2010)					
Master	s degr	ee (1 major) FUKUS Phy	SICS (2011)	ra a gonorated of Aug and	0Y2m	D200 445 / 202
master S WI	iai i majo		reg. data red	cord Master (120 ECTS) Physik	< - 2010	page 115 / 200

Module	title				Abbreviation	
Computational Materials Science 11-CMS-122-mo1						
Module coordinator				Module offered by		
Managi and Ast	ng Dire trophys	ector of the Institute of sics	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	n	Module level	Other prerequisites			
1 semester graduate		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	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	tc					
Green's on/Lan interact plemen ten prop 4-5 topi the exe	s functi czos), i tion, dy t the b gramm ics of tl rcise.	ons, quantum dots, An introduction to continu vnamic mean field theo asic ideas of different es. Electronic submiss he lecture/exercise (fre	derson impurity model ous-time quantum Mor ory (DMFT exercise). Lec algorithms, either base ion of all exercises and eely chosen by the stud	(exercise, implemer nte Carlo (exercise), ture + 4-5 exercises d on template progra approx. 20 minutes ent) with a little mor	ntation of the exact of crystal field symmet in the CIP pool. The ammes or on comple presentation about e elaboration on the	Jiagonalisati- ry, Coulomb exercises im- etely self-writ- one of the topic than in
Intende	ed leari	ning outcomes				
Theoret liarity w function materia as the k Monte (	tical tre vith DF ns by p uls. Kno Kondo i Carlo fo	eatment of the above to a software packages su rojecting DFT results o owledge how to obtain regime. Ability to use in or the solution of the D	opics complemented by ich as VASP or Wien2k nto atomic orbitals usin many-body solutions o mpurity solvers based of MFT self-consistency ed	v hands-on tutorials t and and construction ng wannier90. Focus f the AIM and explor on exact diagonalizat quations.	to be held in the CIP n of maximally locali on applications to t e some of its limiting tion or continuous-ti	-Pool. Fami- ized Wannier opological g cases such me quantum
Course	<b>S</b> (type, n	umber of weekly contact hour	s, language — if other than Ge	rman)		
V + R (n	o infor	mation on SWS (weekl	y contact hours) and co	ourse language avail	able)	
Methoo module is	<b>l of ass</b> creditab	e <b>essment</b> (type, scope, lang le for bonus)	guage — if other than German,	examination offered — if no	ot every semester, informat	ion on whether
a) written examination (90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate) 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 or English						
Allocation of places						
Additional information						
L						
Master's wi	th 1 majoi	Physics (2010)	JMU Würzbu reg. data reg	rrg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. k - 2010	page 116 / 280

#### 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

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 (2010)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 117 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module	e title				Abbreviation	
Compu	Computational Materials Science 11-CMS-131-m01					
Module	e coord	inator		Module offered by		
Manag and As	ing Dire trophys	ector of the Institute of sics	Theoretical Physics	Faculty of Physics a	and Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
8	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 semester graduate		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	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 semesters			
Conten	Its					
Density Green's on/Lan interac plemer ten pro 4-5 top the exe	y tuncti s functi aczos), tion, dy nt the b gramm ics of th ercise.	onal theory (DFT)/local ons, quantum dots, An introduction to continu ynamic mean field theo asic ideas of different a es. Electronic submiss he lecture/exercise (fre	-density approximatior derson impurity model ous-time quantum Moi ry (DMFT exercise). Lec algorithms, either base ion of all exercises and ely chosen by the stud	a (exercise with "Wie (exercise, implemen nte Carlo (exercise), ture + 4-5 exercises d on template progra approx. 20 minutes ent) with a little mor	n2k"; band structure ntation of the exact of crystal field symmet in the CIP pool. The ammes or on comple presentation about e elaboration on the	e programme, diagonalisati- ry, Coulomb exercises im- etely self-writ- one of the e topic than in
Intende	ed lear	ning outcomes				
The stu algorith	idents l nms for	have advanced knowle the application of thes	dge of mathematical m se methods and to imp	ethods of material s lement them into pro	ciences. They are ab ogrammes.	le to develop
Course	<b>S</b> (type, r	number of weekly contact hour	s, language — if other than Ge	rman)		
V + R (r	no infor	mation on SWS (weekl	y contact hours) and co	ourse language avail	able)	
Metho module is	<b>d of ass</b> s creditab	<b>sessment</b> (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	ot every semester, informat	ion on whether
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009. Language of assessment: German, English						
Allocat	ion of p	olaces				
Additional information						
Workload						
Teaching cycle						
Master's w	Master's with 1 major Physics (2010)     JMU Würzburg • generated 26-Aug-2024 • exam. reg. data record Master (120 ECTS) Physik - 2010     page 118 / 280					

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

#### Module appears in

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 (2010)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 119 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title					Abbreviation	
Disorde	Disordered Systems 11-UGS-131-m01					
Module	e coord	inator		Module offered by		
Managi and Ast	ing Dire trophys	ector of the Institute of sics	Theoretical Physics	Faculty of Physics a	and Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
4	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		graduate	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	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 semesters		
Conten	ts					
help of transpo vers no with ran and in introdu integra man-Ka	quanti ort prop n-linea ndom i more th ced se l metho ac meth	an statistical methods perties, magnetic instat r partial differential eq nhomogeneity. Where a nan one space dimensi parately. As a methodo od is derived for classic nod).	which are introduced i pilities and phase trans uations, which also de applicable, exact solub on, diagram methods a plogical development o cal and quantum mecha	n a separate lesson. Sitions as well as conscribe systems far be wility in a space dime and renormalisation of the methods of the anical models and di	The students learn to npeting orders. Part eyond equilibrium and nsion will be covere groups are applied, course Mathematics ifferential equations	is with the co calculate II: Part II co- nd systems d; otherwise which will be s 3, the path (e.g. Feyn-
Intende	ed lear	ning outcomes				
The stu random stems a of non- tiate be	dents a n paran and nor orderee etween	acquire insights into th neters. They learn to co n-equilibrium differenti d systems are often tim quantum mechanical u	e calculability of the be nstruct diagram develo al equations. They und tes simpler and how a r uncertainty and random	ehaviour of physical opments for specific lerstand why physica new order arises from n uncertainty as well	and non-physical mo models, both for Har al laws describing th n disorder. They lear as between disorde	odels with miltonian sy- e behaviour n to differen- r and chaos.
Course	<b>S</b> (type, r	umber of weekly contact hour	s, language — if other than Ge	rman)		
V + R (n	o infor	mation on SWS (weekl	y contact hours) and co	ourse language avail	able)	
Methoo module is	<b>d of ass</b> creditab	s <b>essment</b> (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	ot every semester, informat	ion on whether
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009. Language of assessment: German, English						
Allocation of places						
Additional information						
Workload						
Master's wi	th 1 majo	Physics (2010)	JMU Würzbu reg. data red	irg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. k - 2010	page 120 / 280

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

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#### Module appears in

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 with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 121 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation		
Solid State Spectroscopy 2 11-FKS2-132-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. con	npl. of module(s)			
6 numerical grade					
Duration Module level	Other prerequisites	i			
1 semester graduate					
Contents					
and excitations such as phonons and is gation of magnetic, orbital and charge gnetic and electronic properties of thir of excitations in solids and thin films; agreement.	magnetic waves; resc order; X-ray and neut films and superlattic STEM ("scanning tran	a to investigate the a onant elastic X-ray sc tron reflectometry; in ces; resonant inelast ismission electron m	attering and magnetic attering and absorpt vestigation of the st ic X-ray scattering; in icroscopy"); further	structure tion; investi- ructural, ma- nvestigation topics upon	
The students know different modern so tering, modern scattering theory, X-ray are familiar with the theoretical princip	cattering methods survised and neutron reflecto oles and applications	ch as neutron scatte metry and resonant i of these methods.	ring, resonant elastic nelastic X-ray scatte	c X-ray scat- ering. They	
<b>Courses</b> (type, number of weekly contact hours,	language — if other than Gei	rman)			
V + R (no information on SWS (weekly	contact hours) and co	ourse language availa	able)		
Method of assessment (type, scope, langua module is creditable for bonus)	age — if other than German,	examination offered — if no	t every semester, informati	on on whether	
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate) 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.					
Allocation of places					
	-				
Additional information					
Workload					
Teaching cycle					
Referred to in LPO I (examination regulation	ns for teaching-degree progra	ammes)			
Module appears in					
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 (2010) Master's degree (1 major) FOKUS Physics (2011)					
Master's with 1 major Physics (2010)	JMU Würzbu reg. data reg	rrg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 122 / 280	

Module title				Abbreviation		
Physics of Advanced Materials 11-PMM-132-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	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade		•		
Duratio	n	Module level	Other prerequisites	i		
1 seme	ster	graduate				
Conten	ts	5.000000				
Gonora	Inrono	urtios of various matoria		de liquid envetale an	d polymors, magnet	ic matorials
and sup	percon ; two-d	ductors; thin films, het imensional layer mater	erostructures and supe	erlattices. Methods o	f characterising thes	se material
Intende	ed lear	ning outcomes				
The stu	dents l	know the properties an	d characterising metho	ods of some modern	materials.	
Course	<b>S</b> (type, r	number of weekly contact hour	s, language — if other than Ge	rman)		
V + R (n	no infor	mation on SWS (weekl	y contact hours) and co	ourse language avail	able)	
Methoo module is	<b>d of ass</b> creditab	<b>sessment</b> (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
weeks) Assess and wil examin Langua	or d) p ment o l be an ation r ge of a	resentation/seminar p ffered: When and how nounced in due form u egulations) 2009. ssessment: German, E	resentation (approx. 30 often assessment will nder observance of Se nglish	o minutes) be offered depends o ction 32 Subsection ;	on the method of ass 3 ASPO (general aca	sessment demic and
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachir	ng cycl	e				
Referre	d to in	<b>LPO I</b> (examination regulation	ons for teaching-degree progra	ammes)		
				·······,		
Module	appea	urs in				
Bachel	or' deg	ree (1 major) Physics (2	010)			
Bachelor' degree (1 major) Physics (2012)						
Bachelor' degree (1 major) Nanostructure Technology (2010)						
Bachelor' degree (1 major) Nanostructure Technology (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) FOKUS Physics (2010)						
Master	's degr	ee (1 major) FOKUS Phy	SICS (2011)			
Master's wi	ith 1 majo	r Physics (2010)	JMU Würzbı reg. data re	irg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 123 / 280

Module title				Abbreviation		
Topological Order     11-TOPO-132-m01						
Module	coordi	nator		Module offered by		
Managi	ng 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)		
6	numer	ical grade				
Duratio	n	Module level	Other prerequisites			
1 semes	ster	graduate				
Content	s					
<ul> <li>In modern Solid-State Physics, the concept of topologically ordered phases plays an increasingly important role.</li> <li>These phases possess no order in the conventional sense of a broken symmetry, but are characterised by topological quantum numbers. Examples of topological quantum numbers or phases include: <ol> <li>The fractional charge and statistics of quasiparticle excitation in quantum Hall fluids.</li> <li>The fractional quantisation of spins in spin liquids and the accompanying split-up of spin and charge in antiferromagnets.</li> <li>The topological anomalies of fractionally quantised systems on the torus (or generally on surfaces with gender g&gt;o).</li> </ol> </li> <li>4) Majorana fermion states at the interfaces between topological superconductors and topologically trivial regi-</li> </ul>						
Intende	d learr	ing outcomes				
The stud	dents a	cquire in-depth knowl	edge of topological ord	ler in quantum conde	ensates.	
Courses	<b>5</b> (type, n	umber of weekly contact hour	s, language — if other than Gei	rman)		
V + R (n	o infor	mation on SWS (weekl	y contact hours) and co	ourse language availa	able)	
<b>Method</b> module is	of ass	<b>essment</b> (type, scope, lang e for bonus)	uage — if other than German,	examination offered — if no	t every semester, informati	on on whether
a) writte in group weeks) Assessn and will examina Languag	en exar os (app or d) p ment of be and tion re ge of as	nination (approx. 90 m rox. 30 minutes per ca resentation/seminar p fered: When and how nounced in due form u egulations) 2009. ssessment: German, E	inutes) or b) oral exam ndidate) or c) project ro resentation (approx. 30 often assessment will l nder observance of Seo nglish	ination of one candi eport (approx. 8 to 10 o minutes) pe offered depends o ction 32 Subsection 3	date each or oral exa o pages, time to com on the method of ass 3 ASPO (general aca	amination plete: 1 to 4 sessment demic and
Allocati	on of p	laces				
Addition	nal info	ormation				
Workloa	ad					
Teachin	g cycle	9				
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module	appea	rs in				
Master's Master's Master's Master's	s degre s degre s degre s degre	e (1 major) Physics (20 e (1 major) Physics (20 e (1 major) FOKUS Phy e (1 major) FOKUS Phy	010) 011) sics (2010) sics (2011)			
Master's wit	h 1 major	Physics (2010)	JMU Würzbu reg. data red	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physik	• exam. < - 2010	page 124 / 280

Module title				Abbreviation	
Topology in Solid State Physics					11-TFP-132-m01
Module	coord	inator		Module offered by	
Managi	ng Dire	ector of the Institute of Ap	plied Physics	Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
6	nume	rical grade		· · · · · ·	
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts				
The stu cal met	dents a hods n	are familiar with the theo ecessary for their descrip	ry of topological effeo otion and are able to	cts in Solid-State Phy apply these methods	vsics. They know the mathemati- s to simple problems.
Intende	ed learr	ning outcomes			
The stu cal met	dents a hods n	are familiar with the theo ecessary for their descrip	ry of topological effeo otion and are able to	ts in Solid-State Phy apply these methods	ysics. They know the mathemati- s to simple problems.
Course	<b>S</b> (type, n	umber of weekly contact hours.	anguage — if other than Ger	man)	
V + R (n	o infor	mation on SWS (weekly o	contact hours) and co	urse language availa	able)
Methor	lofass	essment (type scope langua	ge — if other than German	examination offered — if no	t every semester information on whether
module is	creditab	le for bonus)			t every semester, mornation on whether
in grou weeks) Assess and wil examin Langua	ps (app or d) p ment o l be an ation re ge of a	prox. 30 minutes per cano resentation/seminar pres ffered: When and how off nounced in due form und egulations) 2009. ssessment: German, Eng	lidate) or c) project re sentation (approx. 30 ten assessment will b ler observance of Sec lish	eport (approx. 8 to 10 o minutes) oe offered depends of tion 32 Subsection 3	o pages, time to complete: 1 to 4 on the method of assessment 3 ASPO (general academic and
Allocat	ion of p	olaces			
Additio	nal info	ormation			
Worklo	ad				
Teachir	ng cycl	9			
	<u> </u>				
Referre	d to in	LPO I (examination regulations	for teaching-degree progra	mmes)	
Module appears in					
Master's degree (1 major) Physics (2010)					
Master's degree (1 major) Physics (2011)					
Master's degree (1 major) Nanostructure Technology (2011)					
Master	s degre	ee (1 major) Nanostructur	e Technology (2010)		
Master	s degre	ee (1 major) FOKUS Physi	cs (2010)		
Master	s degre	ee (1 major) FOKUS Physi	cs (2011)		



Physics

# **Astrophysics and Particle Physics**

(40 ECTS credits)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 126 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title				Abbreviation		
Astrophysics					11-A4-072-m01	
Module	coord	inator		Module offered by		
Managi and Ast	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				
Duratio	n	Module level	Other prerequisites			
1 semester undergraduate		Admission prerequi 50% of exercises. C sion to assessment ve details at the beg be considered a dec students have obtai over the course of th assessment into eff mitted to assessme assessment at a late for admission to ass	Admission prerequisite to assessment: successful completion of approx. 50% of exercises. Certain prerequisites must be met to qualify for admis- sion to assessment. The lecturer will inform students about the respecti- ve details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be ad- mitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification			
Conten	ts					
History pes and stellar r large-so nucleos <b>Intende</b> The stu physica ons. The lopmen	of astr d detec medium cale str synthes <b>ed learn</b> dents a il obse ey know t.	onomy, coordinates an tors, stellar structure, n, structure of the Milk ucture of the universe, sis, cosmic microwave <b>hing outcomes</b> are familiar with the m rvations and evaluatio w the structure of the u	nd time measurement, t stellar atmospheres, st 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	the solar system, size ellar evolution, final expanding space-tim els, thermodynamics structure formation, rophysics. They know e these methods to p nd galaxies and unde	e scales in outer spa stages of stellar evo e, galaxies, active ga of the early univers inflation w methods and tools lan and analyse owr erstand the process	ce, telesco- lution, inter- alactic nuclei, e, primordial s for astro- n observati- of their deve-
Courses	<b>S</b> (type, n	umber of weekly contact hou	rs, language — if other than Ge	rman)		
V + S (n	o infor	mation on SWS (week	ly contact hours) and co	ourse language avail	able)	
Method module is	l of ass creditab	<b>essment</b> (type, scope, lan le for bonus)	guage — if other than German,	examination offered — if no	t every semester, informati	ion on whether
written	examiı	nation (approx. 120 mi	nutes)			
Allocati	ion of p	olaces				
Only as	part o	f pool of general key s	kills (ASQ): 15 places. P	laces will be allocate	ed by lot.	
Additio	nal inf	ormation				
Worklo	ad					
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Bachelo	ar' dea	ree (1 major) Physics (*	2007)			
Maria						
Master's wi	th 1 majoi	Physics (2010)	JMU Würzbu reg. data red	irg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 127 / 280





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

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 128 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title				Abbreviation		
Astronomical Methods					11-ASM-131-m01	
Module	coord	inator		Module offered by		
Managi and Ast	ng Dire rophys	ector of the Institute of ics	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				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		Certain prerequisite sessment. The lectur at the beginning of the sidered a declaration dents have obtained the course of the se sessment into effect ted to assessment i sessment at a later admission to assess	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 anow.			
Conten	ts					
Method tional d	s of ob ata fro	servational astronomy m radio, optical, X-ray	across the electromag and gamma-ray telesco	netic spectrum. Extra opes.	action and reduction	ı of observa-
Intende	d learr	ning outcomes				
Overvie dio, opt ability t	w of th ical, X o cond	e methods used in obs ray and gamma-ray en uct astronomical obse	servational astronomy i ergies). Knowledge of p rvations.	n various parts of the principles and applic	e electromagnetic sp ations of these meth	pectrum (ra- nods and
Courses	<b>5</b> (type, n	umber of weekly contact hour	s, language — if other than Gei	rman)		
V + R (n	o infor	mation on SWS (weekl	y contact hours) and co	ourse language availa	able)	
<b>Method</b> module is	l <b>of ass</b> creditab	<b>essment</b> (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informati	ion on whether
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate) 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.						amination 1plete: 1 to 4 sessment demic and
Allocati	on of p	olaces				
Additional information						
Workload						
Teaching cycle						
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)						
Module appears in						
Master's wit	th 1 major	Physics (2010)	JMU Würzbu reg. data reg	rg • generated 26-Aug-2024 ( cord Master (120 FCTS) Physik	• exam.	page 129 / 280
				、,, sin		



Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (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)

		1
Master's with 1 major Physics (2010)	IMU Würzburg • generated 26-Aug-2024 • exam.	page 130 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation			
Introduction to Plasmaphysics				11-EPP-092-m01		
Module coordinator				Module offered by		
Managing Director of the Institute of Th and Astrophysics		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				
Duratio	n	Module level	Other prerequisites			
1 semester       graduate       Certain prerequisites must be met to qualiform stude at the beginning of the course. Registra sidered a declaration of will to seek addres have obtained the qualification for the course of the semester, the lecturer sessment into effect. Students who meted to assessment in the current or in the sessment at a later date, students will here.		s must be met to qua rer will inform stude the course. Registrat n of will to seek adm d the qualification fo mester, the lecturer w t. Students who mee n the current or in the date, students will he sment anew.	alify for admission to nts about the respec- ion for the course wi ission to assessmer r admission to asses will put their registra t all prerequisites wi e subsequent semes ave to obtain the qua	as- tive details ll be con- nt. If stu- sment over tion for as- ill be admit- ster. For as- alification for		
Conten	ts		-			
Plasma Transpo thin the celerati	Astrop ort equ solar on and	hysics: Dynamics of ch ations for energetic pa wind, Particle accelera I transport in galaxies a	narged particles in elec rticles, Properties of ma tion via shock waves ar and other astrophysical	tric and magnetic fie agnetic turbulence, F nd via interaction wit l objects, Cosmic rad	lds, Magnetohydrod Propagation of solar h plasma turbulence iation.	ynamics, particles wi- e, Particle ac-
Intende	ed learı	ning outcomes				
The stu ma. The	dents l ey are a	know the principles of able to solve basic prob	Plasma Physics, especi blems of Plasma Physic	ally the description of ally the description of a sand to apply this k	of transport phenom nowledge to Astroph	ena in plas- iysics.
Courses	<b>5</b> (type, n	umber of weekly contact hour	s, language — if other than Gei	rman)		
V + R (n	o infor	mation on SWS (weekl	y contact hours) and co	ourse language availa	able)	
Method module is	l of ass creditab	s <b>essment</b> (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informati	on on whether
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.					amination in iutes) or c) esentation sessment demic and	
Allocati	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	Workload					
Teachin	ng cycl	е				
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)						
Master's wit	th 1 majoi	Physics (2010)	JMU Würzbu reg. data reg	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physik	• exam. < - 2010	page 131 / 280



# 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)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 132 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module	title				Abbreviation	
Cosmol	Cosmology 11-AKM-092-m01					
Module coordinator			Module offered by			
Managi and Ast	ng Dire rophys	ector of the Institute of ics	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				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		Certain prerequisite sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the se sessment into effect ted to assessment in sessment at a later admission to assess	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					
Expand matter, and gal	ing spa primor axy clu	ace-time, Friedmannia dial nucleosynthesis, sters, intergalactic me	n cosmology, basics of cosmic microwave back dium, cosmological pa	general relativity, the ground, structure fo rameters	e early universe, infla rmation, supercluste	ation, dark er, galaxies
Intende	ed learr	ning outcomes				
The stu le to rel scientif	dents l ate the ic ques	nave basic knowledge em to observations. The stions.	of cosmology. They kno ey have gained insights	w the theoretical me into current researc	ethods of cosmology h topics and are able	and are ab- e to work on
Courses	<b>5</b> (type, n	umber of weekly contact hour	s, language — if other than Ger	rman)		
R + V (n	o infor	mation on SWS (weekl	y contact hours) and co	ourse language availa	able)	
Method module is	l of ass creditab	essment (type, scope, lang le for bonus)	guage — if other than German, o	examination offered — if no	t every semester, informati	on on whether
a) writte groups project (approx Assessi and wil examin Langua	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.					amination in nutes) or c) esentation sessment demic and
Allocati	ion of p	olaces				
Additio	nal inf	ormation				
Workload						
Teaching cycle						
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)					
Master's wi	th 1 major	Physics (2010)	JMU Würzbu reg. data rec	rg • generated 26-Aug-2024 ( cord Master (120 ECTS) Physik	• exam. < - 2010	page 133 / 280



#### 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)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 134 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation			
Plasma-Astrophysics 11-APL-092-m01						
Module coordinator			Module offered by			
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics a	nd Astronomy			
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		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 asses	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for			
Conten	ts					
Plasma getic pa acceler galaxie	Astrop articles ation v s and c	hysics: Dynamics of cl . Properties of magneti ia shock waves and via other cosmic objects.	narged particles in elec c turbulence. Propagat a interaction with plasn	tric and magnetic fie ion of solar particles na turbulence. Partic	lds. Transport equat within the solar win le acceleration and t	ions for ener- Id. Particle transport in
Intende	ed learn					
The stu motion compai	dents I and ac re and o	nave basic knowledge celeration of charged evaluate theory and ex	of Plasma Astrophysics particles in space, they periments.	s. They have mastere know corresponding	d the theoretical des g measuring method	s and can
Course	<b>S</b> (type, n	umber of weekly contact hour	s, language — if other than Ge	rman)		
R + V (n	io infor	mation on SWS (weekl	y contact hours) and co	ourse language avail	able)	
Methoo module is	<b>d of ass</b> creditab	e <b>essment</b> (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
a) writte groups project (approx Assess and wil examin Langua	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.					
Allocat	ion of p	olaces				
Additional information						
Workload						
Teachir	Teaching cycle					
Master's with 1 major Physics (2010) JMU Würzburg • generated 26-Aug-2024 • exam. page 135 / reg. data record Master (120 ECTS) Physik - 2010					page 135 / 280	



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)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 136 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module	title				Abbreviation	
Introduction to Space Physics				11-ASP-092-m01		
Module coordinator			Module offered by			
Managi and Ast	ng Dire trophys	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				
Duratio	n	Module level	Other prerequisites			
1 semestergraduateCertain prerequisites must be met to qualify for admissions sessment. The lecturer will inform students about the at the beginning of the course. Registration for the coursidered a declaration of will to seek admission to assidered a declaration of will to seek admission to assidents have obtained the qualification for admission to the course of the semester, the lecturer will put their resessment into effect. Students who meet all prerequisited to assessment at a later date, students will have to obtain		alify for admission to nts about the respec- ion for the course wi nission to assessmen r admission to asses will put their registra t all prerequisites wi e subsequent semes ave to obtain the qu	) as- tive details Il be con- nt. If stu- ssment over tion for as- til be admit- ster. For as- alification for			
Conten	ts					
<ol> <li>Overview</li> <li>Dynamics of charged particles in magnetic and electric fields</li> <li>Elements of space physics</li> <li>The sun and heliosphere</li> <li>Acceleration and transport of energetic particles in the heliosphere</li> <li>Instruments to measure energetic particles in extraterrestrial space</li> <li>Intended learning outcomes</li> <li>The students have basic knowledge of Space Physics, in particular of the characterisation of the dynamics of charged particles in space and in the heliosphere. They know relevant parameters, theoretical concepts and measuring methods.</li> <li>Courses (type, number of weekly contact hours, language – if other than German)</li> <li>R + V (no information on SWS (weekly contact hours) and course language available)</li> <li>Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether</li> </ol>				iamics of epts and ion on whether		
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009. Language of assessment: German, English Allocation of places  Additional information 						
Worklo	Workload					
Master's wi	th 1 majoi	Physics (2010)	JMU Würzbu reg. data ree	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 137 / 280

**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) 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) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) Computational Mathematics (2012)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 138 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation			
Atmosphere and Space Physics				11-AWP-092-m01		
Module coordinator			Module offered by			
Managi and Ast	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				
Duratio	n	Module level	Other prerequisites			
1 semestergraduateCertain 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 at a later date, students will have to obtain the qualification.			o as- ctive details ill be con- nt. If stu- ssment over ation for as- ill be admit- ster. For as- alification for			
Conten	ts					
Structur tary ma exoplar	re of pl gnetos nets.	anetary atmospheres. pheres and interplane	Interaction of planetary ary medium. (Micro) m	/ atmospheres with t eteorites, asteroids,	he Sun. Physics of c planetary rings. Atn	louds. Plane- nospheres of
Intende	ed learr	ning outcomes				
The stur and nea ry space	dents ł ar-Eartł e missi	nave knowledge of the n space. They are able to ons.	physics of planetary at to apply the acquired k	mospheres, especial nowledge to the solu	lly of the atmospher ition of problems of	e of the Earth interplaneta-
R + V (n	o infor	mation on SWS (week)	v contact hours) and co	ourse language availa	able)	
Method	l of ass	essment (type, scope, lang	uage — if other than German,	examination offered — if no	t every semester, informati	ion on whether
a) writte groups or d) pro Assessi and will examin Langua	en exar (appro esenta ment o l be an ation re	nination (approx. 90 m x. 30 minutes per cand tion/seminar presenta ffered: When and how nounced in due form u egulations) 2009. ssessment: German or	inutes) or b) oral exam idate) or c) project rep tion (approx. 30 minute often assessment will I nder observance of Sec English	ination of one candior ort (approx. 8 pages, es) be offered depends of ction 32 Subsection 3	date each or oral exa time to complete: 1 on the method of ass 3 ASPO (general aca	amination in to 4 weeks) sessment demic and
Allocati	ion of p	olaces				
 Additio	nal info	ormation				
workload						
Tooching syste						
Referred to in IPO I (examination regulations for teaching-degree programmes)						
				,		
L						
Master's wit	th 1 major	Physics (2010)	JMU Würzbu reg. data red	rg • generated 26-Aug-2024 • cord Master (120 ECTS) Physik	• exam. < - 2010	page 139 / 280



#### Module appears in

Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2012) Bachelor' degree (1 major) Aerospace Computer Science (2009) Bachelor' degree (1 major) Aerospace Computer Science (2011) 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) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) FOKUS Physics (2011)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 140 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title				Abbreviation		
Group Theory					11-GRT-092-m01	
Module coordinator				Module offered by		
Managing Director of the Institute of Th and Astrophysics			Theoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS Method of grading Only after succ. compl. of mo			npl. of module(s)			
6	numei	rical grade				
Duration		Module level	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 for admission to assessment anew.			
Conten	ts					
Group t	heory.	Finite groups. Lie grou	ps. Lie algebra. Depicti	on. Tensors. Classific	cation theorem. App	lications.
Intende	d learr	ning outcomes				
The students know the basics of group theory, especially of Lie groups. They are able to identify problems of group theory and to solve them by using the acquired methods. They are able to apply group theory to the formulation and processing of physical problems.						
Courses	<b>5</b> (type, n	umber of weekly contact hour	s, language — if other than Gei	rman)		
R + V (n	o infor	mation on SWS (weekl	y contact hours) and co	ourse language availa	able)	
<b>Method of assessment</b> (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)						
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009. Language of assessment: German, English						
Allocati	ion of p	olaces				
Additio	nal info	ormation				
Workload						
Teaching cycle						
<b>RETENENTED TO THE LEVEN</b> (examination regulations for teaching-degree programmes)						
 Madul-	0 F F F F	re in				
moaute	appea	15 1/1				
Master's wi	th 1 major	Physics (2010)	JMU Würzbu reg. data red	rg • generated 26-Aug-2024 • cord Master (120 ECTS) Physik	• exam. < - 2010	page 141 / 280



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)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 142 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title				Abbreviation		
Numerical Methods in Astrophysics11-NMA-092-m01						
Module	Module coordinator			Module offered by		
Managing Director of the Institute of Th and Astrophysics		neoretical Physics	Faculty of Physics and Astronomy			
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duration		Module level	Other prerequisites	;		
1 semester		graduate	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment anew.			
Conten	ts		1			
<ul> <li>various methods used in astrophysical simulations with special emphasis on their applications. N-body algorithms (tree- and polynomial codes). Particle-mesh methods (particle-in-cell methods). Vlasow methods (e.g., Lattice-Boltzmann). Hyperbolic conservation laws (fluid dynamics, finite difference method, Riemann solver, ENO). Methods of high-performance computing. Message-passing interface (MPI). GPGPU programming (Open-CL).</li> <li>Intended learning outcomes</li> <li>The students are able to solve typical problems and equations of Astrophysics and other subdisciplines of Physics with the help of numerical simulations. They are especially capable of choosing adequate strategies to approach such problems and of validating the results.</li> </ul>						
Course	<b>S</b> (type, n	umber of weekly contact hours,	language — if other than Ger	man)		
V + Ü (r	no infor	mation on SWS (weekly	contact hours) and co	ourse language avail	able)	
Method module is	<b>d of ass</b> s creditab	<b>essment</b> (type, scope, langua le for bonus)	age — if other than German, o	examination offered — if no	t every semester, informat	ion on whether
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009. Language of assessment: German, English						
Allocation of places						
Additional information						
Toaching cyclo						
Teachi	ng cycl	e				
Master's wi	ith 1 majoı	Physics (2010)	JMU Würzbu reg. data rec	rg • generated 26-Aug-2024 • cord Master (120 ECTS) Physik	• exam. < - 2010	page 143 / 280

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

#### Module appears in

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

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 144 / 280				
	reg. data record Master (120 ECTS) Physik - 2010					
Module title				Abbreviation		
--	--	---	--	---	--	---
Quantu	m Field	l Theory II			11-QFT2-092-m01	
Module	coord	inator		Module offered by		
Managi and Ast	ng Dire rophys	ector of the Institute of sics	Theoretical Physics	retical Physics Faculty of Physics and Astronomy		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		Certain prerequisite sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the se sessment into effect ted to assessment in sessment at a later admission to assess	s must be met to qua rer will inform studen the course. Registration of will to seek adm the qualification fo mester, the lecturer with the current who mee on the current or in the date, students will have sment anew.	alify for admission to nts about the respec- ion for the course wi ission to assessmer r admission to asses will put their registra t all prerequisites wi e subsequent semes ave to obtain the qua	as- tive details ll be con- nt. If stu- soment over tion for as- ill be admit- ster. For as- alification for	
Conten	ts					
Quantu theories	m field s. Spor	theory II. Generating f ntaneous symmetry bre	unctionals. Path integra aking. Effective field th	al. Renormalisation. leory (optional).	Renormalisation gro	up. Gauge
Intende	ed learn	ning outcomes				
The stur red the problen	dents l princip ns of q	nave advanced knowle ples, especially of reno uantum field theory by	dge of the methods and rmalisation and gauge using the acquired cal	d concepts of quantu theories. They are at culation methods.	Im field theory. They Die to formulate and	have maste- solve simple
Courses	<b>S</b> (type, n	umber of weekly contact hours	s, language — if other than Ger	rman)		
R + V (n	o infor	mation on SWS (weekly	y contact hours) and co	ourse language availa	able)	
Method module is	l of ass creditab	e <b>essment</b> (type, scope, lang le for bonus)	uage — if other than German, o	examination offered — if no	t every semester, informati	on on whether
a) writte groups project (approx Assessin and will examini- Languag	en exar (appro report 3. 30 m ment o l be an ation re ge of a	nination (approx. 90 m x. 30 minutes per cand (approx. 8 to 10 pages, inutes) ffered: When and how nounced in due form u egulations) 2009. ssessment: German, El	inutes) or b) oral exam idate, for modules with time to complete: 1 to often assessment will h nder observance of Sec nglish	ination of one candin less than 4 ECTS cro 4 weeks) or d) prese be offered depends o ction 32 Subsection 3	date each or oral exa edits approx. 20 min entation/seminar pre on the method of ass 3 ASPO (general aca	amination in nutes) or c) esentation sessment demic and
Allocati	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachin	ng cycl	e				
Referre	d to in	LPO I (examination regulation	ons for teaching-degree progra	mmes)		
Master's wit	th 1 major	Physics (2010)	JMU Würzbu reg. data rec	rg • generated 26-Aug-2024 • cord Master (120 ECTS) Physik	• exam. - 2010	page 145 / 280



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)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 146 / 280
	reg. data record Master (120 ECTS) Physik - 2010	1

Module	e title				Abbreviation
Renormalization Theory   11-RNT-092-m01				11-RNT-092-m01	
Module	e coord	inator		Module offered by	
Managi and Ast	ing Dire	ector of the Institute of Th sics	eoretical Physics	Faculty of Physics and Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)	
6	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme:	ster	graduate	Certain prerequisite sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the se sessment into effect ted to assessment it sessment at a later admission to assess	s must be met to qua rer will inform stude the course. Registrat n of will to seek adm d the qualification fo mester, the lecturer t. Students who mee n the current or in the date, students will he sment anew.	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
Conten	ts				
Renorm behavio levance ons. Sto berg-Ma and cor	nalisati our for e for ph ochast a differ mparise ed lear	on group methods for Ha dynamics beyond the eq lase diagrams in cryogen ic non-linear partial differ rential equations. Symme on of different RG methoo ning outcomes	miltonian systems. P uilibrium. Classical-c ic temperatures. Inst rential equations. Co etries, e.g. in the stoc ds.	artial non-linear diffe ritical and quantum- ability of statistical a nstruction of generat hastic Burgers' equa	erential equations with scaling critical phenomena and their re- and dynamic mean-field soluti- ting functionals. Halperin-Hohen- ition (KPZ equation). Introduction
The stu tions. T	dents l hey kn	have gained an overview ow important examples a	of renormalisation gr and corresponding sc	roup methods for nor olving methods and a	n-linear partial differential equa- are able to apply them to specific
Course	S (tuno	umbor of weakly contact have -	anguago _ if other than C	man)	
$R \pm V$ (n	o infor	mation on SWS (weekly contact nours, t	contact hours) and co	nian) Nurse language avail:	able)
Method	l of ace	sessment (type scope langua	ge — if other than German	examination offered - if no	t every semester information on whether
module is	creditab	le for bonus)			e every semester, mornation on whether
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.					
Allocation of places					
Additio	nal inf	ormation			
Worklo	Workload				

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 147 / 280
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## Teaching cycle

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

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Module appears in

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 148 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module	e title				Abbreviation	
Relativ	istical	Quantumfield Theory			11-RQFT-092-m01	
Module	e coord	inator		Module offered by	Module offered by	
Managi and Ast	ing Dire trophys	ector of the Institute of Th sics	neoretical Physics	Faculty of Physics and 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 graduate		Certain prerequisite sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the se sessment into effect ted to assessment i sessment at a later admission to assess	s must be met to qua irer 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.	alify for admission t nts about the respe ion for the course w nission to assessme r admission to asse will put their registr t all prerequisites w e subsequent seme ave to obtain the qu	o as- ctive details vill be con- ent. If stu- essment over ation for as- vill be admit- ester. For as- ualification for	
Conten	ts		I			
Symme theory. normal	etries. L Feynm isation	agrange formalism for fie an rules. Quantum electr	elds. Field quantisatio rodynamic processes	on. Gauge principle a in Born approximati	and interaction. Peri on. Radiative correc	turbation ctions and re-
Intende	ed lear	ning outcomes				
The stu They kr process standir	dents l now ho ses in t ng of ra	have mastered the princi w to use perturbation the he framework of quantur diative corrections and re	ples and underlying r eory and how to apply n electrodynamics in enormalisation.	mathematics of relat / Feynman rules. The leading order. More	ivistic quantum field y are able to calcula over, they have a ba	d theories. ate basics asic under-
Course	<b>S</b> (type, r	umber of weekly contact hours, l	language — if other than Ger	rman)		
R + V (n	io infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)	
Methoo module is	<b>d of ass</b> creditab	<b>eessment</b> (type, scope, langua le for bonus)	ge — if other than German,	examination offered — if no	t every semester, informa	tion on whether
a) writt groups project (approx Assess and wil examin Langua	en exai (appro report k. 30 m ment o l be an ation r ge of a	mination (approx. 90 mir x. 30 minutes per candid (approx. 8 to 10 pages, t inutes) ffered: When and how of nounced in due form und egulations) 2009. ssessment: German, Eng	nutes) or b) oral exam late, for modules with ime to complete: 1 to ten assessment will h der observance of Sec glish	ination of one candi n less than 4 ECTS cr 4 weeks) or d) prese be offered depends o ction 32 Subsection 3	date each or oral ex edits approx. 20 mi entation/seminar pr on the method of as 3 ASPO (general aca	amination in nutes) or c) resentation sessment ademic and
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachi	ng cycl	e				
L						
Master's wi	ith 1 majo	r Physics (2010)	JMU Würzbu	irg • generated 26-Aug-2024	• exam.	page 149 / 280

aster's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	pa
	reg. data record Master (120 ECTS) Physik - 2010	



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

## Module appears in

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 150 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title				Abbreviation		
Theory	of Rela	itivity			11-RTT-092-m01	
Module	coord	inator		Module offered by		
Managi and Ast	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				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		Certain prerequisite sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the se sessment into effect ted to assessment in sessment at a later admission to assess	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.			
Conten	ts					
Mathen ments o general	natical of diffe relativ	foundations of the the rential geometry; electr ity; stellar models; intr	ory of relativity; differe odynamics as an exam oduction to cosmology	ntial forms; brief sun ple of a relativistic g ; Hamiltonian formu	nmary of special rela auge theory; field eo lation	ntivity; ele- quations of
Intende	ed learı	ning outcomes				
The stu mathen able to	dents a natical apply t	are familiar with the ba understanding of the f he acquired knowledg	sic physical and mathe ormulation of general r e to problems of Astrop	ematical concepts of elativity on the basis physics and cosmolo	general relativity. Th of differential forms gy.	iey have a s. They are
Courses	<b>5</b> (type, n	umber of weekly contact hour	s, language — if other than Ger	rman)		
R + V (n	o infor	mation on SWS (weekl	y contact hours) and co	ourse language availa	able)	
<b>Method</b> module is	<b>l of ass</b> creditab	e <b>ssment</b> (type, scope, lang le for bonus)	uage — if other than German, o	examination offered — if no	t every semester, informati	on on whether
a) writte groups project (approx Assessi and wil examin Langua	a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.					
Allocati	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Master's wi	th 1 majoi	Physics (2010)	JMU Würzbu reg. data rec	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physik	• exam. < - 2010	page 151 / 280



Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 152 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title				Abbreviation		
Theoretical Elementary Particle Physics				11-TEP-092-m01		
Module	coord	inator		Module offered by		
Managi and Ast	ng Dire trophys	ector of the Institute of sics	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	n	Module level	Other prerequisites			
1 semester graduate		Certain prerequisite sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the se sessment into effect ted to assessment i sessment at a later admission to assess	s must be met to qua rer will inform stude the course. Registrat n of will to seek adm d the qualification fo mester, the lecturer t. Students who mee n the current or in th date, students will h sment anew.	alify for admission to nts about the respec- ion for the course wi nission to assessmen r admission to asses will put their registra t all prerequisites wi e subsequent semes ave to obtain the qu	) as- tive details Il be con- nt. If stu- ssment over tion for as- till be admit- ster. For as- alification for	
Conten	ts					
Fundan Gauge t tension	nental theorie is of th	forces and particles. G s. Spontaneous symm e standard model.	roups and symmetries. etry breaking. Electrow	Quark model. Princi eak standard model.	ples of quantum field Quantum chrome d	d theory. ynamics. Ex-
Intende	ed lear	ning outcomes				
The stu structur lation n re, they	dents a re of th nethod v know	are familiar with the ma e standard model base s for the processing of the tests and limits of	athematical methods of ed on symmetry princip simple problems and p the standard model and	f Elementary Particle les and experimenta processes of Element d the basics of exten	Physics. They under l observations. They ary Particle Physics. ded theories.	stand the know calcu- Furthermo-
Courses	<b>S</b> (type, r	number of weekly contact hour	s, language — if other than Gei	man)		
R + V (n	o infor	mation on SWS (weekl	y contact hours) and co	ourse language avail	able)	
Methoo module is	<b>of ass</b> creditab	essment (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informati	on on whether
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.						
Allocat	ion of p	olaces				
Additional information						
Workload						
 Teaching cycle						
Master's wi	th 1 majo	r Physics (2010)	JMU Würzbu reg. data rec	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 153 / 280



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

## Module appears in

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 154 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title				Abbreviation			
Experimental Particle Physics					11-TPE-092-m01		
Module	e coord	inator		Module offered by			
Manag	ing Dire	ector of the Institute of	Applied Physics	plied Physics Faculty of Physics and Astronomy			
ECTS	Metho	od of grading	Only after succ. con	Only after succ. compl. of module(s)			
4	nume	rical grade					
Duratio	on	Module level	Other prerequisites	i			
1 semester graduate		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 asses	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						
Physics with modern particle detectors at the LHC and at the Tevatron. Discovery of the Higgs boson. Search for supersymmetry and other physics beyond the standard model. Determination of the top quark mass and W mass as well as other parameters of the standard model. Introduction to modern methods of analysis and assessment of systematic errors				. Search for and W mass assessment			
Intende	Intended learning outcomes						
The stu questic lysis ar	idents a ons of F nd are a	are familiar with the pr Particle Physics, which able to put results into	nciples of modern part are examined by using context and to assess t	icle detector physics these detectors. The heir systematic unce	s, especially with cur y know modern met ertainties.	rently open hods of ana-	
Course	<b>S</b> (type, r	number of weekly contact hour	s, language — if other than Ge	rman)			
R + V (r	no infor	mation on SWS (weekl	y contact hours) and co	ourse language avail	able)		
Method module is	d of ass s creditab	<b>sessment</b> (type, scope, lang le for bonus)	guage — if other than German,	examination offered — if no	t every semester, informat	ion on whether	
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.				amination in nutes) or c) esentation sessment demic and			
Allocat	ion of p	olaces					
Additio	nal inf	ormation					
Workload							
Teaching cycle							
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)						
Master's wi	ith 1 majo	r Physics (2010)	JMU Würzbu reg. data re	rrg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 155 / 280	



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

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 156 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title				Abbreviation		
Particle Physics (Standard Model)					11-TPS-092-m01	
Module coordinator				Module offered by		
Managi the Inst	ng Dire itute o	ectors of the Institute o f Theoretical Physics a	f Applied Physics and nd Astrophysics	pplied Physics and Faculty of Physics and Astronomy Astrophysics		
ECTS	Metho	od of grading	Only after succ. com	Only after succ. compl. of module(s)		
8	numei	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		Certain prerequisite sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the se sessment into effect ted to assessment in sessment at a later admission to assess	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for			
Conten	ts					
Introdu standar	ction to d mod	o the theory of electrow el and determination o	veak interaction and sp f model parameters.	ontaneous symmetry	/ breaking. Experime	ents on the
Intende	d learr	ning outcomes				
The stur perimer theoret	dents k nts tha ical res	know the theoretical fu t have established and ults in the framework (	ndamental laws of the confirmed the standar of the standard model a	standard model of Pa d model. They are ab and know its validity	article Physics and t ble to interpret exper and limits.	he key ex- 'imental or
Courses	<b>5</b> (type, n	umber of weekly contact hour	s, language — if other than Ger	man)		
R + V (n	o infor	mation on SWS (weekl	y contact hours) and co	ourse language availa	able)	
Method module is	of ass	essment (type, scope, lang le for bonus)	uage — if other than German, e	examination offered — if no	t every semester, informati	on on whether
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.				amination in iutes) or c) esentation sessment demic and		
Allocati	on of p	olaces				
Additio	nal info	ormation				
Workload						
Teaching cycle						
Referre	Referred to in LPO I (examination regulations for teaching-degree programmes)					
Master's wit	th 1 major	Physics (2010)	JMU Würzbu reg. data rec	rg • generated 26-Aug-2024 • ord Master (120 ECTS) Physik	• exam. - 2010	page 157 / 280



Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 158 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation			
Supersymmetry I and II				11-SUS-092-m01		
Module coordinator				Module offered by		
Managing Director of the Institute of T and Astrophysics			Theoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. compl. of module(s)			
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		Certain prerequisite sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the se sessment into effect ted to assessment in sessment at a later admission to assess	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for			
Conten	ts					
Supersy persym Supersy ticles. F	ymmet metry: ymmet Phenon	ry I: Grassmann variabl Algebra and multiplets ry II: Minimal supersym nenology of LEP, Tevatr	e. Coleman-Mandula th S. Superfield formalism Imetric standard mode on and LHC, supersym	neorem and Haag-Lo . Breaking of supersy l. Higgs sector. The s metric neutrino mass	puszanski-Sohnius /mmetry. pectrum of supersyr s models. Violation c	theorem. Su- nmetric par- of R-parity.
Intende	d learı	ning outcomes				
The stu tric moo importa	dents I dels. Th Ince fo	nave knowledge of the ney understand the the r phenomenology of ele	mathematical and physory's formalism and reconstruction of the second seco	sical principles of su cognise its connectio	persymmetry and su ons to other models	ipersymme- as well as its
Courses	<b>5</b> (type, n	umber of weekly contact hour	s, language — if other than Ger	rman)		
V + R (n	o infor	mation on SWS (weekl	y contact hours) and co	ourse language availa	able)	
Method module is	l of ass creditab	s <b>essment</b> (type, scope, lang le for bonus)	uage — if other than German, o	examination offered — if no	t every semester, informati	on on whether
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.				amination in nutes) or c) esentation sessment demic and		
Allocati	ion of p	olaces				
Additional information						
Workload						
Teaching cycle						
Master's wi	th 1 majoı	Physics (2010)	JMU Würzbu reg. data rec	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 159 / 280



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#### Module appears in

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 160 / 280
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Module title				Abbreviation	
Theoretical Astrophysics				11-AST-092-m01	
Module coordinator				Module offered by	
Managing Director of the Institute of Thand Astrophysics			eoretical 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 seme	ster	graduate			
Conter	Its				
Theore	tical As	trophysics, models for th	e description of com	plex observation res	ults, numeric simulations.
Intend	ed lear	ning outcomes			
The stu observ	dents ations	have basic knowledge of and to test the models wi	the methods of Theo th the help of simula	retical Astrophysics. tions.	They are able to design complex
Course	<b>S</b> (type, r	number of weekly contact hours, l	anguage — if other than Ger	rman)	
R + V (1	no infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)
Metho module i	<b>d of ass</b> s creditab	eessment (type, scope, langua le for bonus)	ge — if other than German, o	examination offered — if no	ot every semester, information on whether
written	exami	nation (approx. 120 minu	tes)		
Allocat	ion of <sub>l</sub>	olaces			
Additio	onal inf	ormation			
Worklo	ad				
Teachi	ng cycl	e			
Referre	ed to in	LPOI (examination regulations	s for teaching-degree progra	mmes)	
Modul	e appea	nrs in	<u>``</u>		
Bachel	or' deg	ree (1 major) Physics (20:	10)		
Bachel	or deg or deg	ree (1 major) Physics (20: ree (1 major) Mathematic	12) al Physics (2000)		
Bachel	or' deg	ree (1 major) Mathematic	al Physics (2009)		
Master	Master's degree (1 major) Physics (2010)				
Master	Master's degree (1 major) Physics (2011)				
Master	's degr	ee (1 major) Mathematica	al Physics (2012)		
Master	's degr	ee (1 major) FOKUS Physi	cs (2010)		
Master	's degr	ee (1 major) FUKUS Physi	CS (2011)		
master	s uegr	εε (1 παjυι) Γυκυδ Ρηγεί	13 (2000)		

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 161 / 280
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Module title			Abbreviation			
Strong Interaction in Accelerator Experim			periments		11-WWB-102-m01	
Module coordinator				Module offered by		
Managi	ing Dire	ector of the Institute of	Applied Physics	plied Physics Faculty of Physics and Astronomy		
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)		
3	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		Certain prerequisite sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the se sessment into effect ted to assessment in sessment at a later admission to assess	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					
Asymptomatic freedom/confinement. Hadron production in e+/e- collisions. QCD coherence/interference pheno- mena. QCD Jet simulation. Hadron production in electron-proton collisions. Hadron production in proton-proton collisions.						
Intende	Intended learning outcomes					
The students know the basic organisation of QCD processes. They are able to interpret results of accelerator ex- periments. They have knowledge of methods of data analysis, understand the underlying theories and are able to apply them.						
V . D (n	s (type, n	mation on SWS (wook)	v contact hours) and co		able)	
Method			y contact hours) and co	variation offered if no	t overv comester informati	ion on whothor
module is	creditab	le for bonus)	uage — if other than German, o	examination onered — if no	t every semester, informati	on on whether
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.				amination in outes) or c) asentation sessment demic and		
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Workload						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Master's wi	th 1 majoi	Physics (2010)	JMU Würzbu reg. data rec	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physik	• exam. < - 2010	page 162 / 280



Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (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) FOKUS Physics (2006)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 163 / 280
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Module	title				Abbreviation	
Practica	Practical Course Astrophysics 11-APP-111-m01					
Module	coord	inator		Module offered by		
Managi and Ast	ng Dire rophys	ector of the Institute of Tl ics	neoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
6	(not) s	successfully completed				
Duration Module level		Other prerequisites				
1 semester graduate		Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment anow.				
Conten	ts					
Astroph tions.	Astrophysical experiments in the fields of detectors, telescopes, methodology, analysis and astronomic observa- tions.				omic observa-	
Intende	d learr	ning outcomes				
The students have mastered experimental methods of Astrophysics and are able to analyse and interpret the measuring data and present the results. They are familiar with the working methods of observational Astronomy and with basic techniques of detecting electromagnetic radiation. They are able to plan and evaluate observations and measurements and to present the results.						
Courses	<b>5</b> (type, n	umber of weekly contact hours,	language — if other than Gei	rman)		
P (no in	format	ion on SWS (weekly con	tact hours) and cours	e language available	)	
Method module is	l of ass creditab	<b>essment</b> (type, scope, langua le for bonus)	age — if other than German,	examination offered — if no	t every semester, informat	ion on whether
a) Prepa (exam) test the nutes). Assessi and will examin	a) Preparing, performing and evaluating the experiments will be considered successfully completed if a Testat (exam) is passed. Experiments that were not successfully completed can be repeated once. Or b) discussion to test the candidate's understanding of the physics-related contents and results of the experiment (approx. 20 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				if a Testat scussion to pprox. 20 mi- sessment idemic and	
Allocati	ion of p	olaces				
Additio	nal inf	ormation				
Workload						
Teachin	ig cycl	9				
Referre	d to in	LPOI (examination regulation	is for teaching-degree progra	mmes)		
Master's wit	th 1 major	Physics (2010)	JMU Würzbu reg. data reg	rg • generated 26-Aug-2024 • cord Master (120 ECTS) Physik	• exam. < - 2010	page 164 / 280



Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (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) FOKUS Physics (2006)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 165 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title				Abbreviation			
Particle Radiation Detectors					11-DTS-111-m01		
Module	e coord	inator		Module offered by			
Managi	ing Dire	ector of the Institute of	Applied Physics	plied Physics Faculty of Physics and Astronomy			
ECTS	Metho	od of grading	Only after succ. con	Only after succ. compl. of module(s)			
4	nume	rical grade					
Duratio	n	Module level	Other prerequisites	i			
1 semester graduate		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 asses	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						
Princip minatic	les of i on of m	nteraction between pa omentum, energy and	rticles and matter. Parti particle identification.	cle detectors for spa Conception of partic	ce and time measur le detectors in exam	ement, deter- ples.	
Intende	ed learı	ning outcomes					
The students know the physical principles and the basic structure of particle detectors. They know the functions and applications of different types of detectors, they can explain the measurement of physical values and have basic knowledge of the conception of detector systems.							
Course	<b>S</b> (type, n	umber of weekly contact hour	rs, language — if other than Ge	rman)			
V + Ü (r	no infor	mation on SWS (week	ly contact hours) and co	ourse language avail	able)		
Methoo module is	d of ass creditab	<b>essment</b> (type, scope, lang le for bonus)	guage — if other than German,	examination offered — if no	t every semester, informat	ion on whether	
a) writte groups project (approx Assess and wil examin Langua	en exar (appro report <. 30 m ment o l be an ation r ge of a	mination (approx. 90 n x. 30 minutes per cand (approx. 8 to 10 pages inutes) ffered: When and how nounced in due form u egulations) 2009. ssessment: German, E	ninutes) or b) oral exam didate, for modules with , time to complete: 1 to often assessment will Inder observance of Sec nglish	ination of one candi n less than 4 ECTS cr 4 weeks) or d) prese be offered depends o ction 32 Subsection	date each or oral ex edits approx. 20 mir entation/seminar pre on the method of ase 3 ASPO (general aca	amination in 1utes) or c) esentation sessment demic 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	e appea	in in					
Master's wi	th 1 majoi	Physics (2010)	JMU Würzbu reg. data re	rrg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 166 / 280	



Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (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) FOKUS Physics (2006)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 167 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title				Abbreviation		
Modern	Astro	physics			11-MAS-111-m01	
Module	coord	inator		Module offered by		
Managi and Ast	ng Dire rophys	ector of the Institute of ics	Theoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
4	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		Certain prerequisite sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the se sessment into effect ted to assessment i sessment at a later admission to assess	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					
Introdu	ction to	o a field of modern Ast	rophysics, e.g. extra-ga	lactic jets.		
Intende	d learn	ning outcomes				
The students know the current state of research on the modern topic of Astrophysics. They know the physical va- lues and are to plan and conduct observations in this area. This includes the ability to conceptualise a specific observational project and e.g. to apply for observation time at large telescopes.						
Courses	<b>5</b> (type, n	umber of weekly contact hour	s, language — if other than Gei	rman)		
V + R (n	o infor	mation on SWS (weekl	y contact hours) and co	ourse language availa	able)	
<b>Method</b> module is	<b>l of ass</b> creditab	s <b>essment</b> (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informati	ion on whether
a) writte groups project (approx Assessi and will examin Langua	en exar (appro report a. 30 m ment o l be an ation re ge of a	nination (approx. 90 m x. 30 minutes per canc (approx. 8 to 10 pages inutes) ffered: When and how nounced in due form u egulations) 2009. ssessment: German, E	ninutes) or b) oral exam lidate, for modules with , time to complete: 1 to often assessment will h nder observance of Seo nglish	ination of one candi n less than 4 ECTS cr 4 weeks) or d) prese pe offered depends o ction 32 Subsection 3	date each or oral exa edits approx. 20 mir entation/seminar pre on the method of ase 3 ASPO (general aca	amination in nutes) or c) esentation sessment demic and
Allocati	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module	appea	ins in				
Master's wit	th 1 major	Physics (2010)	JMU Würzbu reg. data reg	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physik	• exam. < - 2010	page 168 / 280



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 (2006)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 169 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title				Abbreviation		
Introdu	Introduction to Elementary Particle Theory				11-ETT-111-m01	
Module	coord	inator		Module offered by		
Managi and Ast	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)		
4	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		Certain prerequisite sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the se sessment into effect ted to assessment i sessment at a later admission to assess	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					
Symme dynami	tries in cs and	Particle Physics. Quar in the standard model	k model of hadrons. Fe . Parton model and dee	ynman rules. Simple ep inelastic lepton-ni	processes in quanti ucleon scattering.	um electro-
Intende	d learr	ning outcomes				
The stu	dents l	nave in-depth knowled	ge of Theoretical Eleme	entary Particle Physic	s.	
Courses	<b>5</b> (type, n	umber of weekly contact hour	s, language — if other than Gei	rman)		
V (no in	format	ion on SWS (weekly co	ntact hours) and cours	e language available	e)	
<b>Method</b> module is	<b>l of ass</b> creditab	s <b>essment</b> (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informati	ion on whether
a) writte groups project (approx Assessi and will examin Langua	en exar (appro report 3. 30 m ment o l be an ation re ge of a	nination (approx. 90 m x. 30 minutes per cand (approx. 8 to 10 pages inutes) ffered: When and how nounced in due form u egulations) 2009. ssessment: German, E	inutes) or b) oral exam lidate, for modules with , time to complete: 1 to often assessment will l nder observance of Sec nglish	ination of one candi n less than 4 ECTS cr 4 weeks) or d) prese pe offered depends o ction 32 Subsection 3	date each or oral exa edits approx. 20 mir entation/seminar pre on the method of ase 3 ASPO (general aca	amination in nutes) or c) esentation sessment demic and
Allocati	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						
master'	s degre	ee (1 major) Physics (20	010)			
Master's wi	th 1 major	Physics (2010)	JMU Würzbu reg. data red	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physik	• exam. < - 2010	page 170 / 280

## Julius-Maximilians-UNIVERSITÄT WÜRZBURG



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) FOKUS Physics (2006)

		1
Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 171 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation			
Quantu	m Loop	o Gravity			11-QSG-102-m01	
Module	coord	inator		Module offered by		
Managi and Ast	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)		
4	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		Certain prerequisite sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the se sessment into effect ted to assessment it sessment at a later admission to assess	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			
Content	Contents					
Aside fr chanica bles are on discu Therefo Intende	om str al descr e identi retised re, QLC ed learr	ing theory, quantum lo ription of gravity. Gene fied with the correspon graphs, so-called spin belongs to the specu <b>hing outcomes</b>	op gravity (QLG) is one ral relativity is formulat nding Poisson brackets networks. In doing so, lative theories which pa	of the most importaned in Hamiltonian fo . These variables are e.g. a quantisation aint a picture of the c	nt approaches to a c rmalism and the ele e quantised in the typ of elemental volume constitution of space	Juantum me- mental varia- pical manner s appears. and time.
ted topi	ic and	have proved their know	vledge in a seminar pre	sentation.		or a selec-
Courses	<b>5</b> (type, n	umber of weekly contact hour	s, language — if other than Ger	rman)		
V + S (n	o infor	mation on SWS (weekl	y contact hours) and co	ourse language availa	able)	
Method module is	<b>of ass</b> creditab	s <b>essment</b> (type, scope, lang le for bonus)	uage — if other than German, o	examination offered — if no	t every semester, informati	on on whether
<ul> <li>a) written examination (approx. 90 minutes) or</li> <li>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</li> <li>c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or</li> <li>d) presentation/seminar presentation (approx. 30 minutes)</li> <li>Language of assessment: German, English</li> <li>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 or complete)</li> </ul>						
Allocati	ion of p	olaces				
Additio	nal info	ormation				
Workload						
Teaching cycle						
Master's wit	th 1 major	Physics (2010)	JMU Würzbu reg. data rec	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physik	• exam. < - 2010	page 172 / 280

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## Module appears in

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 (2006)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 173 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation			
Concepts of Theoretical Astroparticle physics					11-ATT-111-m01	
Module	Module coordinator			Module offered by		
Managi and Ast	ng Dire rophys	ector of the Institute of ics	Theoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS Method of grading Only a			Only after succ. con	npl. of module(s)		
4	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		Certain prerequisite 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 i sessment at a later admission to assess	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.			
Conten	ts					
Concep mic acc	ts of Th elerato	neoretical Astro-Particl ors, dark energy, inflati	e Physics, e.g. Dark ma on.	tter, cosmic radiatio	n, neutrinos, baryog	enesis, cos-
Intende	ed learn	ning outcomes				
The stu be pher proache	dents ł nomen es for p	nave basic knowledge a of Astroparticle Phys roblems.	of the concepts of Thec ics on the basis of metl	pretical Astroparticle hods of Theoretical P	Physics. They are ab hysics and to find so	ole to descri- olution ap-
Courses	<b>S</b> (type, n	umber of weekly contact hou	rs, language — if other than Ge	rman)		
V + R (n	o infor	mation on SWS (week	y contact hours) and co	ourse language avail	able)	
<b>Method</b> module is	l of ass creditab	<b>essment</b> (type, scope, lang le for bonus)	guage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
a) writte groups project (approx Assessi and wil examin	en exar (appro report x. 30 m ment o l be an ation re	nination (approx. 90 n x. 30 minutes per cand (approx. 8 to 10 pages inutes) ffered: When and how nounced in due form u egulations) 2009.	ninutes) or b) oral exam didate, for modules with , time to complete: 1 to often assessment will l under observance of Sec	ination of one candi n less than 4 ECTS cr 4 weeks) or d) prese be offered depends o ction 32 Subsection	date each or oral exa edits approx. 20 mir entation/seminar pre on the method of ass 3 ASPO (general aca	amination in nutes) or c) esentation sessment demic and
Allocati	ion of p	olaces				
Additio	nal inf	ormation				
Workload						
Tooshing syste						
Referred to in LPO L (examination regulations for teaching degree programmer)						
Module appears in						
waster's wi	un 1 major	Priysics (2010)	JMU Würzbu reg. data ree	ord Master (120 ECTS) Physil	• exam. < - 2010	page 174 / 280



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Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 175 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation			
General	General Theory of Relativity				11-ART-112-m01	
Module	coord	inator		Module offered by		
Managing Director of the Institute of Theore and Astrophysics			Theoretical Physics	Physics Faculty of Physics and Astronomy		
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
4	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semestergraduateCertain prerequisites must be met to qual sessment. The lecturer will inform student at the beginning of the course. Registratio sidered a declaration of will to seek admis 		alify for admission to nts about the respec- ion for the course wi ission to assessmen r admission to asses will put their registra t all prerequisites wi e subsequent semes ave to obtain the qu	as- tive details Il be con- nt. If stu- ssment over tion for as- ill be admit- ster. For as- alification for			
Content	ts		-			
Mathem ments c general	natical of diffe relativ	foundations of the theo rential geometry; electr ity; stellar models; intr	ory of relativity; differen odynamics as an exam oduction to cosmology	ntial forms; brief sun ple of a relativistic g ; Hamiltonian formu	nmary of special rela auge theory; field ea lation	itivity; ele- quations of
Intende	d learn	ning outcomes				
The stue mathem able to	dents a natical apply t	are familiar with the bas understanding of the fo he acquired knowledge	sic physical and mathe prmulation of general r e to problems of Astrop	matical concepts of elativity on the basis physics and cosmolog	general relativity. Th of differential forms gy.	ey have a 5. They are
Courses	<b>5</b> (type, n	umber of weekly contact hours	, language — if other than Ger	man)		
V + R (n	o infor	mation on SWS (weekly	contact hours) and co	ourse language availa	able)	
Method module is	l <b>of ass</b> creditab	essment (type, scope, lang le for bonus)	uage — if other than German, e	examination offered — if no	t every semester, informati	on on whether
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and will be approxed)				amination in nutes) or c) esentation sessment demic and		
Allocati	on of p	olaces				
Additio	nal inf	ormation				
Workload						
Teaching cycle						
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Master's wit	th 1 major	Physics (2010)	JMU Würzbu reg. data rec	rg • generated 26-Aug-2024 • ord Master (120 ECTS) Physik	• exam. <- 2010	page 176 / 280



Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) 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) Master's degree (1 major) FOKUS Physics (2006)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 177 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title					Abbreviation			
Special	Theory	y of Relativity		11-SRT-112-m01				
Module coordinator				Module offered by				
Managing Director of the Institute of Th and Astrophysics			Theoretical Physics	Faculty of Physics a	nd Astronomy			
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)				
4	nume	rical grade						
Duratio	n	Module level	Other prerequisites	equisites				
1 semester		graduate	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for admission to assessment anew.					
Conten	ts							
Mathen nian eq	natical uation	principles; differential of motion; relativistic	forms; special relativit free particle	y; Minkowski space;	Lorentz transformat	tion, Hamilto-		
Intende	ed learr	ning outcomes						
The students are familiar with the physical concepts and mathematical principles of special relativity. They are familiar with modern mathematical formulation of special relativity. They are able to apply the acquired knowledge to problems of special relativity.den.								
Courses	<b>S</b> (type, n	umber of weekly contact hour	s, language — if other than Ge	rman)				
V + R (n	o infor	mation on SWS (weekl	y contact hours) and co	ourse language availa	able)			
<b>Method of assessment</b> (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)								
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.								
Allocati	ion of p	olaces						
Additio	nal inf	ormation						
Worklo	ad							
		_						
reaching cycle								
Peferred to in LPO L (eventiantian regulations for the shifts down and an and a second								
Module appears in								
waster's wi	in 1 major	riysics (2010)	JMU Wurzbu reg. data red	org • generated 26-Aug-2024 cord Master (120 ECTS) Physik	• exam. < - 2010	page 178 / 280		



Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) 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) Master's degree (1 major) FOKUS Physics (2006)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 179 / 280
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# **Complex Systems, Quantum Control and Biophysics**

(40 ECTS credits)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 180 / 280				
	reg. data record Master (120 ECTS) Physik - 2010					
Module title			Abbreviation			
--	-----------------------------	---	---	---	---	----------------
Nano-O	Nano-Optics 11-NOP-092-m01					
Module coordinator			Module offered by			
Managing Director of the Institute of Ap		Applied Physics	Faculty of Physics a	nd Astronomy		
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
4	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester graduate		Certain prerequisite sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the se sessment into effect ted to assessment in sessment at a later admission to assess	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		•			
Theoret quantu	tical pri m emit	inciples. Focussing of li ters. Light emission in r	ght. Microscopy. Optic nano-tailored environn	al nearfield probes. 1ents. Plasmons. Op	Nearfield microscop tical antennas.	y. Single
Intende	ed learı	ning outcomes				
The stu retical p	dents l princip	nave specific and advar les and application area	nced knowledge in the as of nano-optics and v	field of nano-optics. with current develop	They are familiar wi ments in this field.	th the theo-
Course	<b>S</b> (type, n	umber of weekly contact hours	, language — if other than Ger	rman)		
R + V (no information on SWS (weekly contact hours) and course language available)						
Methoo module is	<b>d of ass</b> creditab	<b>eessment</b> (type, scope, langu le for bonus)	uage — if other than German, o	examination offered — if no	t every semester, informati	on on whether
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.					amination in iutes) or c) esentation sessment demic and	
Allocat	ion of p	olaces	<u> </u>			
Additio	nal inf	ormation				
Worklo	ad					
Teaching cycle						
Referre	d to in	LPO I (examination regulatio	ns for teaching-degree progra	mmes)		
Module	e appea	ins in				
Bachel	or' deg	ree (1 major) Physics (20	010)			
Master's wi	th 1 major	Physics (2010)	JMU Würzbu reg. data rec	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physik	exam. - 2010	page 181 / 280

#### Julius-Maximilians-UNIVERSITÄT WÜRZBURG



Bachelor' degree (1 major) 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) 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)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 182 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title		Abbreviation				
Biophysical Measurement Technology in Medical Science				11-BMT-092-m01		
Module coordinator			Module offered by			
Managing Director of the Institute of Ap		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	n	Module level	Other prerequisites			
1 semester graduate		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	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					
The lect topics a sound a image p	ture co are con and MR process	vers the physical princ ventional X-ray technic R-tomography. The lect sing.	iples of imaging techni que, computer tomogra ure additionally addres	ques and their appli phy, imaging technic ses systems theory o	cation in Biomedicin ques of nuclear med of imaging systems a	ie. The main icine, ultra- and digital
Intende	ed learı	ning outcomes				
The stu derstar images	dents l nd the p	know the physical prin principles of image ger	ciples of imaging techn leration and are able to	iques and their appl explain different tec	ication in Biomedici chniques and interpr	ne. They un- et simple
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)						
R + V (n	o infor	mation on SWS (week	y contact hours) and co	ourse language avail	able)	
Methoo module is	<b>d of ass</b> creditab	<b>essment</b> (type, scope, lang le for bonus)	guage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.						
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teaching cycle						
Referre	d to in	LPO I (examination regulat	ons for teaching-degree progra	ammes)		
Master's wi	ith 1 majoi	Physics (2010)	JMU Würzbu reg. data ree	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 183 / 280





# 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) 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 (2011) Master's degree (1 major) FOKUS Physics (2012)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 184 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Master's with 1 major Physics (2010)

Module title				Abbreviation	
Labora	tory an	d Measurement Technol	ogy in Biophysics		11-LMB-092-m01
Module	e coord	inator		Module offered by	
Managing Director of the Institute of Applied Phy		oplied Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	pl. 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 sessment. The lecturer will inform students about the respect to the beginning of the course. Registration for the course is sidered a declaration of will to seek admission to assess methers have obtained the qualification for admission to assess the course of the semester, the lecturer will put their regist sessment into effect. Students who meet all prerequisites ted to assessment at a later date, students will have to obtain the qualification for admission to assess the course of the semester in the subsequent sem sessment at a later date, students will have to obtain the qualification for admission to assess the course of the semester in the subsequent sem sessment at a later date, students will have to obtain the qualification for admission to assess the course of the semester in the subsequent sem sessment at a later date, students will have to obtain the qualification for admission the semester is the semester of the semester is the subsequent sem set of the semester is the semester in the subsequent sem sets the semester is the semester in the subsequent sem sets the semester is the semester in the semister is the semister is the semister in the semister is the semister is the semister is the semister in the semister is the semister in the semister is		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			
Conten	ts				
The lec physica measu methoo	ture co al proce ring tec ls of st	vers relevant principles or edures for the examination hniques and sensors, mo ructure elucidation of bio	of molecular and cellu on and manipulation o ethods of single-parti omolecules.	llar biology as well a of biological systems cle detection, specia	s the physical principles of bio- s. The main topics are optical al microscoping techniques and
Intende	ed learı	ning outcomes			
The stu sical pr measu biomol	The students know the principles of molecular and cellular biology as well as the physical principles of biophy- sical procedures for the examination and manipulation of biological systems. They have knowledge of optical measuring techniques and their applications and are able to apply techniques of structure elucidation to simple biomolecules.				e physical principles of biophy- ney have knowledge of optical of structure elucidation to simple
Course	<b>Courses</b> (type, number of weekly contact hours, language — if other than German)				
R + V (r	no infor	mation on SWS (weekly o	contact hours) and co	urse language availa	able)
Method module is	<b>d of ass</b> s creditab	s <b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and					
examin	ation r	egulations) 2009.	lich		
		Jaces	u311		
		/10/03			
Additio	Additional information				
Worklo	Workload				
Teachi	ng cycl	e			

JMU Würzburg • generated 26-Aug-2024 • exam. reg. data record Master (120 ECTS) Physik - 2010

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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) Nanostructure Technology (2010)
Bachelor' degree (1 major) Nanostructure Technology (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) 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) Functional Materials (2012)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 186 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Master's with 1 major Physics (2010)

Module title		Abbreviation		
Physics of Complex Systems				11-PKS-092-m01
Module coordinator		Module offered by		
Managing Dir and Astrophy	ector of the Institute of Th sics	eoretical Physics	Faculty of Physics a	nd Astronomy
ECTS Meth	od of grading	Only after succ. com	pl. of module(s)	
6 nume	rical grade			
Duration	Module level	Other prerequisites		
1 semester	graduate Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective d at the beginning of the course. Registration for the course will be c sidered a declaration of will to seek admission to assessment. If st dents have obtained the qualification for admission to assessmen the course of the semester, the lecturer will put their registration for sessment into effect. Students who meet all prerequisites will be a ted to assessment in the current or in the subsequent semester. For sessment at a later date, students will have to obtain the qualification devices of the semester. Students will have to obtain the qualification for admission to assessment at a later date, students will have to obtain the qualification for admission to assessment at a later date, students will have to obtain the qualification for admission the subsequent semester. For sessment at a later date, students will have to obtain the qualification for admission to assess the 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	
Contents	• •			
<ol> <li>Ineory of cl</li> <li>Introductio</li> <li>Entropy pro</li> <li>Phase trans</li> <li>Universality</li> <li>Spin glasse</li> <li>Theory of n</li> </ol>	n into the physics out of e oduction and fluctuations sitions away from equilibry yt est eural networks	nai equilibriumt equilibriumt t riumt		
Intended learning outcomes				
The students methods of S such systems	The students have specific and advanced knowledge in the field of physics of complex systems. They know the methods of Statistical Physics, Computational Physics and non-linear dynamics, which are used to describe such systems. They are able to work on current research problems in this area.			
Courses (type,	number of weekly contact hours, l	anguage — if other than Ger	man)	
R + V (no info	rmation on SWS (weekly o	contact hours) and co	ourse language avail	able)
Method of as module is credital	<b>sessment</b> (type, scope, langua ble for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009. Language of assessment: German, English				
Allocation of	places			
Additional inf	ormation			
Workload				

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### **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)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 188 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation		
Quantum Information and Quantum Computing				11-QIC-092-m01	
Module coordinator				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)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate	Certain prerequisites must be met to qualify for admission to as- sessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be con- sidered a declaration of will to seek admission to assessment. If stu- dents have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for as- sessment into effect. Students who meet all prerequisites will be admit- ted to assessment in the current or in the subsequent semester. For as- sessment at a later date, students will have to obtain the qualification for		alify for admission to as- nts about the respective details ion for the course will be con- hission 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
Conten	ts				
The firs ses the entang tron sp states.	t part i main c led stat in state	ntroduces the theoretical quantum algorithms. The tes. One of the main topi es. The third part covers t	l concepts of quantur second part discuss cs is the production, he description and e	n information and qu es experimental pos controlling and man xplanation of decohe	uantum computers. It discus- sibilities for the realisation of ipulation of coherent two-elec- erence of quantum mechanical
Intende	ed learı	ning outcomes			
The stu They ar	dents l e able	have an advanced unders to solve simple problems	standing of quantum of quantum informa	theory and basic kno tion theory.	owledge of quantum calculation.
Course	<b>S</b> (type, n	number of weekly contact hours, l	anguage — if other than Ger	man)	
R + V (n	io infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)
Methoo module is	<b>d of ass</b> creditab	<b>sessment</b> (type, scope, langua le for bonus)	ge — if other than German, o	examination offered — if no	t every semester, information on whether
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes) Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.					
Langua	ge of a	ssessment: German, Eng	lish		
Allocation of places					
Additional information					
Worklo	ad				
Teachin	ng cycl	e			
			· · · · · · · · · · · · · · · · · · ·		

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 189 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

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

## Module appears in

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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) 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 with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 190 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Modul	e title				Abbreviation	
Statist	ics, Dat	ta Analysis and Compu	ter Physics		11-SDC-092-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)		
4	nume	rical grade				
Duratio	on	Module level	Other prerequisites			
1 semester graduate		Certain prerequisite sessment. The lectu at the beginning of t sidered a declaratio dents have obtained the course of the se sessment into effect ted to assessment i sessment at a later admission to assess	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	its					
Statist	ics, dat	a analysis and comput	er physics.			
Intend	ed lear	ning outcomes				
The stu Physic:	ıdents l s.	have specific and adva	nced knowledge in the	field of statistics, da	ita analysis and Com	ıputational
Course	<b>S</b> (type, r	number of weekly contact hour	s, language — if other than Ger	rman)		
R + V (1	no infor	mation on SWS (weekl	y contact hours) and co	ourse language avail	able)	
Metho module i	<b>d of ass</b> s creditab	sessment (type, scope, lang le for bonus)	guage — if other than German,	examination offered — if no	t every semester, informat	on on whether
a) writt groups project (appro Assess and wi examir Langua	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.					amination in nutes) or c) esentation sessment demic and
Allocat	ion of p	olaces				
	_					
Additio	onal inf	ormation				
	-					
Worklo	ad					
Teachi	ng cycl	e				
Reterred to in LPO I (examination regulations for teaching-degree programmes)						
Modul	Module appears in					
Bachel	or deg or deg	ree (1 major) Physics (2 ree (1 major) Physics (2	2010) 2012)			
Master's w	ith 1 majo	r Physics (2010)	JMU Würzbu reg. data reg	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 191 / 280

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-Maxir

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WÜRZBURG

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# **Other Modules Specialisation**

(40 ECTS credits)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 193 / 280
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Module title			Abbreviation		
Module Type 4A Special Training Astronomy				11-SF-4A-072-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)	
4	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts				
Specifi	c, adva	nced knowledge of one c	or more of the Faculty	's current research a	reas in the field of Astronomy.
Intende	ed lear	ning outcomes			
The stu field of	dents l Astron	nave specific and advanc omy.	ed knowledge of one	e or more current rese	earch areas of the faculty in the
Course	<b>S</b> (type, r	umber of weekly contact hours, l	anguage — if other than Ger	rman)	
V + R (n	o infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)
Methoo module is	<b>d of ass</b> creditab	s <b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, o	examination offered — if no	t every semester, information on whether
a) writt date ea	en exai ich or c	nination (approx. 90 min ral examination in group	utes) or b) talk (appr s (approx. 30 minute	ox. 30 minutes) or c) s) or d) project repor	oral examination of one candi- t (approx. 8 pages)
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
Teachir	ng cycl	e			
Referre	d to in	LPOI (examination regulation	s for teaching-degree progra	immes)	
Module	e appea	ars in			
Master	's degr	ee (1 major) Physics (201	0)		
Master	's degr	ee (1 major) FOKUS Physi	cs (2010)		
Master	's degr	ee (1 major) FOKUS Physi	CS (2006)		

Module	e title				Abbreviation
Module Type 4D Special Training Didactics			11-SF-4D-072-m01		
Module coordinator			Module offered by		
Managi	ing Dire	ector of the Institute of Ap	plied Physics	Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)	
4	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts				
Specifi	c, adva	nced knowledge of one o	or more of the Faculty	's current research a	reas in the field of Didactics.
Intende	ed leari	ning outcomes			
The stu field of	dents l Didact	nave specific and advanc ics.	ed knowledge of one	or more current rese	earch areas of the faculty in the
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V + R (n	infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)
Methoo module is	<b>d of ass</b> creditab	s <b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
a) writt date ea	en exai ich or o	mination (approx. 90 min ral examination in group	utes) or b) talk (appr s (approx. 30 minute	ox. 30 minutes) or c) s) or d) project repor	oral examination of one candi- t (approx. 8 pages)
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
Teachir	ng cycl	e			
Referre	<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)				
Module	e appea	in in			
Master	's degr	ee (1 major) Physics (201	0)		
Master	's degro	ee (1 major) FOKUS Physi	CS (2010)		
master	s aegr	ee (1 major) FUKUS Physi	(2006)		

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 195 / 280
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Module	title				Abbreviation
Module	Module Type 4E Special Training Experimental Physics         11				11-SF-4E-072-m01
Module coordinator Module offered			Module offered by		
Managi	ng Dire	ector of the Institute of Ap	plied Physics	Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)	
4	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts				
Specific Physics	c, adva 5.	nced knowledge of one o	r more of the Faculty	's current research a	reas in the field of Experimental
Intende	ed learı	ning outcomes			
The stu field of	dents l Experi	nave specific and advanc mental Physics.	ed knowledge of one	or more current rese	earch areas of the faculty in the
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	rman)	
V + R (n	o infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)
Methoo module is	<b>l of ass</b> creditab	s <b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
a) writte date ea	en exai ch or o	nination (approx. 90 min ral examination in group	utes) or b) talk (appr s (approx. 30 minute	ox. 30 minutes) or c) s) or d) project repor	oral examination of one candi- t (approx. 8 pages)
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
Teachir	ng cycl	9			
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	
Module	appea	irs in			
Master'	s degr	ee (1 major) Physics (2010	o)		
Master's degree (1 major) Nanostructure Technology (2010)					
Master'	s degr	ee (1 major) FOKUS Physi	cs - Nanostructuring	Technology (2010)	
Master'	Master's degree (1 major) FOKUS Physics (2010)				
Master'	s degr	ee (1 major) FOKUS Physic	cs - Nanostructuring cs (2006)	Technology (2006)	
master	s uego	ee (1 majui) rukus physh	(2000)		

Module	e title				Abbreviation
Module	e Type 4	4I Special Training Interd	isciplinary Research	Fields	11-SF-4l-072-m01
Module coordinator			Module offered by		
Managi the Inst	ing Dire titute o	ectors of the Institute of A f Theoretical Physics and	pplied Physics and Astrophysics	Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
4	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts				
Specifi	c, adva	nced knowledge of one c	or more of the Faculty	's current research a	reas.
Intende	ed learr	ning outcomes			
The stu terdisci	dents ł iplinary	nave specific and advanc	ed knowledge of one	or more current rese	earch areas of the faculty in an in-
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V + R (n	infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)
Methoo module is	<b>d of ass</b> creditab	<b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
a) writt date ea	en exar ich or o	nination (approx. 90 min ral examination in group	utes) or b) talk (appr s (approx. 30 minute	ox. 30 minutes) or c) s) or d) project repor	oral examination of one candi- t (approx. 8 pages)
Allocat	ion of p	olaces			
Additio	nal info	ormation			
Worklo	ad				
Teachir	ng cycl	9			
Referre	d to in	LPOI (examination regulations	s for teaching-degree progra	mmes)	
Module	e appea	rs in			
Master	's degre	ee (1 major) Physics (201	0)		
Master's degree (1 major) Nanostructure Technology (2010)					
Master	Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)				
Master	's degre	ee (1 major) FOKUS Physi	cs (2010)	Tashaalaa ( )	
Master	s aegre	ee (1 major) FUKUS Physi	cs - Nanostructuring	rechnology (2006)	
master	5 uegle	ee (1 major) rokus rhyst	(2000)		

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Module title				Abbreviation		
Module Type 4T Special Training Theoretical Physics					11-SF-4T-072-m01	
Module coordinator				Module offered by		
Managi and Ast	ng Dire trophys	ector of the Institute of Th ics	eoretical Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)		
4	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semes	ster	graduate				
Conten	ts					
Specific Physics	c, adva 5.	nced knowledge of one c	or more of the Faculty	's current research a	reas in the field of Theoretical	
Intende	ed learr	ning outcomes				
The stu field of	dents ł Theore	nave specific and advanc tical Physics.	ed knowledge of one	or more current rese	earch areas of the faculty in the	
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	rman)		
V + R (n	o infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)	
Method module is a) writte	l of ass creditab en exar	eessment (type, scope, langua le for bonus) nination (approx. 90 min	ge — if other than German, o utes) or b) talk (appr	examination offered — if no ox. 30 minutes) or c)	t every semester, information on whether oral examination of one candi-	
date ea	ch or o	ral examination in group	s (approx. 30 minute	s) or d) project repor	t (approx. 8 pages)	
Allocat	ion of p	olaces				
Additio	nal info	ormation				
Worklo	ad					
Teachir	ng cycl	e				
Referre	d to in	LPO I (examination regulation	s for teaching-degree progra	mmes)		
Module	e appea	rs in				
Master'	s degre	ee (1 major) Physics (201	0)			
Master'	s degre	ee (1 major) Nanostructur	re Technology (2010)	Tachnology (acto)		
Master'	Master's degree (1 major) FUKUS Physics - Nanostructuring lechnology (2010)					
Master'	s degre	ee (1 major) FOKUS Physi	cs - Nanostructuring	Technology (2006)		
Master'	Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2006) Master's degree (1 major) FOKUS Physics (2006)					

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Module title Abbreviation					Abbreviation	
Module Type 5A Special Training Astronomy			onomy		11-SF-5A-072-m01	
Module	Module coordinator			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. com	pl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Specifi	c, adva	nced knowledge of one c	or more of the Faculty	's current research a	reas in the field of Astronomy.	
Intende	ed leari	ning outcomes				
The stu field of	dents l Astron	nave specific and advanc omy.	ed knowledge of one	or more current rese	earch areas of the faculty in the	
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V + R (n	io infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)	
Methoo module is	<b>d of ass</b> creditab	<b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
a) writt date ea	en exai ich or o	mination (approx. 90 min ral examination in group	utes) or b) talk (appr s (approx. 30 minute	ox. 30 minutes) or c) s) or d) project repor	oral examination of one candi- t (approx. 10 pages)	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachir	ng cycl	e				
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)		
Module	e appea	irs in				
Master	's degr	ee (1 major) Physics (201	o)			
Master	's degr	ee (1 major) FOKUS Physi	cs (2010)			
Master	Master's degree (1 major) FOKUS Physics (2006)					

Module title					Abbreviation	
Module	Module Type 5D Special Training Didactics				11-SF-5D-072-m01	
Module coordinator				Module offered by		
Managi	ing Dire	ector of the Institute of Ap	plied Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Specifi	c, adva	nced knowledge of one c	or more of the Faculty	's current research a	reas in the field of Didactics.	
Intende	ed leari	ning outcomes				
The stu field of	dents l Didact	nave specific and advanc ics.	ed knowledge of one	or more current rese	earch areas of the faculty in the	
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V + R (n	infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)	
Methoo module is	<b>d of ass</b> creditab	s <b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
a) writt date ea	en exai ich or o	mination (approx. 90 min ral examination in group	utes) or b) talk (appr s (approx. 30 minute	ox. 30 minutes) or c) s) or d) project repor	oral examination of one candi- t (approx. 10 pages)	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachir	ng cycl	e				
Referre	<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)					
Module	e appea	ins in				
Master	's degr	ee (1 major) Physics (201	o)			
Master	's degr	ee (1 major) FOKUS Physi	cs (2010)			
master	Master's degree (1 major) FOKUS Physics (2006)					

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Module title			Abbreviation			
Module Type 5E Special Training Experimental Physics       11-SF-5E-072-m01				11-SF-5E-072-m01		
Module	coord	inator		Module offered by		
Managi	ng Dire	ector of the Institute of Ap	plied Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semes	ster	graduate				
Conten	ts					
Specific Physics	c, adva 5.	nced knowledge of one o	r more of the Faculty	's current research a	reas in the field of Experimental	
Intende	ed learı	ning outcomes				
The stu field of	dents l Experi	nave specific and advanc mental Physics.	ed knowledge of one	or more current rese	earch areas of the faculty in the	
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V + R (n	o infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)	
<b>Methoc</b> module is	<b>l of ass</b> creditab	s <b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
a) writte date ea	en exai ch or o	mination (approx. 90 min ral examination in group	utes) or b) talk (appr s (approx. 30 minute	ox. 30 minutes) or c) s) or d) project repor	oral examination of one candi- t (approx. 10 pages)	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachir	ıg cycl	e				
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)		
Module	Module appears in					
Master'	s degr	ee (1 major) Physics (2010	o)			
Master'	s degr	ee (1 major) Nanostructur	e Technology (2010)			
Master'	s degr	ee (1 major) FOKUS Physic	cs - Nanostructuring	lechnology (2010)		
Master'	s degr	ee (1 major) FUKUS Physic ee (1 major) FOKUS Physic	us (2010) cs - Nanostructuring	Technology (2006)		
Master'	s degr	ee (1 major) FOKUS Physic	cs (2006)	(2000)		

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Module title			Abbreviation		
Module Type 5I Special Training Interdisciplinary Research Fields				11-SF-5I-072-m01	
Module	Module coordinator			Module offered by	
Managi the Inst	ing Dire titute o	ectors of the Institute of A f Theoretical Physics and	pplied Physics and Astrophysics	Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts				
Specifi	c, adva	nced knowledge of one c	or more of the Faculty	's current research a	reas.
Intende	ed learı	ning outcomes			
The stu terdisci	dents l iplinary	nave specific and advanc	ed knowledge of one	or more current rese	earch areas of the faculty in an in-
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V + R (n	no infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)
Methoo module is	<b>d of ass</b> creditab	s <b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
a) writt date ea	en exai ich or o	nination (approx. 90 min ral examination in group	utes) or b) talk (appr s (approx. 30 minute	ox. 30 minutes) or c) s) or d) project repor	oral examination of one candi- t (approx. 10 pages)
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
Teachir	ng cycl	9			
Referre	d to in	LPOI (examination regulation	s for teaching-degree progra	mmes)	
Module	e appea	rs in			
Master	's degr	ee (1 major) Physics (201	0)		
Master	's degr	ee (1 major) Nanostructu	re Technology (2010)	, .	
Master	's degr	ee (1 major) FOKUS Physi	cs - Nanostructuring	Technology (2010)	
Master	's degre	ee (1 major) FOKUS Physi	CS (2010)	Tachnology (acc)	
Master'	's degri	ee (1 major) FOKUS Physi	cs (2006)	Technology (2006)	
master	2 4051				

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Module title					Abbreviation
Module Type 5T Special Training Theoretical Physics					11-SF-5T-072-m01
Module coordinator				Module offered by	
Managi and Ast	ng 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)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts				
Specific Physics	c, adva 5.	nced knowledge of one c	or more of the Faculty	's current research a	reas in the field of Theoretical
Intende	ed learı	ning outcomes			
The stu field of	dents l Theore	nave specific and advanc tical Physics.	ed knowledge of one	e or more current rese	earch areas of the faculty in the
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Gei	rman)	
V + R (n	io infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)
Methoo module is	<b>d of ass</b> creditab	<b>eessment</b> (type, scope, langua le for bonus)	ge — if other than German,	examination offered — if no	t every semester, information on whether
a) writte date ea	en exai ich or o	mination (approx. 90 min ral examination in group	utes) or b) talk (appr s (approx. 30 minute	ox. 30 minutes) or c) s) or d) project repor	oral examination of one candi- t (approx. 10 pages)
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
Teachir	ıg cycl	e			
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	
Module	e appea	ars in			
Master	's degr	ee (1 major) Physics (201	o)		
Master	's degr	ee (1 major) Nanostructu	re Technology (2010)	<b>-</b>	
Master	s degr	ee (1 major) FOKUS Physi	cs - Nanostructuring	Technology (2010)	
Master	s uegn 's degri	ee (1 major) FOKUS Physi	cs (2010) cs - Nanostructuring	Technology (2006)	
Master	's degr	ee (1 major) FOKUS Physi	cs (2006)		

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Module title Abbreviation					Abbreviation	
Module Type 6A Special Training Astronomy			onomy		11-SF-6A-072-m01	
Module	Module coordinator			Module offered by		
Managi and Ast	ng Dire trophys	ector of the Institute of Th ics	eoretical 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	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Specifi	c, adva	nced knowledge of one o	or more of the Faculty	's current research a	reas in the field of Astronomy.	
Intende	ed leari	ning outcomes				
The stu field of	dents l Astron	nave specific and advanc omy.	ed knowledge of one	or more current rese	earch areas of the faculty in the	
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	rman)		
V + R (n	o infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)	
Methoo module is	<b>l of ass</b> creditab	e <b>ssment</b> (type, scope, langua le for bonus)	ge — if other than German, o	examination offered — if no	t every semester, information on whether	
a) writt date ea	en exai ch or o	nination (approx. 90 min ral examination in group	utes) or b) talk (appr s (approx. 30 minute	ox. 30 minutes) or c) s) or d) project repor	oral examination of one candi- t (approx. 12 pages)	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachir	ng cycl	9				
Referre	d to in	LPOI (examination regulations	s for teaching-degree progra	mmes)		
Module	appea	irs in				
Master	s degr	ee (1 major) Physics (201	0)			
Master	s degr	ee (1 major) FOKUS Physi	cs (2010)			
Master	Master's degree (1 major) FOKUS Physics (2006)					

Module title					Abbreviation	
Module Type 6D Special Training Didactics				11-SF-6D-072-m01		
Module	Module coordinator			Module offered by		
Managi	ing Dire	ector of the Institute of Ap	plied Physics	Faculty of Physics a	ind Astronomy	
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)		
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Specifi	c, adva	nced knowledge of one o	or more of the Faculty	's current research a	reas in the field of Didactics.	
Intende	ed learn	ning outcomes				
The stu field of	dents l Didact	nave specific and advanc ics.	ed knowledge of one	or more current res	earch areas of the faculty in the	
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	rman)		
V + R (n	infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)	
Methoo module is	<b>d of ass</b> creditab	s <b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	ot every semester, information on whether	
a) writt date ea	en exai ich or o	mination (approx. 90 min ral examination in group	utes) or b) talk (appr s (approx. 30 minute	ox. 30 minutes) or c) s) or d) project repor	) oral examination of one candi- t (approx. 12 pages)	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachir	ng cycl	e				
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)		
Module	e appea	in				
Master	's degr	ee (1 major) Physics (201	o)			
Master	's degr	ee (1 major) FOKUS Physi	cs (2010)			
Master	Master's degree (1 major) FOKUS Physics (2006)					

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Module title				Abbreviation	
Module	Module Type 6E Special Training Experimental Physics11-SF-6E-072-m01				
Module coordinator Module offe				Module offered by	
Managi	ing Dire	ector of the Institute of Ap	plied Physics	Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)	
6	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts				
Specific Physics	c, adva 5.	nced knowledge of one o	r more of the Faculty	's current research a	reas in the field of Experimental
Intende	ed learı	ning outcomes			
The stu field of	dents l Experi	nave specific and advanc mental Physics.	ed knowledge of one	or more current rese	earch areas of the faculty in the
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	rman)	
V + R (n	io infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)
Methoo module is	<b>l of ass</b> creditab	<b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
a) writte date ea	en exai ich or o	mination (approx. 90 min ral examination in group	utes) or b) talk (appr s (approx. 30 minute	ox. 30 minutes) or c) s) or d) project repor	oral examination of one candi- t (approx. 12 pages)
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
Teachir	ıg cycl	e			
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	
Module appears in					
Master's degree (1 major) Physics (2010) 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 - Nanostructuring Technology (2006) Master's degree (1 major) FOKUS Physics (2006)					

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	reg. data record Master (120 ECTS) Physik - 2010	

Module title					Abbreviation	
Module Type 6I Special Training Interdisciplinary Research Fields					11-SF-6l-072-m01	
Module	e coord	inator		Module offered by		
Managi the Inst	ing Dire titute o	ectors of the Institute of A f Theoretical Physics and	Applied Physics and Astrophysics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
6	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Specifi	c, adva	nced knowledge of one c	or more of the Faculty	's current research a	reas.	
Intende	ed learr	ning outcomes				
The stu terdisci	dents ł iplinary	nave specific and advanc	ed knowledge of one	or more current rese	earch areas of the faculty in an in-	
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V + R (n	infor	mation on SWS (weekly o	contact hours) and co	ourse language availa	able)	
Methoo module is	<b>d of ass</b> creditab	s <b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
a) writt date ea	en exar ich or o	nination (approx. 90 min ral examination in group	utes) or b) talk (appr s (approx. 30 minute	ox. 30 minutes) or c) s) or d) project repor	oral examination of one candi- t (approx. 12 pages)	
Allocat	ion of p	olaces				
Additio	nal info	ormation				
Worklo	ad					
Teachir	ng cycl	9				
Referre	d to in	LPOI (examination regulations	s for teaching-degree progra	mmes)		
Module appears in						
Master	's degre	ee (1 major) Physics (201	0)			
Master	Master's degree (1 major) Nanostructure Technology (2010)					
Master	Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)					
Master	's degre	ee (1 major) FOKUS Physi	CS (2010)	Tachnology (acc)		
Master'	s uegre 's degre	ee (1 major) FOKUS Physi	cs (2006)	rechnology (2006)		
Master 5 degree (1 major) 1 0K03 Filysics (2000)						

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 207 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title					Abbreviation
Module	е Туре о	6T Special Training Theo	11-SF-6T-072-m01		
Module	e coord	inator		Module offered by	
Managi and Ast	ng Dire trophys	ector of the Institute of Th ics	eoretical Physics	Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
6	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts				
Specific Physics	c, adva 5.	nced knowledge of one c	or more of the Faculty	's current research a	reas in the field of Theoretical
Intende	ed leari	ning outcomes			
The stu field of	dents l Theore	nave specific and advanc tical Physics.	ed knowledge of one	or more current rese	earch areas of the faculty in the
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V + R (n	io infor	mation on SWS (weekly o	contact hours) and co	urse language availa	able)
Methoo module is	<b>d of ass</b> creditab	s <b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
a) writte date ea	en exai ich or o	nination (approx. 90 min ral examination in group	utes) or b) talk (appr s (approx. 30 minute	ox. 30 minutes) or c) s) or d) project repor	oral examination of one candi- t (approx. 12 pages)
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
Teachir	ng cycl	e			
Referre	d to in	LPOI (examination regulations	s for teaching-degree progra	mmes)	
Module appears in					
Master'	's degr	ee (1 major) Physics (201	0)		
Master'	's degr	ee (1 major) Nanostructur	re Technology (2010)		
Master'	's degr	ee (1 major) FOKUS Physi	cs - Nanostructuring	Technology (2010)	
Master'	's degr	ee (1 major) FOKUS Physi	CS (2010)		
Master'	s degre	ee (1 major) FUKUS Physi	cs - Nanostructuring	recnnology (2006)	
Master's degree (1 major) FUKUS Physics (2006)					

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Module title					Abbreviation
Module	e Type 8	3A Special Training Astro	onomy		11-SF-8A-072-m01
Module	coord	inator		Module offered by	
Managi and Ast	ng Dire trophys	ector of the Institute of Th ics	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 seme	ster	graduate			
Conten	ts				
Specific	c, adva	nced knowledge of one o	or more of the Faculty	's current research a	reas in the field of Astronomy.
Intende	ed learr	ning outcomes			
The stu field of	dents ł Astron	nave specific and advanc omy.	ed knowledge of one	or more current rese	earch areas of the faculty in the
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	rman)	
V + R (n	o infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)
Methoo module is	<b>l of ass</b> creditab	e <b>ssment</b> (type, scope, langua le for bonus)	ge — if other than German, o	examination offered — if no	t every semester, information on whether
a) writte date ea	en exar ch or o	nination (approx. 90 min ral examination in group	utes) or b) talk (appr s (approx. 30 minute	ox. 30 minutes) or c) s) or d) project repor	oral examination of one candi- t (approx. 16 pages)
Allocat	ion of p	olaces			
Additio	nal info	ormation			
Worklo	ad				
Teachir	ng cycl	9			
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)					
Module appears in					
Master'	s degre	ee (1 major) Physics (201	0)		
Master'	s degre	ee (1 major) FOKUS Physi	cs (2010)		
Master's degree (1 major) FOKUS Physics (2006)					

Module title				Abbreviation	
Module	Module Type 8D Special Training Didactics       11-SF-8D-072-m01				
Module	Module coordinator			Module offered by	
Managi	ing Dire	ector of the Institute of Ap	plied Physics	Faculty of Physics a	nd Astronomy
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)	
8	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts				
Specifi	c, adva	nced knowledge of one c	or more of the Faculty	's current research a	reas in the field of Didactics.
Intende	ed learn	ning outcomes			
The stu field of	dents l Didact	nave specific and advanc ics.	ed knowledge of one	or more current res	earch areas of the faculty in the
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V + R (n	infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)
Methoo module is	<b>d of ass</b> creditab	s <b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
a) writt date ea	en exai ich or o	mination (approx. 90 min ral examination in group	utes) or b) talk (appr s (approx. 30 minute	ox. 30 minutes) or c) s) or d) project repor	oral examination of one candi- t (approx. 16 pages)
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					
Master	's degr	ee (1 major) Physics (201	o)		
Master	's degr	ee (1 major) FOKUS Physi	cs (2010)		
Master's degree (1 major) FUKUS Physics (2006)					

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Module title				Abbreviation		
Module Type 8E Special Training Experimental Physics11-SF-8E-072-m01					11-SF-8E-072-m01	
Module coordinator Module				Module offered by		
Managi	ng Dire	ector of the Institute of Ap	plied Physics	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
8	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Specific Physics	c, adva s.	nced knowledge of one o	or more of the Faculty	's current research a	reas in the field of Experimental	
Intende	ed learı	ning outcomes				
The stu field of	dents l Experi	nave specific and advanc mental Physics.	ed knowledge of one	or more current rese	earch areas of the faculty in the	
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V + R (n	io infor	mation on SWS (weekly o	contact hours) and co	urse language avail	able)	
Methoo module is	<b>l of ass</b> creditab	<b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
a) writte date ea	en exai ich or o	mination (approx. 90 min ral examination in group	utes) or b) talk (appr s (approx. 30 minute	ox. 30 minutes) or c) s) or d) project repor	oral examination of one candi- t (approx. 16 pages)	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachir	ng cycl	e				
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)		
Module appears in						
Master's degree (1 major) Physics (2010)						
Master	Master's degree (1 major) Nanostructure Technology (2010)					
Master	Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)					
Master	s degre	ee (1 major) FUKUS Physic	CS (2010)	Technology (2007)		
Master Master	s uegri 's degri	ee (1 major) FOKUS Physic ee (1 major) FOKUS Physic	cs - Nanostructuring	rechnology (2006)		
Master's degree (1 major) FORUS Physics (2006)						

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Module title					Abbreviation	
Module Type 8I Special Training Interdisciplinary Research Fields				Fields	11-SF-8I-072-m01	
Module	e coord	inator		Module offered by		
Managi the Inst	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. com	pl. of module(s)		
8	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Specifi	c, adva	nced knowledge of one c	or more of the Faculty	's current research a	reas.	
Intende	ed learr	ning outcomes				
The stu terdisci	dents ł iplinary	nave specific and advanc	ed knowledge of one	or more current rese	earch areas of the faculty in an in-	
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V + R (n	no infor	mation on SWS (weekly o	contact hours) and co	urse language availa	able)	
Methoo module is	<b>d of ass</b> creditab	<b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
a) writt date ea	en exar ich or o	nination (approx. 90 min ral examination in group	utes) or b) talk (appr s (approx. 30 minute	ox. 30 minutes) or c) s) or d) project repor	oral examination of one candi- t (approx. 16 pages)	
Allocat	ion of p	olaces				
Additio	nal info	ormation				
Worklo	ad					
Teachir	ng cycl	9				
Referre	d to in	LPOI (examination regulations	s for teaching-degree progra	mmes)		
Module appears in						
Master's degree (1 major) Physics (2010)						
Master	Master's degree (1 major) Nanostructure Technology (2010)					
Master	Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)					
Master	s uegre 's deore	ee (1 major) FORUS PRIVSI	cs (2010) cs - Nanostructuring <sup>-</sup>	Technology (2006)		
Master	's degre	ee (1 major) FOKUS Physi	cs (2006)	(2000)		

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	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation		
Module Type 8T Special Training Theoretical Physics			11-SF-8T-072-m01		
Module coordinator		Module offered by			
Managi and Ast	ing Dire trophys	ector of the Institute of Th ics	eoretical 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	n	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts				
Specific Physics	c, adva 5.	nced knowledge of one c	or more of the Faculty	's current research a	reas in the field of Theoretical
Intende	ed learn	ning outcomes			
The stu field of	dents ł Theore	nave specific and advanc tical Physics.	ed knowledge of one	or more current rese	earch areas of the faculty in the
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V + R (n	io infor	mation on SWS (weekly o	contact hours) and co	urse language availa	able)
Methoo module is	<b>d of ass</b> creditab	e <b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candi- date each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 16 pages)					
Allocation of places					
Additio	nal info	ormation			
Worklo	ad				
Teachir	ng cycl	9			
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	
Module	e appea	irs in	<u>``</u>		
Master'	's degre	ee (1 major) Physics (2010	0) oc. Nonostructurizzi	Tachnology (acto)	
Master Master	s uegre 's degre	ee (1 major) FOKUS Physi ee (1 major) FOKUS Physi	cs (2010)	rechnology (2010)	
Master'	's degre	ee (1 major) FOKUS Physi	cs - Nanostructuring	Technology (2006)	
Master'	Master's degree (1 major) FOKUS Physics (2006)				

Master's with 1 major Physics (2010)	JMU Würzburg ● generated 26-Aug-2024 ● exam.	page 213 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation		
Visiting Research Project			11-FPA-112-m01		
Module coordinator			Module offered by		
Manag	ing Dire	ector of the Institute of Ap	plied Physics	Faculty of Physics a	and Astronomy
ECTS	Metho	od of grading	Only after succ. com	npl. of module(s)	
10	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate	Approval by examination	ation committee req	uired.
Conten	ts				
Indepe tific exp to othe	ndent v perimer r unive	work on a current researc nts including analysis an rsities or research institu	h topic of Experiment d documentation of t tes.	al and Theoretical P he results, especiall	hysics. Implementation of scien- y in the context of research visits
Intende	ed lear	ning outcomes			
The stu conduc	dents a t and a	are able to independently malyse scientific experim	work on a current re ents and to documer	search area of Expent nt the results.	rimental or Theoretical Physics, to
Course	<b>S</b> (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)	
R (no ir	format	ion on SWS (weekly cont	act hours) and cours	e language available	2)
Method module is	<b>d of ass</b> creditab	<b>sessment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
project Langua	report ge of a	(approx. 10 to 20 pages) ssessment: German, Eng	lish		
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Additio	nal info	ormation on module dura	tion: 1 to 2 semester	s.	
Worklo	ad				
Teachi	ng cycl	e			
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	
Module	e appea	ars in			
Master Master Master Master	's degr 's degr 's degr 's degr	ee (1 major) Physics (2010 ee (1 major) Physics (2010 ee (1 major) Nanostructur ee (1 major) Nanostructur	o) 1) re Technology (2011) re Technology (2010)		

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 214 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation
Current Topics in Experimental Physics			11-EXE5-111-m01
Module coordinator		Module offered by	
chairperson of examination committee	2	Faculty of Physics a	nd Astronomy
ECTS Method of grading	Only after succ. com	pl. of module(s)	
5 numerical grade			
Duration Module level	Other prerequisites		
1 semester graduate	Approval by examin	ation committee req	uired.
Contents			
Current topics of Experimental Physics or study abroad.	. Accredited academi	c achievements, e.g.	in case of change of university
Intended learning outcomes			
The students have advanced competer sics of the Master's programme. They derstand the measuring and/or evalua fy the subject-specific contexts and kn	ncies corresponding t have knowledge of a c ation methods necess ow the application ar	o the requirements of current subdiscipline ary to acquire this kr eas.	of a module of Experimental Phy- e of Experimental Physics and un- nowledge. They are able to classi-
<b>Courses</b> (type, number of weekly contact hours,	language — if other than Ger	man)	- 1.1 )
V + R (no information on SWS (weekly	contact nours) and co	urse language availa	able)
<b>Method of assessment</b> (type, scope, langua module is creditable for bonus)	age — if other than German, e	examination offered — if no	t every semester, information on whether
a) written examination (approx. 120 m less otherwise specified) or b) oral exa minutes per candidate, for modules wi prox. 8 to 10 pages, time to complete: tes) Language of assessment: German, Eng	inutes, for modules w amination of one cand ith less than 4 ECTS c 1 to 4 weeks) or d) pro glish	ith less than 4 ECTS lidate each or oral ex redits approx. 20 min esentation/seminar	credits approx. 90 minutes; un- kamination in groups (approx. 30 nutes) or c) project report (ap- presentation (approx. 30 minu-
Allocation of places			
Additional information			
Workload			
Teaching cycle			
Referred to in LPO I (examination regulation	is for teaching-degree progra	mmes)	
Module appears in			
Master's degree (1 major) Physics (201 Master's degree (1 major) Physics (201 Master's degree (1 major) FOKUS Phys Master's degree (1 major) FOKUS Phys Master's degree (1 major) FOKUS Phys	0) 1) ics (2010) ics (2011) ics (2006)		

Master's with 1	major Physics	(2010)	
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Module title			Abbreviation	
Current Topics in Experimental Physics			11-EXE6-111-m01	
Module coordinator		Module offered by		
chairperson	of examination committee		Faculty of Physics a	nd Astronomy
ECTS Meth	nod of grading	Only after succ. com	pl. of module(s)	
6 num	erical grade			
Duration	Module level	Other prerequisites		
1 semester	graduate	Approval by examination	ation committee req	uired.
Contents				
Current topic or study abro	s of Experimental Physics oad.	. Accredited academi	c achievements, e.g.	in case of change of university
Intended lea	rning outcomes			
The students sics of the M derstand the fy the subjec	have advanced competer aster's programme. They h measuring and/or evalua t-specific contexts and kn	ncies corresponding t nave knowledge of a c tion methods necess ow the application ar	o the requirements of current subdiscipline ary to acquire this kr eas.	of a module of Experimental Phy- e of Experimental Physics and un- nowledge. They are able to classi-
Courses (type,	number of weekly contact hours, l	anguage — if other than Ger	man)	
V + R (no info	ormation on SWS (weekly o	contact hours) and co	urse language availa	able)
Method of as module is credita	<b>ssessment</b> (type, scope, langua able for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
a) written exa less otherwis minutes per prox. 8 to 10 tes) Language of	amination (approx. 120 mi se specified) or b) oral exa candidate, for modules wi pages, time to complete: assessment: German, Eng	nutes, for modules w mination of one cand th less than 4 ECTS cr 1 to 4 weeks) or d) pro- lish	ith less than 4 ECTS idate each or oral ex redits approx. 20 min esentation/seminar	credits approx. 90 minutes; un- camination in groups (approx. 30 nutes) or c) project report (ap- presentation (approx. 30 minu-
Allocation of	places			
Additional in	formation			
Workload				
Teaching cyc	le			
Referred to i	<b>n LPO I</b> (examination regulation	s for teaching-degree progra	mmes)	
		· · · · · · · · ·		
Module appe	ears in			
Master's deg Master's deg Master's deg Master's deg Master's deg Master's deg	ree (1 major) Physics (201 ree (1 major) Physics (201 ree (1 major) Nanostructur ree (1 major) FOKUS Physi ree (1 major) FOKUS Physi ree (1 major) FOKUS Physi	o) 1) re Technology (2011) cs (2010) cs (2011) cs (2006)		

Master's with 1 major Physics (2010)						
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Module title					Abbreviation	
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Current Topics in Experimental Physics					11-EXE7-111-m01	
Module coordinator				Module offered by		
chairpe	erson o	f examination committee		Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
7	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate	Approval by examina	ation committee req	uired.	
Conten	ts					
Current or stud	topics y abroa	of Experimental Physics. ad.	Accredited academi	c achievements, e.g.	in case of change of university	
Intende	ed learı	ning outcomes				
The stu sics of t derstar fy the s	dents l the Ma id the r ubject-	nave advanced competer ster's programme. They h neasuring and/or evaluat specific contexts and kno	ncies corresponding t have knowledge of a c tion methods necess ow the application ar	o the requirements of current subdiscipline ary to acquire this kr eas.	of a module of Experimental Phy- e of Experimental Physics and un- nowledge. They are able to classi-	
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V + R (n	io infor	mation on SWS (weekly o	contact hours) and co	urse language availa	able)	
Method module is	creditab	<b>;essment</b> (type, scope, langua; le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
a) writte less oth minute prox. 8 tes) Langua	en exai nerwise s per ca to 10 p ge of a	nination (approx. 120 mi e specified) or b) oral exa andidate, for modules wi ages, time to complete: a ssessment: German, Eng	nutes, for modules w mination of one cand th less than 4 ECTS cr 1 to 4 weeks) or d) pre lish	ith less than 4 ECTS idate each or oral ex redits approx. 20 min esentation/seminar	credits approx. 90 minutes; un- kamination in groups (approx. 30 nutes) or c) project report (ap- presentation (approx. 30 minu-	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachir	Teaching cycle					
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)						
Module appears in						
Master' Master' Master'	Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) Master's degree (1 major) FOKUS Physics (2010)					
Master	's degr	ee (1 major) FOKUS Physic	cs (2011)			
Master	's degr	ee (1 major) FOKUS Physi	cs (2006)			

Master's with 1 major Physics (2010)	JML
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Module title					Abbreviation	
Current Topics in Experimental Physics					11-EXE8-111-m01	
Module coordinator				Module offered by		
chairpe	erson o	f examination committee		Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
8	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate	Approval by examina	ation committee req	uired.	
Conten	ts					
Current or stud	topics y abroa	of Experimental Physics. ad.	Accredited academi	c achievements, e.g.	in case of change of university	
Intende	ed leari	ning outcomes				
The stu sics of derstar fy the s	dents I the Ma nd the r ubject-	nave advanced competer ster's programme. They h neasuring and/or evalua specific contexts and kno	acies corresponding t have knowledge of a c tion methods necess how the application ar	o the requirements of current subdiscipline ary to acquire this kr eas.	of a module of Experimental Phy- e of Experimental Physics and un- nowledge. They are able to classi-	
Course	S (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V + R (n	io infor	mation on SWS (weekly o	contact hours) and co	urse language availa	able)	
module is	<b>1 Of ass</b> creditab	<b>;essment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
a) writte less oth minute prox. 8 tes) Langua	en exar nerwise s per ca to 10 p ge of a	mination (approx. 120 mi e specified) or b) oral exa andidate, for modules wi ages, time to complete: ssessment: German, Eng	nutes, for modules w mination of one cand th less than 4 ECTS cr t to 4 weeks) or d) pre lish	ith less than 4 ECTS idate each or oral ex redits approx. 20 min esentation/seminar	credits approx. 90 minutes; un- camination in groups (approx. 30 nutes) or c) project report (ap- presentation (approx. 30 minu-	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachir	ıg cycl	e				
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Master	s degr	ee (1 major) Physics (201	D)			
Master	's degr	ee (1 major) Physics (201)	1)			
Master	s degri 's degri	ee (1 major) FORUS Physi ee (1 major) FORUS Physi	rs (2010)			
Master	's degr	ee (1 major) FOKUS Physi	cs (2006)			

Master's with	1 major Physics (	(2010)
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Module title					Abbreviation	
Current Topics in Theoretical Physics					11-EXT5-111-m01	
Module coordinator				Module offered by		
chairpe	erson o	f examination committee	_	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate	Approval by examination	ation committee req	uired.	
Conten	ts					
Current study a	topics broad.	of Theoretical Physics. A	ccredited academic a	achievements, e.g. ir	n case of change of university or	
Intende	ed leari	ning outcomes				
The stu sics of t sics and of Theo	dents l the Ma d have retical	nave advanced competer ster's programme. They h mastered the required m Physics.	ncies corresponding t have advanced specia ethods. They are able	o the requirements o alist knowledge of a e to apply the acquir	of a module of Theoretical Phy- subdiscipline of Theoretical Phy- red methods to current problems	
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V + R (n	o infor	mation on SWS (weekly o	contact hours) and co	urse language availa	able)	
Methoo module is	<b>d of ass</b> creditab	s <b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
a) writte less oth minute prox. 8 tes) Langua	en exar nerwise s per ca to 10 p ge of a	mination (approx. 120 mi e specified) or b) oral exa andidate, for modules wi ages, time to complete: a ssessment: German, Eng	nutes, for modules w mination of one cand th less than 4 ECTS cr 1 to 4 weeks) or d) pre lish	ith less than 4 ECTS lidate each or oral ex redits approx. 20 min esentation/seminar	credits approx. 90 minutes; un- kamination in groups (approx. 30 nutes) or c) project report (ap- presentation (approx. 30 minu-	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachir	ıg cycl	e				
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Master	Master's degree (1 major) Physics (2010)					
Master	Master's degree (1 major) Physics (2011)					
Master	s degri 's degri	ee (1 major) FORUS Physi ee (1 major) FORUS Physi	cs (2010)			
Master	's degr	ee (1 major) FOKUS Physi	cs (2006)			

Module coordinator       Module coordinator         chairperson of examination committee       Factor         ECTS       Method of grading       Only after succ. compl. or         6       numerical grade	11-EXT6-111-mo1         dule offered by         ulty of Physics and Astronomy         of module(s)         n committee required.				
Module coordinator       Mod         chairperson of examination committee       Face         ECTS       Method of grading       Only after succ. compl. or         6       numerical grade	dule offered by ulty of Physics and Astronomy of module(s) n committee required.				
chairperson of examination committeeFactECTSMethod of gradingOnly after succ. compl. of6numerical grade	ulty of Physics and Astronomy of module(s) n committee required.				
ECTSMethod of gradingOnly after succ. compl. o6numerical grade	of module(s)				
6 numerical grade	n committee required.				
	n committee required.				
Duration Module level Other prerequisites	n committee required.				
1 semester graduate Approval by examination					
Contents					
Current topics of Theoretical Physics. Accredited academic achie study abroad.	evements, e.g. in case of change of university or				
Intended learning outcomes					
The students have advanced competencies corresponding to the sics of the Master's programme. They have advanced specialist l sics and have mastered the required methods. They are able to a of Theoretical Physics.	e requirements of a module of Theoretical Phy- knowledge of a subdiscipline of Theoretical Phy- apply the acquired methods to current problems				
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)					
V + R (no information on SWS (weekly contact hours) and course	e language available)				
<b>Method of assessment</b> (type, scope, language — if other than German, examir module is creditable for bonus)	nation offered — if not every semester, information on whether				
a) written examination (approx. 120 minutes, for modules with le less otherwise specified) or b) oral examination of one candidate minutes per candidate, for modules with less than 4 ECTS credits prox. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presen- tes) Language of assessment: German, English	ess than 4 ECTS credits approx. 90 minutes; un- e each or oral examination in groups (approx. 30 is approx. 20 minutes) or c) project report (ap- itation/seminar presentation (approx. 30 minu-				
Allocation of places					
Additional information					
Workload					
Teaching cycle					
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)					
Module appears in					
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) FOKUS Physics (2010) Master's degree (1 major) FOKUS Physics (2011) Master's degree (1 major) FOKUS Physics (2006)					

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.
	reg. data record Master (120 ECTS) Physik - 2010

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Module title					Abbreviation	
Current Topics in Theoretical Physics					11-EXT7-111-m01	
Module coordinator				Module offered by		
chairpe	rson o	f examination committee	_	Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
7	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate	Approval by examination	ation committee req	uired.	
Conten	ts					
Current study a	topics broad.	of Theoretical Physics. A	ccredited academic a	achievements, e.g. ir	n case of change of university or	
Intende	ed learı	ning outcomes				
The stu sics of t sics and of Theo	dents l the Ma d have retical	nave advanced competer ster's programme. They h mastered the required m Physics.	ncies corresponding t nave advanced specia nethods. They are able	o the requirements o alist knowledge of a e to apply the acquir	of a module of Theoretical Phy- subdiscipline of Theoretical Phy- red methods to current problems	
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V + R (n	o infor	mation on SWS (weekly o	contact hours) and co	urse language availa	able)	
Methoo module is	l of ass creditab	s <b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
a) writte less oth minutes prox. 8 tes) Langua	en exan nerwise s per ca to 10 p ge of a	nination (approx. 120 mi e specified) or b) oral exa andidate, for modules wi ages, time to complete: ssessment: German, Eng	nutes, for modules w mination of one cand th less than 4 ECTS cr 1 to 4 weeks) or d) pro lish	ith less than 4 ECTS lidate each or oral ex redits approx. 20 min esentation/seminar	credits approx. 90 minutes; un- kamination in groups (approx. 30 nutes) or c) project report (ap- presentation (approx. 30 minu-	
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachir	ng cycl	e				
Referred to in LPO I (examination regulations for teaching-degree programmes)						
Module appears in						
Master's degree (1 major) Physics (2010)						
Master'	Master's degree (1 major) Physics (2011)					
Master'	s degr	ee (1 major) FUKUS Physi	CS (2010)			
Master'	s degr	ee (1 major) FOKUS Physi	cs (2006)			

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Module title					Abbreviation	
Current Topics in Theoretical Physics					11-EXT8-111-m01	
Module coordinator				Module offered by		
chairpe	erson of	f examination committee		Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
8	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate	Approval by examination	ation committee req	uired.	
Conten	ts					
Current study a	topics broad.	of Theoretical Physics. A	ccredited academic a	achievements, e.g. ir	n case of change of university or	
Intende	ed learr	ning outcomes				
The stu sics of t sics and of Theo	dents ł the Ma d have retical	nave advanced competer ster's programme. They h mastered the required m Physics.	ncies corresponding t ave advanced specia ethods. They are able	o the requirements o alist knowledge of a e to apply the acquir	of a module of Theoretical Phy- subdiscipline of Theoretical Phy- red methods to current problems	
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V + R (n	o infor	mation on SWS (weekly o	contact hours) and co	urse language availa	able)	
Methoo module is	<b>d of ass</b> creditab	e <b>essment</b> (type, scope, langua; le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
a) writte less oth minute prox. 8 tes) Langua	en exar nerwise s per ca to 10 p ge of a	nination (approx. 120 mi e specified) or b) oral exa andidate, for modules wi ages, time to complete: a ssessment: German, Eng	nutes, for modules w mination of one cand th less than 4 ECTS cr t to 4 weeks) or d) pre lish	ith less than 4 ECTS idate each or oral ex redits approx. 20 min esentation/seminar	credits approx. 90 minutes; un- camination in groups (approx. 30 nutes) or c) project report (ap- presentation (approx. 30 minu-	
Allocat	ion of p	olaces				
Additio	nal info	ormation				
Worklo	ad					
Teachir	ng cycl	9				
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)						
Module appears in						
Master	's degre	ee (1 major) Physics (2010	o)			
Master	Master's degree (1 major) Physics (2011)					
Master	s aegre 's deore	ee (1 major) FUKUS Physic Pe (1 major) FOKUS Physic	LS (2010) LS (2011)			
Master	's degre	ee (1 major) FOKUS Physic	cs (2006)			
	master 5 degree (1 major) i okos i mysics (2000)					



# **Compulsory Electives Subsidiary Subjects Physics**

(10 ECTS credits)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 223 / 280
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Module title					Abbreviation	
Techno	<b>Fechnology of Sensor and Actor Materials including Smart Fluids</b> 08-SAM-092-m01					
Module coordinator				Module offered by		
holder thesis	of the (	Chair of Chemical Techno	logy of Material Syn-	Chair of Chemical T	echnology of Material Synthesis	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Fabrica materia	tion, ef als and	fects and applications of magnetostrictive materia	sensory and actuato als. Electrorheologica	ry materials such as l and magnetorheolo	piezoelectrics, shape memory ogical fluids, magnetofluids.	
Intende	ed learn	ning outcomes				
Studen	ts have	e developed fundamental	knowledge in the are	ea of sensory and ac	tuatory materials.	
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V + P (n	o infor	mation on SWS (weekly o	contact hours) and co	urse language availa	able)	
Methoo module is written	d of ass creditab examir	e <b>essment</b> (type, scope, langua le for bonus) nation (90 minutes)	ge — if other than German, 6	examination offered — if no	t every semester, information on whether	
Allocat	ion of r	olaces				
Additio	nal info	ormation				
Worklo	ad					
Teachir	ng cycl	9				
Referre	d to in	LPOI (examination regulations	s for teaching-degree progra	mmes)		
Module appears in						
Master	's degre	ee (1 major) Physics (201	o)			
Master's degree (1 major) Physics (2011)						
Master's degree (1 major) Technology of Functional Materials (2010)						
Master'	's degre	ee (1 major) Nanostructu	re Technology (2011)	3 (2009)		
Master	's degre	ee (1 major) Nanostructur	re Technology (2010)			

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	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation		
Electro	Electrochemical Energy Storage and Conversion				08-EEW-101-m01
Module	e coord	inator		Module offered by	
holder thesis	of the (	Chair of Chemical Techno	logy of Material Syn-	Chair of Chemical T	echnology of Material Synthesis
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	graduate			
Conten	ts				
Chemis um and cal dou (Si, CIS	stry and I nickel Ible lay , CIGS,	l application of: battery s metal hydride, sodium s er capacitors, redox-flow GaAs, organic and dye so	ystems (aqueous and ulphur, sodium nicke batteries, fuel cell sy olar cell), thermoelec	d non-aqueous syste el chloride, lithium ic vstems (AFC, PEMFC, tric devices.	ms such as lead, nickel cadmi- on accumulators), electrochemi- DMFC, PAFC, SOFC), solar cells
Intende	ed learı	ning outcomes			
Studen that kn	ts have owledg	e developed a knowledge ge to research problems.	of electrochemical e	nergy storage and co	onversion and are able to apply
Course	<b>S</b> (type, n	number of weekly contact hours, l	anguage — if other than Ger	man)	
V + P +	E (no ii	nformation on SWS (weel	kly contact hours) and	d course language av	vailable)
Method module is	<b>d of ass</b> s creditab	<b>sessment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
written	examiı	nation (90 minutes) and l	ab report (approx. 5	pages)	
Allocat	ion of p	olaces			
Additio	nal inf	ormation			
Worklo	ad				
Teachi	ng cycl	e			
Referre	d to in	LPOI (examination regulations	s for teaching-degree progra	mmes)	
Module appears in					
Bachel	Bachelor' degree (1 major) Nanostructure Technology (2010)				
Master	's degr	ee (1 major) Physics (201	0)		
Master	Master's degree (1 major) Physics (2011)				
Master	's degri	ee (1 major) Technology C ee (1 major) Nanostructur	n runctional Material re Technology (2011)	5 (2010)	
Master	's degr	ee (1 major) Nanostructur	re Technology (2011)		

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 225 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

In the state state is a state	Module title				Abbreviation		
Module offered by         Deam of Studies watermatik (Mathewatics)       Institute of Mathematics         ECTS       Molure is grade       Only attematics         Bar matrix       grade	Numer	Numerical Mathematics 1     10-M-NM1-082-m01					
Dean of Studies Mathematik (Mathematics)         Institute of Mathematics           ECTS         Metive of grading         Only after succ. comp L. of module(s)           8         num=riced grade            Duration         Module level         Other 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 course. Segsment. The lecturer will uniform students about the respective details at the beginning of the course. Registration for the course set lip the course. Registration for the course will be admitted to assessment and the qualification for admission to assessment are the course of the semester, the lecturer will put their registration for admission to assessment are the course of the semester, the lecturer will put their registration for admission to assessment are at later date, students will have to obtain the qualification for admission to assessment at a later date, students will have to obtain the qualification for admission to inscrease and trigonometric functions, numerical integration.           Integraduate           Setudent is acquainted with the fundamental concepts and methods in numerical mathematics, applies them to practical problems and knows about their typical fields of application.           Courses type. scope. Janguage – if ather than Geman.           V 1 (no information on SWS (weekly contact hours) and course language available)           Metion addition of application.           Metintegraduate           Se	Module	e coord	inator		Module offered by		
ECTS         Method of grading         Only after succ. compl. of module(s)           8         numerical grade	Dean o	f Studi	es Mathematik (Mather	natics)	Institute of Mathem	atics	
8       numerical grade          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. The lecturer will inform of will to seek admission to assessment. To respective details at the beginning of the course, the lecturer will put their registration for assessment into effect. Students who meet all prequeguistes will be admitted to assessment and the trade, students will have to obtain the qualification for admission to assessment and will to assessment and extrement of a stressment and extrement of the subsequent semester. For assessment and systems of linear equations and curve fitting problems, nonlinear equations and systems of equations, interpolation with polynomials, splines and trigonometric functions, numerical integration.         Intended learning outcomes       The student is acquainted with the fundamental concepts and methods in numerical mathematics, applies them to practical problems and knows about their typical fields of application.         Courses (type, number of weekly contact hours, language – if other than German)       V + 0 (on information on SWS (weekly contact hours) and course language available)         Method of assessment (type, scope, language – if other than German)       V + 0 (on information on SWS (weekly contact hours, and pulce there written examination on ane replaced by an oral examination of approx, 30 minutes); if announced by the lecturer, the written examination on ane candidate each (approx, 20 minutes).	ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
Duration         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 over the course of the semester, the lecturer will put their registration for as- sessment 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         Solution of systems of linear equations and curve fitting problems, nonlinear equations and systems of equati- ons, interpolation with polynomials, splines and trigonometric functions, numerical integration.           The student is acquainted with the fundamental concepts and methods in numerical mathematics, applies them to practical problems and knows about their typical fields of application.           Courses (type, number of weekly contact hours), language – if other than Geman)         V           V + U (no information on SWS (weekly contact hours) and course language available)           Method of assessment (segma and trigon the course. Number of weekly contact hours) if announced by the lecturer, the written examination on no whether module is creditable for boau3           written examination of one candidate each (approx. 20 minutes) if announced by the lecturer, the written examination in groups (groups of 2, approx. 30 minutes)           Language of assessment: German, English if agreed upon with the examiner           Aldication of places <td>8</td> <td>nume</td> <td>rical grade</td> <td></td> <td>, ,,</td> <td></td> <th></th>	8	nume	rical grade		, ,,		
1 semester       Undergraduate       Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details sessment. The lecturer will inform students about the respective details is details have obtained the qualification for admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will be qualification for admission to assessment over the course of the semester, the lecturer will be qualification for admission to assessment at a later date, students who meet all prerequisites will be admitted to assessment in the current or in the sublequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment at a later date, students will have to obtain the qualification for admission to assessment at a later date, students will have to obtain the qualification for admission to assessment at a later date, students will have to obtain the qualification for admission to assessment at a later date, students will have to obtain the qualification for admission to assessment at a later date, students will have to obtain the qualification for admission to assessment and the prequisite will be admitted to accessent and the prequisite will be admitted to accessent the course and have be admitted to a prepay and the prequisite admitt	Duratio	on	Module level	Other prerequisites			
Contents         Solution of systems of linear equations and curve fitting problems, nonlinear equations and systems of equations, interpolation with polynomials, splines and trigonometric functions, numerical integration.         Intended learning outcomes         The student is acquainted with the fundamental concepts and methods in numerical mathematics, applies them to practical problems and knows about their typical fields of application.         Courses (type, number of weekly contact hours), language – if other than German)         V + Ű (no information on SWS (weekly contact hours) and course language available)         Method of assessment (type, scope, language – if other than German)         V + Ű (no information on SWS (weekly contact hours) and course language available)         Method of assessment (type, scope, language – if other than German)         written examination (approx. 9 on minutes); if announced by the lecturer, the written examination on whether module is creditable for bonus)         written examination of one candidate each (approx. 20 minutes) or an oral examination in groups (groups of 2, approx. 30 minutes)         Language of assessment: German, English if agreed upon with the examiner         Allocation of places               Motkload               Referred to in LPO 1 (examination regulations for teaching degree programmes)         § 7.3 (1) 5. Mathematik Angewandte Mathematik         Module appears in<	1 semester       undergraduate       Certain prerequisites must be met to qualify for admission to sessment. The lecturer will inform students about the respect at the beginning of the course. Registration for the course will sidered a declaration of will to seek admission to assessmen dents have obtained the qualification for admission to assess the course of the semester, the lecturer will put their registration sessment into effect. Students who meet all prerequisites will ted to assessment at a later date, students will have to obtain the qualification to assess sessment at a later date, students will have to obtain the qualification to assess admission to assess sessment anew.		o as- tive details Ill be con- nt. If stu- ssment over tion for as- ill be admit- ster. For as- alification for				
Solution of systems of linear equations and curve fitting problems, nonlinear equations and systems of equations, interpolation with polynomials, splines and trigonometric functions, numerical integration. Intendel learning outcomes The student is acquainted with the fundamental concepts and methods in numerical mathematics, applies them to practical problems and knows about their typical fields of application. Courses (type, number of weekly contact hours, language — if other than German) V + Ü (no information on SWS (weekly contact hours) and course language available) Method of assessment (type, scope, language — if other than German) V + Ü (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 senester, information on whether module is creditable for bonus) written examination (approx. 90 minutes); if announced by the lecturer, the written examination are preplaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups (groups of 2, approx. 30 minutes) Language of assessment: German, English if agreed upon with the examiner Allocation of places	Conten	lts					
Intended learning outcomes         The student is acquainted with the fundamental concepts and methods in numerical mathematics, applies them to practical problems and knows about their typical fields of application.         Courses (type, number of weekly contact hours, language – if other than German)         V + Ü (no information on SWS (weekly contact hours) and course language available)         Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus)         written examination (approx. 90 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. 90 minutes)         Language of assessment: German, English if agreed upon with the examiner         Allocation of places            Morkload            Verkload            Referred to in LPO 1 (examination regulations for teaching degree programmes)         § 73 (1) 5. Mathematik Angewandte Mathematik         Module appears in         Bachelor' degree (1 major) Computer Scione (2008)         Bachelor' degree (1 major) Physics (2010)         Bachelor' degree (1 major) Physics (2010)         Bachelor' degree (1 major) Physics (2012)	Solutio ons, in	on of sy terpola	stems of linear equation tion with polynomials,	ns and curve fitting pro splines and trigonome	bblems, nonlinear eq tric functions, nume	uations and system rical integration.	s of equati-
The student is acquainted with the fundamental concepts and methods in numerical mathematics, applies them to practical problems and knows about their typical fields of application. COUTSES (type, number of weekly contact hours, language — if other than German) V + 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 is creditable for bonus) written examination (approx. 90 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) Language of assessment: German, English if agreed upon with the examiner Allocation of places	Intend	ed lear	ning outcomes				
Courses (type, number of weekly contact hours, language – if other than German)         V + Ü (no information on SWS (weekly contact hours) and course language available)         Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus)         written examination (approx. 90 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)         Language of assessment: German, English if agreed upon with the examiner         Allocation of places            Additional information            Workload            Referred to in LPO I (examination regulations for teaching-degree programmes)         § 73 (1) 5. Mathematik Angewandte Mathematik         Module appears in         Bachelor' degree (1 major) Computer Science (2010)         Bachelor' degree (1 major) Physics (2010)         Bachelor' degree (1 major) Physics (2010)         Bachelor' degree (1 major) Physics (2012)	The stu to prac	udent is tical pr	acquainted with the fu oblems and knows abo	ndamental concepts a ut their typical fields o	nd methods in nume f application.	erical mathematics, a	applies them
V + Ü (no information on SWS (weekly contact hours) and course language available)         Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus)         written examination (approx. 90 minutes); if announced by the lecturer, the written examination in groups (groups of 2, approx. 30 minutes)         Language of assessment: German, English if agreed upon with the examiner         Allocation of places            Additional information            Workload            Referred to in LPO I (examination regulations for teaching-degree programmes)         § 73 () 5. Mathematik Angewandte Mathematik         Module appears in         Bachelor' degree (1 major) Computer Science (2010)         Bachelor' degree (1 major) Physics (2010)         Bachelor' degree (1 major) Physics (2010)         Macter's with 1 major Physics (2012)	Course	<b>S</b> (type, r	number of weekly contact hours	, language — if other than Ge	rman)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)         written examination (approx. 90 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)         Language of assessment: German, English if agreed upon with the examiner         Allocation of places            Additional information            Morkload            Workload            Referred to in LPO I (examination regulations for teaching-degree programmes)         § 73 (1) 5. Mathematik Angewandte Mathematik         Module appears in         Bachelor' degree (1 major) Ocmputer Science (2010)         Bachelor' degree (1 major) Physics (2009)         Bachelor' degree (1 major) Physics (2012)	V + Ü (I	no infoi	mation on SWS (weekly	/ contact hours) and co	ourse language avail	able)	
module is creditable for bonus)         written examination (approx. 90 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)         Language of assessment: German, English if agreed upon with the examiner         Allocation of places            Additional information            Workload            Teaching cycle            Referred to in LPO1 (examination regulations for teaching-degree programmes)         § 73 (1) 5. Mathematik Angewandte Mathematik         Module appears in         Bachelor' degree (1 major) Computer Science (2010)         Bachelor' degree (1 major) Physics (2012)	Metho	d of ass	sessment (type, scope, lang	uage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
written examination (approx. 90 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) Language of assessment: German, English if agreed upon with the examiner Allocation of places 	module is	s creditab	le for bonus)				
Allocation of places Additional information Workload Teaching cycle Referred to in LPO I (examination regulations for teaching-degree programmes) § 73 (1) 5. Mathematik Angewandte Mathematik Module appears in Bachelor' degree (1 major) Computer Science (2010) Bachelor' degree (1 major) Mathematics (2008) Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2010) Master's with 1 major Physics (2010) Master's with 1 major Physics (2010) Master's with 1 major Physics (2010)	written by an c 2, appr Langua	examin oral exa rox. 30 age of a	nation (approx. 90 minu mination of one candid minutes) ssessment: German, Fr	utes); if announced by ate each (approx. 20 r aglish if agreed upon w	the lecturer, the writ ninutes) or an oral ex vith the examiner	ten examination car camination in groups	be replaced (groups of
Additional information            Workload            Teaching cycle            Referred to in LPO I (examination regulations for teaching-degree programmes)         § 73 (1) 5. Mathematik Angewandte Mathematik         Module appears in         Bachelor' degree (1 major) Computer Science (2010)         Bachelor' degree (1 major) Mathematics (2008)         Bachelor' degree (1 major) Physics (2010)         Bachelor' degree (1 major) Physics (2010)         Bachelor' degree (1 major) Physics (2012)	Allocat	tion of I	places	<u></u>			
Additional information            Workload            Teaching cycle            Referred to in LPO 1 (examination regulations for teaching-degree programmes)         § 73 (1) 5. Mathematik Angewandte Mathematik         Module appears in         Bachelor' degree (1 major) Computer Science (2010)         Bachelor' degree (1 major) Mathematics (2008)         Bachelor' degree (1 major) Physics (2010)         Bachelor' degree (1 major) Physics (2012)							
Workload Teaching cycle Referred to in LPO I (examination regulations for teaching-degree programmes) § 73 (1) 5. Mathematik Angewandte Mathematik Module appears in Bachelor' degree (1 major) Computer Science (2010) Bachelor' degree (1 major) Mathematics (2008) Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2009) Bachelor' degree (1 major) Physics (2012) Master's with 1 major Physics (2010) Rester's With 1 major	Additio	nal inf	ormation				
Workload            Teaching cycle            Referred to in LPO1 (examination regulations for teaching-degree programmes)         § 73 (1) 5. Mathematik Angewandte Mathematik         Module appears in         Bachelor' degree (1 major) Computer Science (2010)         Bachelor' degree (1 major) Mathematics (2008)         Bachelor' degree (1 major) Physics (2010)         Master's with 1 major Physics (2010)         Master's with 1 major Physics (2010)		- nat mit					
Teaching cycle Referred to in LPO I (examination regulations for teaching-degree programmes) § 73 (1) 5. Mathematik Angewandte Mathematik Module appears in Bachelor' degree (1 major) Computer Science (2010) Bachelor' degree (1 major) Mathematics (2008) Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2009) Bachelor' degree (1 major) Physics (2012) Master's with 1 major Physics (2010)  Master's with 1 major Physics (2010) Page 226 / 280	Worklo	ad					
Teaching cycle            Referred to in LPO I (examination regulations for teaching-degree programmes)         § 73 (1) 5. Mathematik Angewandte Mathematik         Module appears in         Bachelor' degree (1 major) Computer Science (2010)         Bachelor' degree (1 major) Mathematics (2008)         Bachelor' degree (1 major) Physics (2010)         Bachelor' degree (1 major) Physics (2010)         Bachelor' degree (1 major) Physics (2010)         Bachelor' degree (1 major) Physics (2012)							
Focusing cycle            Referred to in LPO I (examination regulations for teaching-degree programmes)         § 73 (1) 5. Mathematik Angewandte Mathematik         Module appears in         Bachelor' degree (1 major) Computer Science (2010)         Bachelor' degree (1 major) Mathematics (2008)         Bachelor' degree (1 major) Physics (2010)         Bachelor' degree (1 major) Physics (2010)         Bachelor' degree (1 major) Physics (2010)         Bachelor' degree (1 major) Physics (2012)         Master's with 1 major Physics (2010)         Master's with 1 major Physics (2010)         Image 226 / 280	Teachi	ng cycl	e				
Referred to in LPO I (examination regulations for teaching-degree programmes)         § 73 (1) 5. Mathematik Angewandte Mathematik         Module appears in         Bachelor' degree (1 major) Computer Science (2010)         Bachelor' degree (1 major) Mathematics (2008)         Bachelor' degree (1 major) Physics (2010)         Bachelor' degree (1 major) Physics (2010)         Bachelor' degree (1 major) Physics (2010)         Bachelor' degree (1 major) Physics (2009)         Bachelor' degree (1 major) Physics (2012)			•				
§ 73 (1) 5. Mathematik Angewandte Mathematik         Module appears in         Bachelor' degree (1 major) Computer Science (2010)         Bachelor' degree (1 major) Mathematics (2008)         Bachelor' degree (1 major) Physics (2010)         Bachelor' degree (1 major) Physics (2010)         Bachelor' degree (1 major) Physics (2009)         Bachelor' degree (1 major) Physics (2012)         Master's with 1 major Physics (2010)         JMU Würzburg • generated 26-Aug-2024 • exam. reg. data record Master (120 ECTS) Physik - 2010	Referre	Peferred to in LPO L (summination regulations for teaching degree programmer)					
Module appears in         Bachelor' degree (1 major) Computer Science (2010)         Bachelor' degree (1 major) Mathematics (2008)         Bachelor' degree (1 major) Physics (2010)         Bachelor' degree (1 major) Physics (2009)         Bachelor' degree (1 major) Physics (2009)         Bachelor' degree (1 major) Physics (2012)         Master's with 1 major Physics (2010)         JMU Würzburg • generated 26-Aug-2024 • exam. reg. data record Master (120 ECTS) Physik - 2010	$\delta_{72}$ (1) r. Mathematik Angewandte Mathematik						
Bachelor' degree (1 major) Computer Science (2010)         Bachelor' degree (1 major) Mathematics (2008)         Bachelor' degree (1 major) Physics (2010)         Bachelor' degree (1 major) Physics (2009)         Bachelor' degree (1 major) Physics (2012)         Master's with 1 major Physics (2010)         JMU Würzburg • generated 26-Aug-2024 • exam. reg. data record Master (120 ECTS) Physik - 2010	Module appears in						
Master's with 1 major Physics (2010) JMU Würzburg • generated 26-Aug-2024 • exam. page 226 / 280 reg. data record Master (120 ECTS) Physik - 2010	Bachelor' degree (1 major) Computer Science (2010) Bachelor' degree (1 major) Mathematics (2008) Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2009) Bachelor' degree (1 major) Physics (2012)						
	Master's w	ith 1 majo	r Physics (2010)	JMU Würzbu reg. data re	irg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 226 / 280

## UNIVERSITÄT WÜRZBURG

Bachelor' degree (1 major) Physics (2008) Bachelor' degree (1 major) Technology of Functional Materials (2009) Bachelor' degree (1 major) Technology of Functional Materials (2010) Bachelor' degree (1 major) Nanostructure Technology (2010) Bachelor' degree (1 major) Economathematics (2009) Bachelor' degree (1 major) Economathematics (2008) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Computational Mathematics (2009) Bachelor' degree (1 major) Aerospace Computer Science (2009) Bachelor' degree (1 major) Aerospace Computer Science (2011) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) 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) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Functional Materials (2012) Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008) First state examination for the teaching degree Gymnasium Mathematics (2009)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 227 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation			
Numeri	cal Ma	thematics 2			10-M-NM2-082-mo	1
Module	e coord	inator		Module offered by		
Dean of	f Studi	es Mathematik (Mathe	matics)	Institute of Mathem	atics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester undergraduate Cer ses at t sid der the ses ted ses		Certain prerequisite sessment. The lectu at the beginning of sidered a declaration dents have obtained the course of the se sessment into effect ted to assessment i sessment at a later admission to assess	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					
Solutio nary dif	n meth fferenti	ods and applications f al equations, boundar	or eigenvalue problem value problems.	s, linear programmin	g, initial value probl	ems for ordi-
Intende	ed lear	ning outcomes				
The stu about t and eng	dent is heir ad gineeri	able to draw a distinct vantages and limitatio ng sciences and econo	ion between the differ ns concerning the poss mics.	ent concepts of num sibilities of application	erical mathematics a on in different fields	and knows of natural
Course	<b>S</b> (type, r	number of weekly contact hour	s, language — if other than Ge	rman)		
V + Ü (r	no infor	rmation on SWS (weekl	y contact hours) and co	ourse language avail	able)	
Methoo module is	<b>d of ass</b> creditab	<b>sessment</b> (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
written by an o 2, appr Langua	examin ral exa ox. 30 ge of a	nation (approx. 90 min mination of one candio minutes) ssessment: German, E	utes); if announced by late each (approx. 20 r nglish if agreed upon w	the lecturer, the writ ninutes) or an oral ex rith the examiner	ten examination car kamination in groups	) be replaced 5 (groups of
Allocat	ion of p	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teachir	ng cycl	e				
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)						
§ 73 (1) 5. Mathematik Angewandte Mathematik						
Module appears in						
Bachelor' degree (1 major) Mathematics (2008) Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2009) Bachelor' degree (1 major) Physics (2012)						
Master's wi	ith 1 majo	r Physics (2010)	JMU Würzbu reg. data reg.	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 228 / 280

## UNIVERSITÄT WÜRZBURG

Bachelor' degree (1 major) Physics (2008) Bachelor' degree (1 major) Technology of Functional Materials (2009) Bachelor' degree (1 major) Technology of Functional Materials (2010) Bachelor' degree (1 major) Nanostructure Technology (2010) Bachelor' degree (1 major) Economathematics (2009) Bachelor' degree (1 major) Economathematics (2008) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Computational Mathematics (2009) Bachelor' degree (1 major) Aerospace Computer Science (2009) Bachelor' degree (1 major) Aerospace Computer Science (2011) Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011) 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) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Functional Materials (2012) Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008) First state examination for the teaching degree Gymnasium Mathematics (2009)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 229 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation			
Progra	mming	course for students of I	Mathematics and othe	er subjects	10-M-PRG-082-m01	
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mathem	natics)	Institute of Mathem	natics	
ECTS	Metho	od of grading	Only after succ. con	pl. of module(s)		
3	(not) s	successfully completed		• • • •		
Duratio	n n	Module level	Other prerequisites			
1 seme	ster	undergraduate	Admission prerequi	site to assessment:	regular attendance (a	attendance
Conten	ts	L	Information and a maxim			
Basics matics.	of a mo	odern programming lang	guage (e. g. C or Fortra	n) taking into accour	nt the particular need	ds in mathe-
Intende	ed lear	ning outcomes				
The stu in math	ident is nematio	able to work independents.	ently on small progran	nming exercises and	standard programm	ing problems
Course	<b>S</b> (type, r	number of weekly contact hours	language — if other than Ger	rman)		
P (no ir	nformat	tion on SWS (weekly cor	itact hours) and cours	e language available	<u>a)</u>	
Metho module is	<b>d of ass</b> s creditab	<b>Sessment</b> (type, scope, langu Ile for bonus)	age — if other than German,	examination offered — if no	t every semester, informati	on on whether
project Langua	in the	form of programming ex ssessment: German, En	ercises (as specified a glish if agreed upon w	at the beginning of th vith the examiner	ne course)	
Allocat	ion of p	olaces	<u> </u>			
Additio	nal inf	ormation				
Worklo	ad					
			_			
Teachi		9				
Teacini	ig cyci	e				
			_			
Referre		LPUT (examination regulatio	ns for teaching-degree progra	immes)		
<u>§ 73 (1)</u>	5. Mat	nematik Angewandte M	athematik			
Module	e appea	ars in				
Bachel	or' deg	ree (1 major) Mathemati	cs (2008)			
Bachel	or' deg	ree (1 major) Physics (20	)10)			
Bachel	or deg	ree (1 major) Physics (20	009)			
Bachel	or deg	ree (1 major) Physics (20	)12)			
Bachel	or deg	ree (1 major) Physics (20	108) 1 of Eurotional Matoria			
Bachol	or' dog	ree (1 major) Technolog	of Functional Materia	(2009)		
Bachelor' degree (1 major) Nanostructure Technology (2010)						
Bachelor' degree (1 major) Ronomathematics (2000)						
Bachelor' degree (1 major) Economathematics (2009)						
Bachelor' degree (1 major) Mathematical Physics (2000)						
Bachelor' degree (1 major) Computational Mathematics (2009)						
Master's degree (1 major) Physics (2010)						
Master	's degr	ee (1 major) Technology	of Functional Material	ls (2010)		
Master's w	ith 1 majo	r Physics (2010)	JMU Würzbu reg. data reg	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 230 / 280

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) Mathematics (Minor, 2008) First state examination for the teaching degree Gymnasium Mathematics (2009)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 231 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module	e title				Abbreviation	
Compu	terorie	nted Mathematics			10-M-COM-082-mo	1
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Mathematik (Mather	natics)	Institute of Mathem	natics	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
2	(not)	successfully completed				
Duratio	n (1101) .	Module level	Other proroquisites			
Duratio	/// ata#			, 		£
1 seme	ster	undergraduate	(attendance monito sence).	red, a maximum of o	one incident of unexo	cused ab-
Conten	ts					
Introdu merical 10-M-A lar diffe	iction to l compi NL) and erential	o modern mathematica utation (e. g. Matlab) to d 10-M-LNA). Computer and integral calculus;	l software for symbolic supplement the basic based solution of prob visualisation of functic	c computation (e.g. modules in analysis plems in linear algeb pns.	Mathematica or Map s and linear algebra ra, geometry, analys	le) and nu- ((10-M-ANA or sis, in particu-
Intende	ed lear	ning outcomes				
The stu fields o	ıdent le of appli	earns the use of advanc cation to solve mathem	ed modern mathemati natical problems.	cal software package	es, and is able to ass	sess their
Course	<b>S</b> (type, r	number of weekly contact hour	s, language — if other than Ge	rman)		
V + Ü (r	no infoi	mation on SWS (weekl	y contact hours) and co	ourse language avail	able)	
Method module is	<b>d of ass</b> s creditab	<b>sessment</b> (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	ot every semester, informat	ion on whether
project Assess Langua	in the ment o ge of a	form of programming e ffered: once a year, su ssessment: German, E	xercises (as specified a nmer semester nglish if agreed upon w	at the beginning of th vith the examiner	ne course)	
Allocat	ion of p	olaces				
Additio	onal inf	ormation				
Worklo	ad					
Workto						
Toochi		<u></u>				
Teacini	ig tyti	e				
	• • •					
Referre	ed to in	LPOI (examination regulati	ons for teaching-degree progra	ammes)		
§ 73 (1)	5. Mat	hematik Angewandte N	Nathematik			
Module	e appea	nrs in				
Bachel	or' deg	ree (1 major) Computer	Science (2010)			
Bachelor' degree (1 major) Mathematics (2008)						
Bachelor' degree (1 major) Physics (2010) Bachelor' degree (1 major) Physics (2000)						
Bachelor' degree (1 major) Physics (2009)						
Bachel	Bachelor' degree (1 major) Physics (2002) Bachelor' degree (1 major) Physics (2008)					
Bachel	Bachelor' degree (1 major) Technology of Functional Materials (2009)					
Bachel	Bachelor' degree (1 major) Technology of Functional Materials (2010)					
Bachelor' degree (1 major) Nanostructure Technology (2010)						
Bachel	or' deg	ree (1 major) Economat	hematics (2009)			
Master's wi	ith 1 majo	r Physics (2010)	JMU Würzbu reg. data re	ırg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. k - 2010	page 232 / 280

Bachelor' degree (1 major) Economathematics (2008) Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Computational Mathematics (2009) Master's degree (1 major) Physics (2010) 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) Mathematics (Minor, 2008) First state examination for the teaching degree Gymnasium Mathematics (2009)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 233 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation			
Advanced Analysis				10-M-VAN-082-m01		
Module	coord	inator		Module offered by		
Dean of	Studie	es Mathematik (Mathe	matics)	Institute of Mathem	atics	
ECTS Method 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 a sessment. The lecturer will inform students about the respective at the beginning of the course. Registration for the course will sidered a declaration of will to seek admission to assessment. dents have obtained the qualification for admission to assess the course of the semester, the lecturer will put their registration sessment into effect. Students who meet all prerequisites will ted to assessment at a later date, students will have to obtain the qualification to assess the course of the semester of the semester of the subsequent semester sessment at a later date, students will have to obtain the qualification the subsequent terms are set of the semester of the semester of the semester of the subsequent semester sessment at a later date, students will have to obtain the qualification the subsequent terms are set of the semester of the semester of the semester of the subsequent semester sessment at a later date, students will have to obtain the qualification the subsequent semester of the semester of the semester of the semester of the subsequent semester sessment at a later date, students will have to obtain the qualification of the semester of the se		o as- ctive details Il be con- nt. If stu- ssment over ition for as- ill be admit- ster. For as- alification for				
Conten	ts					
Lebesg and ele	ue inte menta	gral in several variable ry Fourier theory in L^2	s, including theorems of , Gauss's theorem.	on convergence and	Fubini's theorem, L^	p-spaces
Intende	d learr	ning outcomes				
The stu she is a	dent is ble to	acquainted with adva understand the constr	nced topics in analysis uction of a complex ma	. Taking the example thematical concept.	of the Lesbegue int	egral, he or
Courses	<b>5</b> (type, n	umber of weekly contact hour	s, language — if other than Gei	rman)		
Ü + V (n	o infor	mation on SWS (week	y contact hours) and co	ourse language avail	able)	
<b>Method</b> module is	<b>l of ass</b> creditab	s <b>essment</b> (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informati	on on whether
written by an o 2, appro Langua	examir ral exa ox. 30 I ge of a	nation (approx. 90 min mination of one candio minutes) ssessment: German, E	utes); if announced by late each (approx. 20 n nglish if agreed upon w	the lecturer, the writ ninutes) or an oral ex rith the examiner	ten examination can camination in groups	be replaced (groups of
Allocati	ion of p	olaces				
Additio	nal info	ormation				
Workloa	ad					
Teachin	ig cycl	e				
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)						
§ 73 (1) 1. Mathematik Analysis						
Module appears in						
Bachelor' degree (1 major) Mathematics (2008)						
Bachelor' degree (1 major) Economathematics (2009)						
Bachelor' degree (1 major) Economathematics (2008)						
Bachelo	Bachelor' degree (1 major) Mathematical Physics (2009) Bachelor' degree (1 major) Computational Mathematics (2000)					
Master's wit	th 1 major	Physics (2010)	JMU Würzbu reg. data red	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 234 / 280
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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) Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008) First state examination for the teaching degree Gymnasium Mathematics (2009)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 235 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Master's with 1 major Physics (2010)

Module title			Abbreviation		
Genera	l Chem	istry for Physics and Eng	gineers		08-CP1-072-m01
Module	e coord	inator		Module offered by	
lecture	r of the	course	-	Institute of Inorgani	ic Chemistry
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
10	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	undergraduate			
Conten	ts				
This mo	odule d ts the c	liscusses the fundamenta opportunity to learn esse	al principles of both i ntial methods and pe	norganic and organic rform simple experir	c chemistry. The lab course gives nents.
Intende	ed lear	ning outcomes			
Studen to expla cal forn le to ide	ts are a ain bas nulas to entify f	able to explain the princip ic models of the structur o describe chemical reac undamental problems in	oles of the periodic ta e of matter. They have tions and to interpret chemistry and perfor	able and to extract in e developed the abil them by identifying m experiments to so	formation from it. They are able ity to use the language of chemi- the type of reaction. They are ab- lve them.
Course	<b>S</b> (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)	
<ul> <li>Inis module comprises 3 module components. Information on courses will be listed separately for each module component.         <ul> <li>08-IOC-1-072: V (no information on SWS (weekly contact hours) and course language available)</li> <li>08-CP1-1-072: V (no information on SWS (weekly contact hours) and course language available)</li> <li>08-CP1-3-072: P (no information on SWS (weekly contact hours) and course language available)</li> </ul> </li> <li>Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus)</li> <li>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.</li> <li>Assessment in module component o8-IOC-1-072: Organic Chemistry for students of medicine, biomedicine, dentation and the provide a state of the provide a state of the student of the module will require successful completion of all individual assessments.</li> </ul>					
<ul> <li>SECTS, Method of grading: humerical grade</li> <li>written examination (approx. 60 minutes)</li> <li>Assessment in module component o8-CP1-1-072: Basics of General an Inorganic Chemistry</li> <li>5 ECTS, Method of grading: numerical grade</li> <li>written examination (60 minutes)</li> <li>Assessment in module component o8-CP1-3-072: General and Analytical Chemistry (lab)</li> <li>2 ECTS, Method of grading: (not) successfully completed</li> <li>for each experiment: Vortestate (pre-experiment exams, approx. 10 minutes each), assessment of practical performance (log, 2 to 5 pages), Nachtestate (post-experiment exams, approx. 10 minutes each)</li> <li>Assessment offered: once a year, summer semester</li> <li>Only after successful completion of module components: Successful completion of module component</li> </ul>					
Allocation of places					
Additional information					
Worklo	Workload				
			· · · · · · · · · · · · · · · · · · ·		

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## 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 (2007)

Bachelor' degree (1 major) Physics (2009)

Bachelor' degree (1 major) Physics (2008)

Bachelor' degree (1 major) Nanostructure Technology (2008)

Bachelor' degree (1 major) Nanostructure Technology (2007)

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

No final examination Special study offering (2010)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 237 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation		
Introduction to Computer Science for Students of all Faculties			10-I-EIN-072-m01		
Module	e coord	inator		Module offered by	
Dean o	f Studi	es Informatik (Computer S	Science)	Institute of Comput	er Science
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
10	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	undergraduate	Admission prerequis	site to assessment: a ified at the beginnin	academic requirements to be met g of the course.
Conten	ts				
Founda bases,	itions c algorit	of computer science inclu hms and data structures,	ding representation of programming (Java).	of information and w	ebsites (HTML, XML, EBNF), data-
Intende	ed lear	ning outcomes			
The stu mation	dents a and w	are familiar with the fund ebsites (HTML, XML, EBN	amentals of compute F), databases, algorit	r science, e.g. in the hms and data struct	e areas of representation of infor- ures, programming in Java.
Course	<b>S</b> (type, r	number of weekly contact hours, la	anguage — if other than Ger	man)	
V + Ü +	Ü (no i	nformation on SWS (wee	kly contact hours) an	d course language a	vailable)
Methoo module is	<b>d of ass</b> creditab	s <b>essment</b> (type, scope, langua; le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
a) writt or c) or	en exai al exan	mination (approx. 90 min nination in groups (group	utes) or b) oral exam s of 2: 30 minutes, gr	ination of one candi oups of 3: 40 minut	date each (approx. 20 minutes) es)
Allocat	ion of r	olaces			,
Additio	nal inf	ormation			
Worklo	ad				
Teachi	ng cvcl	e			
	<u> </u>	-			
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	
Module	e appea	urs in			
Bachelor' degree (1 major) Geography (2007) Bachelor' degree (1 major) Geography (2008) 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) Nanostructure Technology (2010) Master's degree (1 major) Physics (2010) Bachelor's degree (1 major, 1 minor) Digital Humanities (Minor, 2009) Bachelor's degree (1 major, 1 minor) Digital Humanities (Minor, 2009)					
Bachel	Bachelor's degree (2 majors) Digital Humanities (2009)				

Module title				Abbreviation	
Non-Ph	iysical	Minor Subject			11-EXNP6-112-m01
Module	e coord	inator		Module offered by	
chairpe	erson o	f examination committee		Faculty of Physics a	ind Astronomy
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
6	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate	Approval by examination	ation committee req	uired.
Conten	ts				
Non-ph	ysical	minor. Accredited acader	nic achievements, e.	g. in case of change	of university or study abroad
Intende	ed learı	ning outcomes			
The stu dule in	dents l the fie	nave advanced competer ld of a non-physical mino	ncies on the Master's or (mathematics, cher	level which corresponder	ond to the requirements of a mo- ).
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V + R (r	infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)
Method module is	<b>d of ass</b> creditab	s <b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	ot every semester, information on whether
a) writt in grou weeks) Langua	en exaı ps (app or d) p ge of a	mination (approx. 120 mi prox. 30 minutes per cano resentation/seminar pre ssessment: German, Eng	nutes) or b) oral exan lidate) or c) project re sentation (approx. 3c lish	nination of one cand eport (approx. 8 to 10 o minutes)	lidate each or oral examination o pages, time to complete: 1 to 4
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					
Master	's degr	ee (1 major) Physics (201	0)		
Master	Master's degree (1 major) Physics (2011)				

Module title			Abbreviation			
Databases			10-I-DB-102-m01			
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Informatik (Compute	r Science)	Institute of Comput	er Science	
ECTS	Metho	od of grading	Only after succ. cor	npl. of module(s)		
5	nume	rical grade				
Duratio	on .	Module level	Other prerequisites	i		
1 seme	ster	undergraduate	Admission prerequi announced by the l	site to assessment: ecturer at the beginn	exercises (type and s ing of the course).	scope to be
Conten	ts	~				
Relatio ment.	nal alg	ebra and complex SQL	statements; database	planning and norma	l forms; transaction	manage-
Intende	ed lear	ning outcomes				
The stu	dents	possess knowledge ab	out database modellin	g and queries in SQL	as well as transacti	ons.
Course	<b>S</b> (type, r	number of weekly contact hours	s, language — if other than Ge	rman)		
V + Ü (r	no infoi	rmation on SWS (weekl	y contact hours) and co	ourse language avail	able)	
Methoo module is	<b>d of ass</b> s creditab	sessment (type, scope, lang	uage — if other than German,	examination offered — if no	t every semester, informat	ion on whether
ced by nutes, g Langua	an oral groups ge of a ion of j	examination of one ca of 2: 20 minutes, grou essessment: German, Ei places	ndidate each or an ora os of 3: 25 minutes) nglish if agreed upon w	l examination in grou	ups (one candidate e	each: 15 mi-
Additio	onal inf	ormation				
Worklo	ad					
Teachi	ng cycl	e				
Referre	d to in	LPO I (examination regulation	ons for teaching-degree progra	ammes)		
§ 49 (1) § 69 (1)	) 1. b) [ ) 1. b) [	) atenbanksysteme und )atenbanksysteme und	Softwaretechnologie Softwaretechnologie			
Module	e appea	ars in				
Bachel	or' deg	ree (1 major) Computer	Science (2010)			
Bachel	or' deg or' dog	ree (1 major) Mathemat	ics (2012)			
Bachelor' degree (1 major) Mathematics (2013) Bachelor' degree (1 major) Business Information Systems (2012)						
Bachelor' degree (1 major) Computational Mathematics (2012)						
Bachelor' degree (1 major) Computational Mathematics (2013)						
Bachelor' degree (1 major) Aerospace Computer Science (2009)						
Bachelor' degree (1 major) Aerospace Computer Science (2011)						
Bachelor' degree (1 major) Functional Materials (2012)						
Master's degree (1 major) Computer Science (2010)						
master	s aegr	ee (1 major) watnemati	LS (2012)			
Master's wi	ith 1 majo	r Physics (2010)	JMU Würzbı reg. data re	irg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 240 / 280



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) Computational Mathematics (2012) First state examination for the teaching degree Realschule Computer Science (2012) First state examination for the teaching degree Gymnasium Computer Science (2009)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 241 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation			
Object	-orient	ed Programming			10-I-00P-102-m01	
Module	e coord	inator		Module offered by		
Dean o	f Studi	es Informatik (Compute	r Science)	Institute of Comput	er Science	
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade		-		
Duratio	, on	Module level	Other prerequisites			
1 seme	ster	undergraduate	Admission prerequi	site to assessment: e ecturer at the beginn	exercises (type and s ing of the course).	scope to be
Conten	ts	•	· · · ·			
Polymo ment.	orphism	n, generic programming	, meta programming, v	veb programming, te	mplates, document	manage-
Intende	ed lear	ning outcomes				
The stu their pr	dents a	are proficient in the diff use.	erent paradigms of ob	ject-oriented prograr	nming and have exp	erience in
Course	<b>S</b> (type, r	number of weekly contact hours	, language — if other than Ge	rman)		
V + Ü (r	no infoi	rmation on SWS (weekly	/ contact hours) and co	ourse language avail	able)	
Metho module is	<b>d of ass</b> s creditab	sessment (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informati	on on whether
tion da aminat Langua	te, the ion in g age of a	written examination ca groups (one candidate e ssessment: German, Er	n be replaced by an or each: 15 minutes, grou glish if agreed upon w	al examination of on ps of 2: 20 minutes, vith the examiner	e candidate each or groups of 3: 25 minu	an oral ex- ites)
Additio	nal inf	ormation				
			_			
Worklo	ad					
WOIKIU						
Toachi						
Teacini	ing cyci	e				
Deferre						
Reierre		LPUT (examination regulation	ons for teaching-degree progra	immes)		
		•				
Module	e appea	ars in				
Bachel	or deg	ree (1 major) Computer roo (1 major) Mathemat	Science (2010)			
Bachel	or' deg	ree (1 major) Mathemat	ics(2012)			
Bachelor' degree (1 major) Mathematics (2013) Bachelor' degree (1 major) Business Information Systems (2012)						
Bachelor' degree (1 major) Computational Mathematics (2012)						
Bachelor' degree (1 major) Computational Mathematics (2013)						
Bachelor' degree (1 major) Aerospace Computer Science (2009)						
Bachel	Bachelor' degree (1 major) Aerospace Computer Science (2011)					
Master's degree (1 major) Computer Science (2010)						
Master's degree (1 major) Physics (2010)						
Master's degree (1 major) Physics (2011)						
Master	's degr	ee (1 major) Nanostruct	ure Technology (2011)			
Master's w	ith 1 majo	r Physics (2010)	JMU Würzbı reg. data re	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 242 / 280





Master's degree (1 major) Nanostructure Technology (2010)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 243 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Autorrational control Technology       Io-I-AR-102-mo1         Module control Technology       Institute of Computer Science         CTS       Metu-control Computer Science       Institute of Computer Science         CTS       Module level       Only after succ. compL of module()         S       numercal grade       -         Durational control technology       Admission precession control technology. Laplace transformation, transfer function, plant, control letypes, shasif eedback loop, fundamental principles of control technology. Laplace transformation, manifer nuccion, plant, control letypes, shasif eedback loop. fundamental principles of control expression computation machine-related structure of Petri nets, Petri nets for automisation, machine-related structure of processing computation on whether the students master the fundamental of automation and control.         Courses (ypp, number of weekly contact hours, language – if other than Geman)       V         V + 0 (no information on SWS (weekly contact hours) and course language available         Module is contrable to thours       a promuce day the examination in groups of 3.         Language of assessment (spp, so on mute (spprox.) oral examination in groups of 3. <tr< th=""><th colspan="3">Module title</th><th>Abbreviation</th><th></th></tr<>	Module title			Abbreviation			
Node         Computer Science         Mode offered by           holder rithe Chair of Computer Science         Institute of Computer Science           ECTS         MertLoc of grading         Only after succ. compl. of module(s)           a numerical grade            Duration         Module level         Other prerequisite           Duration         undergraduate         Admission prerequisite to assessment: exercises (typ and scope to be announced by the lecturer at the beginning of the course).           Concents         Overview of automation systems, fundamental principles of control technology, Laplace transformation, transfer to nucritic, plant, controller types, basic feedback loop, fundamental principles of ontrol negineering, automata, structure of Petri nets, Petri nets for automisation, machine-related structure of processing computation machine-related structure of processing computation machine-related structure of processing computation machines; communication brokes communication, real-time operating systems, real-time planning.           Interdeet learning outcomes         Interdeet outons by structure of processing computation machines related by an oral examination of one candidate structure.           V + 0 (no information on SWS (weekly contact hours) and course language available)         Methode of assessment: general related by an oral examination of one candidate each, a 3 o minute (approx) oral examination of one candidate each, a 3 o minute (approx) oral examination in groups of 2 and a 4 o minute (approx) oral examination of one candidate each, a 3 o minute (approx) oral examination in groups of 2 and a 4 o minute (approx) oral exami	Automa	ation a	nd Control Technology			10-I-AR-102-m01	
holder of the Chair of Computer Science VII       Institute of Computer Science         ECTS       Method of grading       Only after succ. comp L of module(s)         8       numerical grade       -         9       Module level       Other prerequisite to assessment: exercises (type and scope to be announced by the lecture at the beginning of the course).         1 semester       undergraduate       Admission prerequisite to assessment: exercises (type and scope to be announced by the lecture at the beginning of the course).         Contents       Science	Module coordinator			Module offered by			
ECTS       Method of grading       Only after succ. compl. of module(s)         8       numerical grade          Duration       Module level       Other prerequisites         1 semestri       undergraduate       Admission prerequisite to assessment: exercises (type and scope to be announced by the lecturer at the beginning of the course).         Contents       Overview of automation systems, fundamental principles of control technology, Laplace transformation, transfer function, plant, controller types, basic feedback loop, fundamental principles of control engineering, automata, structure of Petri nets, Petri nets for automisation, machine-related structure of processing computation mathines, communication between process computers and periphery devices, software for automation systems, process synchronisation, process communication, relatine operating systems, real-time planning.         Intended learning outcomes       The students master the fundamentals of automation and control.         Courses (type, number of weekly contact hours, language – if other than Geman)       V + 0 (no information on SWS (weekly contact hours) and course language available)         Method of assessment (type, scope, language – if other than Geman)       V + 0 (no information on SWS (weekly contact hours) and course language available)         Method of assessment (type, scope, language – if other than Geman)       V + 0 (no eardidate each on an oral examination is groups of 2 and a 40 minute (approx.) oral examination in groups A 80 to 90 minute soft the thour metal examination of one candidate each on an oral examination in groups A 80 to 90 minute (approx.) oral exam	holder	of the (	Chair of Computer Scie	nce VII	Institute of Comput	er Science	
8         numerical grade            Duration         Module level         Other prerequisites           1 semistric         undergraduate         Admission prerequisite to assessment: exercises (type and scope to be announced by the lecturer at the beginning of the course).           Concents         Concents         Concents           Communication systems, fundamental principles of control technology, Laplace transformation, transfer function, plant, controller types, basic feedback loop, fundamental principles of control engineering, automata, structure of Petri nets, Petri nets for automisation, machine-related structure of processing computation machines, communication isotes communication, real-time operating systems, real-time planning.           Intended learning outcomes         Intended learning outcomes           The students master the fundamentals of automation and control.         Course (type, number of weekly contact hours), laguage – if other than German)           V + 0 (no information on SWS (weekly contact hours) and course language available)         Method of assessment (type, scope, language – if other than German)           V + 0 (no information on SWS (weekly contact hours) and course language available)         Method diate each or an oral examination in groups of 3.           Language of assessment (type, scope, language – if other than German)         V + 0 (no innute (approx.) oral examination in groups of 3.           Language of assessment (type, scope, language – if other than German)         V = 0 (no innute (approx.) oral examination of one candidate each or an ora	ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
Duration         Module level         Other prerequisites           1 semester         undergraduate         Admission prerequisite to assessment: exercises (type and scope to be announced by the lecturer at the beginning of the course).           Contents         Contents           Overview of automation systems, fundamental principles of control technology, Laplace transformation, transfer function, plant, controller types, basic feedback loop, fundamental principles of control engineering, automata, structure of processing computation machine-related structure of processing computation machines, communication between process computers and periphery devices, software for automation systems, process synchronisation, process computers and periphery devices, software for automation systems, process synchronisation, process communication, real-time operating systems, real-time planning.           Intended learning outcomes         The students master the fundamentals of automation and control.           Courses (type, number of weekly contact hours, language – if other than German)         V + 0 (no information on SWS (weekly contact hours) and course language available)           Method of assessment (type, scope, language – if other than German, examination of one candidate each or an oral examination in groups. A 80 to 90 minutes). If announced by the lecturer by four weeks prior to the examination of one candidate each or an oral examination in groups of 3.           Language of assessment: German, English if agreed upon with the examine         Additional information            -         -           Workload         -	8	nume	rical grade				
1 semester       undergraduate       Admission prerequisite to assessment: exercises (type and scope to be anounced by the lecturer at the beginning of the course).         Contents       Overview of automation systems, fundamental principles of control technology, Laplace transformation, transfer function, plant, controller types, basic feedback loop, fundamental principles of control engineering, automata, structure of Petri nets, Petri nets for automisation, machine-related structure of processing computation machines, communication between process computers and periphery devices, software for automation systems, process synchronisation, process communication, real-time operating systems, real-time planning.         Intended learning outcomes       The students master the fundamentals of automation and control.         Courses (type, number of weekly contact hours) language – if other than German, examination offered – if not every semester, information on whether module is cellable for bonus)         Wethod of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is cellable for bonus)         written examination (approx. 80 to 90 minutes). If announced by the lecturer by four weeks prior to the examination of one candidate each or an oral examination in groups of 2.         Language of assessment: German, English if agreed upon with the examiner         Additional information         -         Vorkload         -         -         Bachelor' degree (1 major) Computer Science (2010)         Bachelor' degree (1 major) Computer Science	Duratio	n	Module level	Other prerequisites	Other prerequisites		
Contents           Overview of automation systems, fundamental principles of control technology, Laplace transformation, transfer function, plant, controller types, basic feedback loop, fundamental principles of control engineering, automata, structure of Petri nets, Petri nets for automisation, machine-related structure of processing computation machines, communication between process computers and periphery devices, software for automation systems, process systems, real-time operating systems, real-time planning.           Intended learning outcomes         Intended learning outcomes           The students master the fundamentals of automation and control.         Courses (type, number of weekly contact hours, language – if other than German)           V + Û (no information on SWS (weekly contact hours) and course language available)         Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus)           written examination (approx. 80 to 90 minutes). If announced by the lecturer by four weeks prior to the examination of one candidate each, a 30 minute (approx.) oral examination in groups of 2.           Language of assessment: German, English if agreed upon with the examiner           Additional information           -           Modula appears in           Bachelor' degree (1 major) Computer Science (2010)           Bachelor' degree (1 major) Computer Science (2012)           Bachelor' degree (1 major) Computational Mathematics (2013)           Bachelor' degree (1 major) Computational Mathematics (2013) <td>1 seme</td> <td>ster</td> <td>undergraduate</td> <td colspan="3">Admission prerequisite to assessment: exercises (type and scope to be announced by the lecturer at the beginning of the course).</td> <td>scope to be</td>	1 seme	ster	undergraduate	Admission prerequisite to assessment: exercises (type and scope to be announced by the lecturer at the beginning of the course).			scope to be
Overview of automation systems, fundamental principles of control technology, Laplace transformation, transfer function, plant, controller types, basic feedback loop, fundamental principles of control engineering, automata, structure of Petri nets, For automisation, machine-related structure of processing computation machi- nes, communication between process computers and peripheny devices, software for automation systems, pro- cess synchronisation, process communication, real-time operating systems, real-time planning. Intended learning outcomes The students master the fundamentals of automation and control. Courses (type, number of weekly contact hours, language – if other than German) V + Ü (no information on SWS (weekly contact hours) and course language available) Method of assessment (type, scoe, language – if other than German) V + Ü (no information on SWS (weekly contact hours) and course language available) Method of assessment (type, scoe, language – if other than German, examination of one candidate each or an oral exa- mination in groups. A So to go minute sol, if announced by the lecturer by four weeks prior to the examina- tion date, the written examination can be replaced by an oral examination of one candidate each or an oral exa- mination in groups. A So to go minute (approx.) oral examination in groups of 2 and a 40 minute (approx.) oral examination in groups of 3. Language of assessment: German, English if agreed upon with the examiner Aldocation of places 	Conten	ts					
Intended learning outcomes The students master the fundamentals of automation and control. Courses (type, number of weekly contact hours, language – if other than German) V + Ü (no information on SWS (weekly contact hours) and course language available) Method of assessment (type, scope, language – if other than German, examination offeed – if not every semester, information on whether module is certlable for bonus) written examination can be replaced by an oral examination of one candidate each or an oral ex- amination in groups. A 80 to 90 minute written examination is equivalent to a 20 minute (approx.) oral examination in groups of 3. Language of assessment: German, English if agreed upon with the examiner Allocation of places Morkload Referred to in LPO 1 (examinations for teaching-degree programmes) Module appears in Bachelor' degree (1 major) Computer Science (2010) Bachelor' degree (1 major) Computational Mathematics (2012) Bachelor' degree (1 major) Computational Mathematics (2013) Bachelor' degree (1 major) Computer Science (2010) Bachelor' d	Overvie functio structu nes, co cess sy	ew of a n, plan re of Pe mmuni nchror	utomation systems, fur t, controller types, bas etri nets, Petri nets for a ication between proces isation, process comm	ndamental principles of ic feedback loop, funda automisation, machine is computers and perip uunication, real-time op	f control technology, amental principles of -related structure of hery devices, softwa perating systems, rea	Laplace transformat f control engineering processing computa re for automation sy I-time planning.	ion, transfer , automata, tion machi- rstems, pro-
The students master the fundamentals of automation and control. Courses (type, number of weekly contact hours, language – if other than German) V + Ü (no information on SWS (weekly contact hours) and course language available) Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bous) written examination (approx. 80 to 90 minutes). If announced by the lecturer by four weeks prior to the examina- tion date, the written examination can be replaced by an oral examination of one candidate each or an oral ex- amination in groups. A 80 to 90 minute written examination is equivalent to a 20 minute (approx.) oral examina- tion of one candidate each, a 30 minute (approx.) oral examination in groups of 2 and a 40 minute (approx.) oral examination of one candidate each or an oral ex- amination in groups of 3. Language of assessment: German, English if agreed upon with the examiner Allocation of places	Intende	ed lear	ning outcomes				
Courses (type, number of weekly contact hours, language – if other than German)         V + Ü (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 senester, information on whether module is creditable for bonus)         written examination (approx. 80 to 90 minutes). If announced by the lecturer by four weeks prior to the examination of one candidate each or an oral examination in groups. A 80 to 90 minute written examination is equivalent to a 20 minute (approx.) oral examination of one candidate each, a 30 minute (approx.) oral examination in groups of 3.         Language of assessment: German, English if agreed upon with the examiner         Aldication of places            Additional information            Morkload            Referred to in LPO 1 (examination regulations for teaching-degree programmes)            Module appears in         Bachelor' degree (1 major) Computer Science (2010)         Bachelor' degree (1 major) Computer Science (2012)         Bachelor' degree (1 major) Computational Mathematics (2012)         Bachelor' degree (1 major) Computer Science (2010)         Bachelor' degree (1 major) Computational Mathematics (2013)         Bachelor' degree (1 major) Computer Science (2010)         Bachelor' degree (1 major) Computer Science (2013)         Bachelor' deg	The stu	dents	master the fundamenta	als of automation and c	control.		
V + Ü (no information on SWS (weekly contact hours) and course language available)  Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus)  written examination (approx. 80 to 90 minutes). If announced by the lecturer by four weeks prior to the examina- tion date, the written examination are pelaced by an oral examination of one candidate each or an oral ex- amination in groups. A 80 to 90 minute written examination is equivalent to a 20 minute (approx.) oral examina- tion of one candidate each, a 30 minute (approx.) oral examination in groups of 2 and a 40 minute (approx.) oral examination in groups of 3. Language of assessment: German, English if agreed upon with the examiner  Allocation of places	Course	<b>S</b> (type, r	number of weekly contact hour	 s. language — if other than Ge	rman)		
Active construction of the second constructin the second constructin the second construction of th	V + Ü (r	no info	mation on SWS (week	v contact hours) and co	ourse language avail	able)	
Language of assessment: German, English if agreed upon with the examiner          Allocation of places            Additional information            Workload            Teaching cycle            Referred to in LPO I (examination regulations for teaching-degree programmes)            Module appears in         Bachelor' degree (1 major) Computer Science (2010)         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) Computer Science (2009)         Bachelor' degree (1 major) Computational Mathematics (2013)         Bachelor' degree (1 major) Computer Science (2009)         Bachelor' degree (1 major) Computer Science (2009)         Bachelor' degree (1 major) Aerospace Computer Science (2001)         Master's with 1 major Physics (2010)         Master's degree (1 major) Authematics (2012)	Methoo module is written tion da aminat tion of examin	d of ass creditab examin te, the ion in g one ca ation i	sessment (type, scope, lang le for bonus) nation (approx. 80 to 9 written examination ca groups. A 80 to 90 minu ndidate each, a 30 minu n groups of 3.	o minutes). If announc o minutes). If announc n be replaced by an or ute written examinatior ute (approx.) oral exan	examination offered — if no ed by the lecturer by al examination of on n is equivalent to a 2 nination in groups of	four weeks prior to t e candidate each or o minute (approx.) o 2 and a 40 minute (a	on on whether the examina- an oral ex- oral examina- approx.) oral
Allocation of places Additional information Workload Workload Teaching cycle Referred to in LPO 1 (examination regulations for teaching-degree programmes) Referred to in LPO 1 (examination regulations for teaching-degree programmes) Module appears in Bachelor' degree (1 major) Computer Science (2010) Bachelor' degree (1 major) Mathematics (2012) Bachelor' degree (1 major) Computational Mathematics (2012) Bachelor' degree (1 major) Computational Mathematics (2013) Bachelor' degree (1 major) Computer Science (2009) Bachelor' degree (1 major) Aerospace Computer Science (201) Master's degree (1 major) Aetomates (2012) Master's with 1 major Physics (2013) Master's with 1 major Physics (2013)	Langua	ge of a	ssessment: German, E	nglish if agreed upon w	vith the examiner		
Additional information Additional information Workload Teaching 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) Computer Science (2010) 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) Computer Science (2009) Bachelor' degree (1 major) Aerospace Computer Science (2010) Master's degree (1 major) Computer Science (2010) Master's degree (1 major) Mathematics (2012) Master's with 1 major Physics (2010)	Allocat	ion of <sub>l</sub>	olaces				
Additional information            Workload            Teaching 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) Computer Science (2010)         Bachelor' degree (1 major) Mathematics (2012)         Bachelor' degree (1 major) Computational Mathematics (2012)         Bachelor' degree (1 major) Computational Mathematics (2013)         Bachelor' degree (1 major) Aerospace Computer Science (2009)         Bachelor' degree (1 major) Aerospace Computer Science (2011)         Master's degree (1 major) Computer Science (2010)         Master's degree (1 major) Mathematics (2012)         Master's with 1 major Physics (2010)         Master's with 1 major Physics (2010)							
Workload          Teaching 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) Computer Science (2010)       Bachelor' degree (1 major) Mathematics (2012)         Bachelor' degree (1 major) Mathematics (2013)       Bachelor' degree (1 major) Computational Mathematics (2013)         Bachelor' degree (1 major) Computational Mathematics (2013)       Bachelor' degree (1 major) Aerospace Computer Science (2009)         Bachelor' degree (1 major) Aerospace Computer Science (2011)       Master's degree (1 major) Computer Science (2010)         Master's degree (1 major) Computer Science (2010)       Master's degree (1 major) Mathematics (2012)	Additio	nal inf	ormation				
Workload            Teaching cycle            Referred to in LPO I (examination regulations for teaching-degree programmes)            Module appears in         Bachelor' degree (1 major) Computer Science (2010)         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) Aerospace Computer Science (2009)         Bachelor' degree (1 major) Aerospace Computer Science (2011)         Master's degree (1 major) Computer Science (2010)         Master's degree (1 major) Mathematics (2012)		_					
Teaching cycle            Referred to in LPO I (examination regulations for teaching-degree programmes)            Module appears in         Bachelor' degree (1 major) Computer Science (2010)         Bachelor' degree (1 major) Mathematics (2012)         Bachelor' degree (1 major) Mathematics (2013)         Bachelor' degree (1 major) Computational Mathematics (2013)         Bachelor' degree (1 major) Computational Mathematics (2013)         Bachelor' degree (1 major) Aerospace Computer Science (2009)         Bachelor' degree (1 major) Aerospace Computer Science (2011)         Master's degree (1 major) Computer Science (2010)         Master's degree (1 major) Mathematics (2012)	Worklo	ad					
Teaching cycle            Referred to in LPO I (examination regulations for teaching-degree programmes)            Module appears in         Bachelor' degree (1 major) Computer Science (2010)         Bachelor' degree (1 major) Mathematics (2012)         Bachelor' degree (1 major) Mathematics (2013)         Bachelor' degree (1 major) Computational Mathematics (2012)         Bachelor' degree (1 major) Computational Mathematics (2013)         Bachelor' degree (1 major) Aerospace Computer Science (2009)         Bachelor' degree (1 major) Aerospace Computer Science (2011)         Master's degree (1 major) Computer Science (2010)         Master's degree (1 major) Mathematics (2012)							
Referred to in LPO I (examination regulations for teaching-degree programmes)          Module appears in         Bachelor' degree (1 major) Computer Science (2010)       Bachelor' degree (1 major) Mathematics (2012)         Bachelor' degree (1 major) Mathematics (2013)       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) Aerospace Computer Science (2009)       Bachelor' degree (1 major) Aerospace Computer Science (2011)         Master's degree (1 major) Computer Science (2010)       Master's degree (1 major) Mathematics (2012)	Teachi	ng cvcl	e				
Referred to in LPO I (examination regulations for teaching-degree programmes)            Module appears in         Bachelor' degree (1 major) Computer Science (2010)         Bachelor' degree (1 major) Mathematics (2012)         Bachelor' degree (1 major) Mathematics (2013)         Bachelor' degree (1 major) Computational Mathematics (2012)         Bachelor' degree (1 major) Computational Mathematics (2013)         Bachelor' degree (1 major) Aerospace Computer Science (2009)         Bachelor' degree (1 major) Aerospace Computer Science (2011)         Master's degree (1 major) Computer Science (2010)         Master's degree (1 major) Mathematics (2012)         Master's degree (1 major) Mathematics (2012)							
Module appears in         Bachelor' degree (1 major) Computer Science (2010)         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) Aerospace Computer Science (2009)         Bachelor' degree (1 major) Aerospace Computer Science (2011)         Master's degree (1 major) Computer Science (2010)         Master's degree (1 major) Mathematics (2012)         Master's degree (1 major) Mathematics (2012)	Referre	d to in	<b>LPO I</b> (examination regulati	ons for teaching-degree progra	ammes)		
Module appears inBachelor' degree (1 major) Computer Science (2010)Bachelor' degree (1 major) Mathematics (2012)Bachelor' degree (1 major) Mathematics (2013)Bachelor' degree (1 major) Computational Mathematics (2012)Bachelor' degree (1 major) Computational Mathematics (2013)Bachelor' degree (1 major) Aerospace Computer Science (2009)Bachelor' degree (1 major) Aerospace Computer Science (2011)Master's degree (1 major) Computer Science (2010)Master's degree (1 major) Mathematics (2012)							
Bachelor' degree (1 major) Computer Science (2010) Bachelor' degree (1 major) Mathematics (2012) Bachelor' degree (1 major) Mathematics (2013) Bachelor' degree (1 major) Computational Mathematics (2012) Bachelor' degree (1 major) Computational Mathematics (2013) Bachelor' degree (1 major) Aerospace Computer Science (2009) Bachelor' degree (1 major) Aerospace Computer Science (2011) Master's degree (1 major) Computer Science (2010) Master's degree (1 major) Mathematics (2012) Master's with 1 major Physics (2010) JMU Würzburg • generated 26-Aug-2024 • exam. page 244 / 280	Module appears in						
Bachelor' degree (1 major) Mathematics (2012) Bachelor' degree (1 major) Mathematics (2013) Bachelor' degree (1 major) Computational Mathematics (2012) Bachelor' degree (1 major) Computational Mathematics (2013) Bachelor' degree (1 major) Aerospace Computer Science (2009) Bachelor' degree (1 major) Aerospace Computer Science (2011) Master's degree (1 major) Computer Science (2010) Master's degree (1 major) Mathematics (2012) Master's with 1 major Physics (2010) Master's with 1 major Physics (2010) Master's with 1 major Physics (2010) Master's degree (1 major) Mathematics (2012)	Bachelor' degree (1 major) Computer Science (2010)						
Bachelor' degree (1 major) Mathematics (2013) Bachelor' degree (1 major) Computational Mathematics (2012) Bachelor' degree (1 major) Computational Mathematics (2013) Bachelor' degree (1 major) Aerospace Computer Science (2009) Bachelor' degree (1 major) Aerospace Computer Science (2011) Master's degree (1 major) Computer Science (2010) Master's degree (1 major) Mathematics (2012) Master's with 1 major Physics (2010) JMU Würzburg • generated 26-Aug-2024 • exam. page 244 / 280	Bachelor' degree (1 major) Mathematics (2012)						
Bachelor' degree (1 major) Computational Mathematics (2012)Bachelor' degree (1 major) Computational Mathematics (2013)Bachelor' degree (1 major) Aerospace Computer Science (2009)Bachelor' degree (1 major) Aerospace Computer Science (2011)Master's degree (1 major) Computer Science (2010)Master's degree (1 major) Mathematics (2012)Master's with 1 major Physics (2010)JMU Würzburg • generated 26-Aug-2024 • exam.page 244 / 280	Bachel	or' deg	ree (1 major) Mathema	tics (2013)			
Bachelor' degree (1 major) Computational Mathematics (2013) Bachelor' degree (1 major) Aerospace Computer Science (2009) Bachelor' degree (1 major) Aerospace Computer Science (2011) Master's degree (1 major) Computer Science (2010) Master's degree (1 major) Mathematics (2012) Master's with 1 major Physics (2010) JMU Würzburg • generated 26-Aug-2024 • exam. page 244 / 280	Bachelor' degree (1 major) Computational Mathematics (2012)						
Bachelor' degree (1 major) Aerospace Computer Science (2009)         Bachelor' degree (1 major) Aerospace Computer Science (2010)         Master's degree (1 major) Computer Science (2010)         Master's degree (1 major) Mathematics (2012)         Master's with 1 major Physics (2010)         JMU Würzburg • generated 26-Aug-2024 • exam.         page 244 / 280	Bachel	or'deg	ree (1 major) Computat	ional Mathematics (20	13)		
Master's degree (1 major) Computer Science (2010)         Master's degree (1 major) Mathematics (2012)         Master's with 1 major Physics (2010)         JMU Würzburg • generated 26-Aug-2024 • exam.         page 244 / 280	Bachel	or' dog	ree (1 major) Aerospace	e computer Science (20	009J		
Master's degree (1 major) Mathematics (2012)         Master's with 1 major Physics (2010)         JMU Würzburg • generated 26-Aug-2024 • exam.         page 244 / 280	Master	Bachelor Gegree (1 major) Aerospace Computer Science (2011) Master's degree (1 major) Computer Science (2010)					
Master's with 1 major Physics (2010)     JMU Würzburg • generated 26-Aug-2024 • exam.     page 244 / 280	Master	's degr	ee (1 major) Mathemati	ics (2012)			
rog data record Master (roc ECTC) Dhusile as a	Master's w	ith 1 majo	r Physics (2010)	JMU Würzbu	urg • generated 26-Aug-2024	• exam.	page 244 / 280



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) Computational Mathematics (2012) First state examination for the teaching degree Gymnasium Computer Science (2009)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 245 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation		
Operating Systems				10-I-BS-102-m01	
Module	e coord	inator		Module offered by	
holder	of the O	Chair of Computer Scienc	e ll	Institute of Comput	er Science
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	undergraduate	Admission prerequis announced by the le	site to assessment: e	exercises (type and scope to be ing of the course).
Conten	ts				
Batch, schedu nagemo organis	time sh lers, pr ent, seg ation, l	aring, real-time virtual m rocess synchronisation, s gmentation, paging, file s basics of MS operating sy	achines, system calls emaphores, monitor systems, interfaces, d ystems.	s, processes and thre s, critical regions, de irectory structure, no	eads, cooperating processes, eadlocks, dynamic memory ma- etwork file systems, hard drive
Intende	ed learr	ning outcomes			
The stu	dents p	oossess knowledge and p	practical skills in buil	ding and using esse	ntial parts of operating systems.
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V + Ü (r	no infor	mation on SWS (weekly o	contact hours) and co	urse language avail	able)
Methoo module is	<b>d of ass</b> creditab	e <b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
written tion da aminat Langua	examin te, the ion in g ge of a	nation (approx. 50 to 60 r written examination can groups (one candidate ea ssessment: German, Eng	minutes); if announce be replaced by an ora ch: 15 minutes, group lish if agreed upon w	ed by the lecturer by al examination of on os of 2: 20 minutes, ith the examiner	four weeks prior to the examina- e candidate each or an oral ex- groups of 3: 25 minutes)
Allocat	ion of p	olaces			
	· ·				
Additio	nal inf	ormation			
Worklo	ad				
Teachir	ng cycl	9			
Referre	d to in	<b>LPO I</b> (examination regulations	s for teaching-degree progra	mmes)	
§ 69 (1) 1, c) Informatik Technische Informatik					
Module appears in					
Bachelor' degree (1 major) Computer Science (2010)					
Bachelor' degree (1 major) Aerospace Computer Science (2009)					
Bachelor' degree (1 major) Aerospace Computer Science (2011)					
Master's degree (1 major) Computer Science (2010)					
Master	Master's degree (1 major) Physics (2010)				
Master	Master's degree (1 major) Physics (2011)				
Master	s aegre	ee (1 major) Nanostructur	re rechnology (2011)		
Master's degree (1 major) Nanostructure Technology (2010)					

Master's with 1 major Physics (2010)	JMU Würzburg ● generated 26-Aug-2024 ● exam.	page 246 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation			
Computer Architecture			10-I-RAK-102-m01			
Module coordinator		Module offered by				
Dean of Studies Informatik (Computer Science)		Institute of Comput	er Science			
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade		• • • •		
Duratio	Duration Module level Other prerequisites					
1 seme	ster	undergraduate	Admission prerequi	site to assessment: o	exercises (type and s ing of the course).	scope to be
Conten	ts	1		0	<u> </u>	
Instruct ling, ca	tion se ches, v	t architectures, comma /ector processors, mult	nd processing through i-core processors.	pipelining, statical a	and dynamic instruct	ion schedu-
Intende	ed lear	ning outcomes				
The stu compile	dents i ers and	master the most impor l operating systems.	ant techniques to desi	gn fast computers as	s well as their interac	ction with
Course	<b>S</b> (type, r	number of weekly contact hour	s, language — if other than Ge	rman)		
V + Ü (r	no infoi	rmation on SWS (weekl	y contact hours) and co	ourse language avail	able)	
Methoo module is	<b>d of ass</b> creditab	sessment (type, scope, lang	uage — if other than German,	examination offered — if no	t every semester, informati	on on whether
tion da aminat Langua	te, the ion in g	written examination ca groups (one candidate ssessment: German, E	n be replaced by an or each: 15 minutes, grou nglish if agreed upon w	al examination of on ps of 2: 20 minutes, vith the examiner	e candidate each or groups of 3: 25 minu	an oral ex- ites)
Allocat	ion of <sub>l</sub>	places				
Additional information						
Workload						
Teachir	Teaching cycle					
Referre	d to in	LPO I (examination regulati	ons for teaching-degree progra	ammes)		
§ 69 (1)	) 1. c) lr	nformatik Technische Ir	nformatik			
Module	e appea	ars in				
Bachel	or' deg	ree (1 major) Computer	Science (2010)			
Bachel	or' deg	ree (1 major) Mathema	tics (2012)			
Bachel	or' deg	ree (1 major) Mathema	tics (2013)			
Bachelor' degree (1 major) Computational Mathematics (2012)						
Bachelor' degree (1 major) Computational Mathematics (2013)						
Bachelor' degree (1 major) Aerospace Computer Science (2009)						
Bachelor' degree (1 major) Aerospace Computer Science (2011)						
Master	Master's degree (1 major) Computer Science (2010)					
Master	Master's degree (1 major) Mathematics (2012)					
Master	s aegr	ee (1 major) Mathemati	cs (2010)			
Master	Master's degree (1 major) Physics (2010)					
master	s uegi	ee (1 major) Physics (2)	)11)			
Master's wi	ith 1 majo	r Physics (2010)	JMU Würzbu reg. data re	irg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 247 / 280

Master's degree (1 major) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Computational Mathematics (2012)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 248 / 280
	reg. data record Master (120 ECTS) Physik - 2010	1

Module title		Abbreviation			
Programming of Distributed Systems			10-I=PVS-102-m01		
Module coordinator			Module offered by		
holder	of the C	Chair of Computer Science	e ll	Institute of Comput	er Science
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
8	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 semes	ster	graduate	Where applicable, p ning of the course (e	rerequisites as spec e.g. completion of ex	ified by the lecturer at the begin- xercises).
Conten	ts				
Design	and de	velopment of parallely a	nd distributedly exec	uted programs.	
Intende	ed learr	ning outcomes			
The stu and dis	dents p tribute	possess the methodic kn dly running programs.	owledge and practica	l skills for the desig	n and development of parallely
Courses	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V + Ü (n	no infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)
Method module is	l of ass creditab	s <b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
tion dat aminati tion of o examin Langua	tion date, the written examination can be replaced by an oral examination of one candidate each or an oral ex- amination in groups. A 80 to 90 minute written examination is equivalent to a 20 minute (approx.) oral examina- tion of one candidate each, a 30 minute (approx.) oral examination in groups of 2 and a 40 minute (approx.) oral examination in groups of 3.				
Allocati	ion of p	olaces			
Additio	Additional information				
Worklo	ad				
Teachir	ng cycl	e			
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	
Module appears in					
Master's degree (1 major) Computer Science (2010) 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) First state examination for the teaching degree Gymnasium Computer Science (2009)					

Module title		Abbreviation			
Artificial Intelligence		10-l=Kl-102-m01			
Module coordinator		Module offered by			
holder	of the (	Chair of Computer Scienc	e VI	Institute of Comput	er Science
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
8	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate	Where applicable, p ning of the course (e	rerequisites as spec e.g. completion of ex	ified by the lecturer at the begin- xercises).
Conten	ts		<u> </u>	0 1	
Intellig propos Bayesia ning, n	ent age itional an netv eural n	ents, uninformed and heu and predicate logic and i vorks, utility theory and d etworks and statistical le	ristic search, constra nference, knowledge ecidability problems arning methods, rein	int problem solving, representation, pla , learning from obse forcement learning.	, search with partial information, nning, probabilistic closure and rvations, knowledge while lear-
Intende	ed lear	ning outcomes			
The stu possibi	dents   ilities fo	possess theoretical and p or its application.	oractical knowledge a	bout artificial intelli	gence and are able to assess
Course	<b>S</b> (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)	
V + Ü (r	no infoi	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)
Methoo module is	<b>d of ass</b> creditab	<b>Sessment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
written tion da aminat Langua	examin te, the ion in g ge of a	nation (approx. 80 to 90 n written examination can groups (one candidate ea ssessment: German, Eng	minutes); if announce be replaced by an ora ch: 15 minutes, group lish if agreed upon w	ed by the lecturer by al examination of on os of 2: 20 minutes, ith the examiner	four weeks prior to the examina- e candidate each or an oral ex- groups of 3: 25 minutes)
Allocat	ion of p	olaces	·		
Additio	nal inf	ormation			
Worklo	ad				
WORKIO	au				
 Teachir	ng cycl				
	is cyce				
Deferre	d to in				
Referre	αιοιη	LPUT (examination regulations	s for teaching-degree progra	mmes)	
		•			
Module appears in					
Master	Master's degree (1 major) Computer Science (2010)				
master's degree (1 major) Mathematics (2012) Master's degree (1 major) Mathematics (2010)					
Master	Master's degree (1 major) Mathematics (2010) Master's degree (1 major) Physics (2010)				
Master	Master's degree (1 major) Physics (2010) Master's degree (1 major) Physics (2011)				
Master	's degr	ee (1 major) Nanostructur	-/ re Technology (2011)		
Master	's degr	ee (1 major) Nanostructur	re Technology (2010)		
Master	's degr	ee (1 major) Computation	al Mathematics (201)	2)	
First sta	ate exa	mination for the teaching	degree Gymnasium	-/ Computer Science (a	2009)
The state chammation for the teaching degree cymnastam compater science (2009)					

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam. p	
	reg. data record Master (120 ECTS) Physik - 2010	

Module	title				Abbreviation
Databases II		10-l=DB2-102-m01			
Module coordinator		Module offered by			
Dean of	fStudie	es Informatik (Computer S	Science)	Institute of Comput	er Science
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
5	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 seme	ster	graduate	Where applicable, p ning of the course (e	rerequisites as spec . g. completion of ex	ified by the lecturer at the begin- kercises).
Conten	ts				
Data wa	arehou	ses and data mining; XM	L databases; web dat	abases;introductior	n to Datalog.
Intende	ed leari	ning outcomes			
The stu	dents l	have advanced knowledg	e about relational da	tabases, XML and da	ata mining.
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V + Ü (r	no infor	mation on SWS (weekly o	contact hours) and co	urse language avail	able)
Methoo module is	<b>l of ass</b> creditab	sessment (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
written tion dat aminati Langua	examin te, the ion in g ge of a	nation (approx. 50 to 60 r written examination can groups (one candidate ea ssessment: German, Eng	minutes); if announce be replaced by an ora ch: 15 minutes, group lish if agreed upon w	ed by the lecturer by al examination of on os of 2: 20 minutes, ith the examiner	four weeks prior to the examina- e candidate each or an oral ex- groups of 3: 25 minutes)
Allocation of places					
Additional information					
Worklo	ad				
Teachir	ng cycl	e			
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	
Module	appea	urs in			
Master's degree (1 major) Computer Science (2010) 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) Nanostructure Technology (2011) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Business Information Systems (2011) Master's degree (1 major) Business Information Systems (2013) Master's degree (1 major) Computational Mathematics (2012) Master's degree (1 major) Functional Materials (2012)					
First sta	ate exa	mination for the teaching	g degree Gymnasium	Computer Science (2	2009)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 251 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title		Abbreviation			
Program Design and Analysis			10-I=PA-102-m01		
Module coordinator		Module offered by			
holder	of the C	hair of Computer Science	e ll	Institute of Comput	er Science
ECTS	Metho	d of grading	Only after succ. com	pl. of module(s)	
5	numer	ical grade			
Duratio	on	Module level	Other prerequisites		
1 seme	ster	graduate	Where applicable, p ning of the course (e	rerequisites as spec e.g. completion of ex	ified by the lecturer at the begin- kercises).
Conten	ts				
Program	n analy	sis, model creation in so	ftware engineering, p	orogram quality, test	of programs, process models.
Intende	ed learn	ing outcomes			
The stu quality.	idents a	ire able to analyse progra	ams, to use testing fra	ameworks and metri	cs as well as to judge program
Course	<b>S</b> (type, n	umber of weekly contact hours, la	anguage — if other than Ger	man)	
V + Ü (r	no infor	mation on SWS (weekly o	contact hours) and co	urse language avail	able)
Method	d of ass	essment (type, scope, languag	ge — if other than German, e	examination offered — if no	t every semester, information on whether
module is	s creditabl	e for bonus)			
written tion da aminat Langua	examin te, the v ion in g ge of as	nation (approx. 50 to 60 r written examination can roups (one candidate ea ssessment: German, Eng	ninutes); if announce be replaced by an ora ch: 15 minutes, group lish if agreed upon w	ed by the lecturer by al examination of on os of 2: 20 minutes, ith the examiner	four weeks prior to the examina- e candidate each or an oral ex- groups of 3: 25 minutes)
Allocation of places					
Additional information					
Worklo	ad				
Teachir	ng cycle	9			
Referre	d to in	LPO I (examination regulations	s for teaching-degree progra	mmes)	
Module	e appea	rs in			
Master	's degre	ee (1 major) Computer Sc	ience (2010)		
Master's degree (1 major) Mathematics (2012)					
Master's degree (1 major) Mathematics (2010)					
Master's degree (1 major) Physics (2010)					
Master	's degre	e (1 major) Physics (201	1) ` ` `		
Master	's degre	e (1 major) Nanostructur	e lechnology (2011)		
Master	's degre	e (1 major) Nanostructur	e lechnology (2010)	<b>`</b>	
Master	's degre	ee (1 major) Business Info	ormation Systems (20	)11)	
Master	s aegre	e (1 major) Business Info	ormation Systems (20	)13 <i>)</i>	
First st	s uegre	e (1 major) Computation	ai mainematics (2012	2) Computor Science (c	2000)
רוואנ אנמ	First state examination for the teaching degree Gymnasium Computer Science (2009)				

Master's with 1 major Physics (2010)	JMU Würzburg ● generated 26-Aug-2024 ● exam.	page 252 / 280				
	reg. data record Master (120 ECTS) Physik - 2010					
Module title Abbreviation						
---	--	--	--	--	---	--
Applied	l Analy	sis			10-M=AAAN-102-m01	
Module	e coord	inator		Module offered by		
Dean of Studies Mathematik (Mathema		atics)	Institute of Mathem	atics		
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
10 numerical grade						
Duratio	n	Module level	Other prerequisites			
1 semester graduate			Registration for the exercise must be made via SB@home at the begin- ning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be met to qualify for admission to assessment (e. g. successful completion of a certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise will be considered a declaration of will to seek admission to as- sessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their re- gistration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent seme- ster. For assessment at a later date, students will have to obtain the qua-			
In-dept theory of particul theory of Recomm Familia Intende The stu to estal	n study of Hilbe lar FEM of ellip mendee rity wit ed learn dent is blish a	of functional analysis and ert spaces and Fourier an methods), principles of tic, parabolic and hyperb d previous knowledge: h the contents of the mod <b>hing outcomes</b> acquainted with the fun- connection between his/	nd operator theory, S alysis, spectral theor functional analysis, f olic partial differentia dule "Functional Anal damental notions, m /her acquired skills a	obolev spaces and p y and quantum mech unction spaces, emb al equations with me ysis" is strongly reco ethods and results o nd other branches of	oartial differential equations, hanics, numerical methods (in bedding theorems, compactness, ethods from functional analysis. ommended. If higher analysis. He/She is able f mathematics and questions in	
Course	<b>s</b> (type, n	umber of weekly contact hours. I	anguage — if other than Ger	man)		
V + Ü (r	no infor	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)	
Methoo module is	<b>d of ass</b> creditab	sessment (type, scope, langua	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral exami- nation in groups (groups of 2, approx. 30 minutes) Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters. Language of assessment: German, English						
Allocation of places						
Additio	Additional information					
Worklo	Workload					

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

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## Module appears in

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) Economathematics (2011)

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

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 254 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title Abbreviation						
Differer	ntial G	eometry			10-M=ADGM-102-m01	
Differen						
Module	e coord	inator		Module offered by		
Dean of	f Studi	es Mathematik (Mathema	atics)	atics) Institute of Mathematics		
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
10	nume	rical grade				
Duration Module level		Other prerequisites				
1 Semester       graduate       Registration for the exercise must be made via Sb@nome at the beginning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be met to qualify for admission to assessment (e.g. successful completion of a certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise 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 prerequisite will be admitted to assessment in the current or in the subsequent seme ster. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.         Contents         Central and advanced results in differential geometry, in particular about differentiable and Riemannian manifolds.			ade via SB@home at the begin- he lecturer in accordance with tain prerequisites must be met (e. g. successful completion of a cturer will inform students about of the course. Registration for the n of will to seek admission to as- e qualification for admission to ester, the lecturer will put their re- udents who meet all prerequisites urrent or in the subsequent seme- dents will have to obtain the qua- new.			
metric / Intende	Analysi ed lear	is" is recommended. ning outcomes				
The stu able to try.	dent is apply f	acquainted with concep these methods and know	ts and methods for d /s about the interaction	ifferentiable manifol on of local and globa	lds or Riemannian manifolds, is al methods in differential geome-	
Course	<b>S</b> (type, r	number of weekly contact hours, I	language — if other than Ger	man)		
V + Ü (r	no infoi	rmation on SWS (weekly	contact hours) and co	ourse language avail	able)	
<b>Methoc</b> module is	<b>d of ass</b> creditab	<b>sessment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	ot every semester, information on whether	
At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups (groups of 2, approx. 30 minutes) Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters. Language of assessment: German, English						
Allocat	Allocation of places					
Additio	Additional information					
Worklo	ad					

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 255 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

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

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## Module appears in

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 with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 256 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module	e title				Abbreviation		
Comple	ex Anal	ysis			10-M=AFTH-102-mc	)1	
Module	e coord	inator		Module offered by			
Dean o	f Studi	es Mathematik (Mathe	matics)	tics) Institute of Mathematics			
ECTS	Metho	od of grading	Only after succ. con	Only after succ. compl. of module(s)			
10	nume	rical grade					
Duratio	on	Module level	Other prerequisites				
1 semester graduate		Registration for the ning of the course o the specified registr to qualify for admiss certain percentage o the respective detai exercise will be con sessment. If studen assessment over the gistration for assess will be admitted to a ster. For assessmen	Registration for the exercise must be made via SB@home at the begin- ning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be met to qualify for admission to assessment (e. g. successful completion of a certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise will be considered a declaration of will to seek admission to as- sessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their re- gistration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent seme- ster. For assessment at a later date, students will have to obtain the qua-				
			lification for admiss	lification for admission to assessment anew.			
Recom Basic k Intendo The stu ticular	g. ellip mende nowled ed lean ident is the (ge	tic functions). d previous knowledge: dge of the contents of t ning outcomes acquainted with the frometric) mapping prop her acquired skills and	he module "Introductio undamental notions, m perties of holomorphic f	n to Complex Analys ethods and results o functions. He/She is nematics and applica	iorphic functions. Sp sis" is recommended of higher complex an able to establish a c ations in other subje	alysis, in par-	
Course	<b>S</b> (type, r	number of weekly contact hour	rs, language — if other than Ge	rman)	,		
V + Ü (I	no infoi	mation on SWS (week	ly contact hours) and co	ourse language avail	able)		
Metho module is	<b>d of ass</b> s creditab	<b>essment</b> (type, scope, lang le for bonus)	guage — if other than German,	examination offered — if no	ot every semester, informat	ion on whether	
At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral exami- nation in groups (groups of 2, approx. 30 minutes) Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters. Language of assessment: German, English							
Allocation of places							
 Additio	onal inf oad	ormation					
Master's w	Master's with 1 major Physics (2010) JMU Würzburg • generated 26-Aug-2024 • exam. page 257 / 2 reg. data record Master (120 ECTS) Physik - 2010					page 257 / 280	

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

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## Module appears in

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 with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 258 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Modul	a titla				Abbreviation			
	orv				10-M=AI TH-102-m	21		
						51		
Modul	e coord	inator		Module offered by				
Dean o	of Studi	es Mathematik (Mathem	atics)	Institute of Mathem	natics			
ECTS	Metho	od of grading	Only after succ. con	Only after succ. compl. of module(s)				
10	nume	rical grade						
Duratio	on	Module level	Other prerequisites					
1 semester graduate		Registration for the ning of the course o the specified registr to qualify for admiss certain percentage o the respective detai exercise will be con sessment. If studen assessment over the gistration for assess will be admitted to a ster. For assessmen	Registration for the exercise must be made via SB@home at the begin- ning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be met to qualify for admission to assessment (e. g. successful completion of a certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise will be considered a declaration of will to seek admission to as- sessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their re- gistration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent seme- ster. For assessment at a later date, students will have to obtain the qua-					
Canton			lification for admiss	ion to assessment a	inew.			
Recom Basic k mende useful. Intend	mende nowled d. Furth ed lear	d previous knowledge: lge of the contents of th hermore, basic knowledg <b>ning outcomes</b> acquainted with the fur	e modules "Functiona ge of the contents of the content of the	l Analysis" and "Intr ne module "Introduc corems and methods	oduction to Topolog tion to Differential G in Lie theory. He/Sl	y" is recom- beometry" is		
ar alge	bra.	common problems, and		eractions of group tr	ieory, analysis, lopo	logy and the-		
Course	<b>S</b> (type, r	number of weekly contact hours,	language — if other than Ger	man)				
V + Ü (	no info	mation on SWS (weekly	contact hours) and co	ourse language avail	able)			
Metho module i	<b>d of ass</b> s creditab	<b>sessment</b> (type, scope, langu le for bonus)	age — if other than German, o	examination offered — if no	ot every semester, informat	ion on whether		
At the examin nation Assess semes Langua	At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral exami- nation in groups (groups of 2, approx. 30 minutes) Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters. Language of assessment: German English							
Allocation of places								
Additional information								
Worklo	ad							
	1							
Master's w	vith 1 majo	r Physics (2010)	JMU Würzbu	rg • generated 26-Aug-2024	• exam.	page 259 / 280		

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

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## Module appears in

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 with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 260 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title					Abbreviation		
Τοροίο	gy				10-M=ATOP-102-mo	)1	
Module	coord	inator		Module offered by			
Dean of	fStudie	es Mathematik (Mathe	natics)	Institute of Mathem	atics		
ECTS	Metho	od of grading	Only after succ. con	Only after succ. compl. of module(s)			
10	nume	rical grade					
Duration Module level		Other prerequisites					
1 semester graduate		Registration for the ning of the course o the specified registr to qualify for admiss certain percentage o the respective detai exercise will be con sessment. If studen assessment over the gistration for assess will be admitted to a ster. For assessmen lification for admiss	Registration for the exercise must be made via SB@home at the begin- ning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be met to qualify for admission to assessment (e.g. successful completion of a certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise will be considered a declaration of will to seek admission to as- sessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their re- gistration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent seme- ster. For assessment at a later date, students will have to obtain the qua-				
Conton				ion to assessment a	new.		
Set-the spaces.	<b>ts</b> oretic t , coveri	opology, topological in ing spaces.	ivariants (e. g. fundamo	ental group, connect	ion), construction of	topological	
Intende	ed learr	ning outcomes					
The stu these to	dent is o comn	acquainted with the for non problems.	undamental results, the	eorems and methods	in topology and is a	ıble to apply	
Course	<b>S</b> (type, n	umber of weekly contact hour	s, language — if other than Gei	rman)			
V + Ü (r	no infor	mation on SWS (week	y contact hours) and co	ourse language avail	able)		
Methoo module is	l of ass creditab	<b>essment</b> (type, scope, lang le for bonus)	uage — if other than German,	examination offered — if no	t every semester, informat	on on whether	
At the b examin nation i Assessi semest Langua	beginni ation ( in grou ment o er, cou ge of a	ng of the course, the le 90 to 120 minutes), b) ps (groups of 2, appro ffered: Assessment off rse offered on demanc ssessment: German, E	ecturer will choose one oral examination of one (. 30 minutes) ered in the semester in or every four semester nglish	of the following metle candidate each (ap which the course is s.	hods of assessment prox. 20 minutes), c offered and in the s	: a) written :) oral exami- ubsequent	
Allocati	ion of p	olaces	-				
Additional information							
Worklo	Workload						
Teaching cycle							
Referred to in LPO I (examination regulations for teaching-degree programmes)							
Module appears in							
Master's wi	th 1 major	Physics (2010)	JMU Würzbu reg. data rec	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 261 / 280	



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) Computational Mathematics (2012)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 262 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module	e title				Abbreviation						
Numbe	r Theo	ry			10-M=AZTH-102-mc	01					
Module	e coord	inator		Module offered by							
Dean o	f Studi	es Mathematik (Mathe	matics)	tics) Institute of Mathematics							
ECTS	Metho	od of grading	Only after succ. con	Only after succ. compl. of module(s)							
10	nume	rical grade									
Duratio	Duration Module level		Other prerequisites								
1 semester graduate		Registration for the ning of the course o the specified registr to qualify for admiss certain percentage the respective detai exercise will be con sessment. If studen assessment over th gistration for assess will be admitted to a ster. For assessmen lification for admiss	Registration for the exercise must be made via SB@home at the begin- ning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be met to qualify for admission to assessment (e. g. successful completion of a certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise will be considered a declaration of will to seek admission to as- sessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their re- gistration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent seme- ster. For assessment at a later date, students will have to obtain the qua-								
Conton	te	<u> </u>			new.						
Recom Basic k on to A Intende The stu structu into mo	mende nowled Igebra' ed lear ident is res in r odern d	d previous knowledge: dge of algebra and nun ', "Introduction to Num <b>ning outcomes</b> acquainted with the finumber theory and kno levelopments in number	aber theory is assumed ber Theory" and "Appli undamental methods o ws methods for the sol er theory.	, such as can be acq ed Algebra". f analytics number th ution of diophantine	uired in the modules neory, can deal with equations. He/She	s "Introducti- algebraic has insight					
Course	<b>S</b> (type, r	number of weekly contact hour	rs, language — if other than Ge	rman)							
V + Ü (I	no info	rmation on SWS (week	ly contact hours) and co	ourse language avail	able)						
Metho module is	<b>d of ass</b> s creditab	<b>sessment</b> (type, scope, lang le for bonus)	guage — if other than German,	examination offered — if no	t every semester, informati	ion on whether					
At the l examin nation Assess semest Langua	At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral exami- nation in groups (groups of 2, approx. 30 minutes) Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters. Language of assessment: German, English										
Allocation of places											
Additio											
worklo	workload										
Master's w	ith 1 majo	r Physics (2010)	JMU Würzbu reg. data ree	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	ster's with 1 major Physics (2010) JMU Würzburg • generated 26-Aug-2024 • exam. page 263 / 280					

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

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## Module appears in

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 with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 264 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module	e title				Abbreviation
Groups and their Representations					10-M=VGDS-102-m01
Module coordinator			Module offered by		
Dean o	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)	
10	nume	rical grade			
Duratio	on	Module level	Other prerequisites		
	Ster	graduate	Registration for the exercise must be made via SB@home at the begin- ning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be met to qualify for admission to assessment (e. g. successful completion of a certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise will be considered a declaration of will to seek admission to as- sessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their re- gistration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent seme ster. For assessment at a later date, students will have to obtain the qua-		the lecturer in accordance with tain prerequisites must be met (e. g. successful completion of a turer will inform students about of the course. Registration for the n of will to seek admission to as- e qualification for admission to ester, the lecturer will put their re- udents who meet all prerequisites arrent or in the subsequent seme- dents will have to obtain the qua- new.
Contents         Finite permutation groups and character theory of finite groups, interrelations and special techniques such as the S-rings of Schur.         Recommended previous knowledge:         Basic knowledge of algebra is assumed, such as can be acquired in the modules "Introduction to Algebra" and					
Intended learning outcomes					
The student masters advanced algebraic concepts and methods. He/She gains the ability to work on contempo- rary research questions in group theory and representation theory and can apply his/her skills to complex pro- blems.					
Course	<b>Courses</b> (type, number of weekly contact hours, language — if other than German)				

V + Ü (no information on SWS (weekly contact hours) and course language available)

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

At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (approx. 90 to 120 minutes; usually chosen), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups of 2 candidates (approx. 30 minutes total)

Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.

Language of assessment: German, English

**Allocation of places** 

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#### Additional information

Workload

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Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 265 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

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

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## Module appears in

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 with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 266 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module	title				Abbreviation
Geometrical Mechanics					10-M=VGEM-102-m01
Module	Module coordinator			Module offered by	
Dean of	f Studi	es Mathematik (Mathema	atics)	Institute of Mathem	natics
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)	
10	nume	rical grade			
Duratio	n	Module level	Other prerequisites		
1 semestergraduateRegistration for the exercise must be made via SB@home at ning of the course or as announced by the lecturer in accord the specified registration deadlines. Certain prerequisites m to qualify for admission to assessment (e. g. successful com certain percentage of exercises). The lecturer will inform stu the respective details at the beginning of the course. Registr exercise will be considered a declaration of will to seek adm sessment. If students have obtained the qualification for ad assessment over the course of the semester, the lecturer wi gistration for assessment into effect. Students who meet all will be admitted to assessment at a later date, students will have to ot Uistration for assessment at a later date, students will have to ot Uistration for assessment at a later date, students will have to ot Uistration for assessment at a later date, students will have to ot Uistration for assessment at a later date, students will have to ot Uistration for assessment at a later date, students will have to ot Uistration for assessment at a later date, students will have to ot Uistration for assessment at a later date, students will have to ot Uistration for assessment at a later date, students will have to ot Uistration for assessment at a later date, students will have to ot Uistration for assessment at a later date, students will have to ot Uistration for assessment at a later date, students will have to ot Uistration for assessment at a later date, students will have to ot Uistration for assessment at a later date, students will have to ot Uistration for assessment at a later date, students will have to ot Uistration for assessment at a later date, students will have to ot Uistration for assessment at a later date, students will have to ot Uistration for assessment at a later date, students will have to ot Uistration for assessment at a later date			Inde via SB@home at the begin- ne lecturer in accordance with tain prerequisites must be met (e. g. successful completion of a turer will inform students about of the course. Registration for the n of will to seek admission to as- e qualification for admission to ester, the lecturer will put their re- udents who meet all prerequisites urrent or in the subsequent seme- dents will have to obtain the qua- new.		
Introdu grange	ction to equati	o geometric mechanics: b ons, Hamiltonian mechar	basic notions of differ nics on manifolds.	ential geometry and	l symplectic geometry, Euler-La-
Recom Advanc Geome ge of th	mende ed kno try". Kr ieoretic	d previous knowledge: wledge of differential ge owledge of the contents al mechanics can also be	ometry is required, su of the module "Introc e useful.	uch as can be acquir duction to Topology"	ed in the module "Differential ' is also recommended. Knowled-
Intende	ed leari	ning outcomes			
The stu knows	dent is about t	able to apply fundament he interrelation of these	tal methods and cond fields.	cepts of geometry to	problems in mechanics, and
Course	<b>S</b> (type, r	umber of weekly contact hours, l	anguage — if other than Ger	man)	
V + Ü (r	no infoi	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)
Methoo module is	<b>d of ass</b> creditab	s <b>essment</b> (type, scope, langua le for bonus)	ge — if other than German, e	examination offered — if no	t every semester, information on whether
At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (approx. 90 to 120 minutes; usually chosen), b) oral examination of one candidate each (approx. 20 minutes), c) oral examination in groups of 2 candidates (approx. 30 minutes total) Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters. Language of assessment: German, English					
Allocation of places					
Additional information					
Workload					

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

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## Module appears in

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 with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 268 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title			Abbreviation				
Numeric of Partial Differential Equations			10-M=VNPE-102-m	01			
Module coordinator				Module offered by	1		
Dean o	f Studi	es Mathematik (Mather	matics)	Institute of Mathem	natics		
ECTS	Metho	od of grading	Only after succ. cor	Only after succ. compl. of module(s)			
10	nume	rical grade					
Duratio	on	Module level	Other prerequisites	5			
1 semester graduate			Registration for the ning of the course of the specified regist to qualify for admis certain percentage the respective deta exercise will be con sessment. If studen assessment over th gistration for assess will be admitted to ster. For assessmer	Registration for the exercise must be made via SB@home at the begin- ning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be met to qualify for admission to assessment (e. g. successful completion of a certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise will be considered a declaration of will to seek admission to as- sessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their re- gistration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent seme- ster. For assessment at a later date, students will have to obtain the qua-			
			lification for admiss	sion to assessment a	new.		
Recom We rec red in t	mende ommer he moo	at differentiat equations ethods for elliptic, para s Gelerkin finite elemen d previous knowledge: d basic knowledge of f dules "Introduction to F <b>ning outcomes</b>	functional Analysis" and	artial differential equ rences and finite volu l partial differential e d "Applied Analysis"	ations; finite elements, end ations; finite element ume methods). equations, such as ca	an be acqui-	
The stu	ident is	acquainted with adva	nced methods for disci	retising partial differe	ential equations.		
Course	<b>S</b> (type, r	number of weekly contact hour	s, language — if other than Ge	rman)			
V + Ü (I	no info	rmation on SWS (weekl	y contact hours) and c	ourse language avail	able)		
Metho module is	<b>d of ass</b> s creditab	<b>sessment</b> (type, scope, lang le for bonus)	guage — if other than German,	examination offered — if no	ot every semester, informati	ion on whether	
At the l examir nation Assess semest Langua	At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (90 to 120 minutes), b) oral examination of one candidate each (approx. 20 minutes), c) oral exami- nation in groups (groups of 2, approx. 30 minutes) Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters. Language of assessment: German, English						
Allocat	ion of <sub>l</sub>	olaces					
Additional information							
Workload							
Teachi	ng cycl	e					
Master's w	ith 1 majo	r Physics (2010)	JMU Würzbi	urg • generated 26-Aug-2024	• exam.	page 269 / 280	

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

#### Module appears in

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 (2010) Master's degree (1 major) Nanostructure Technology (2010) Master's degree (1 major) Economathematics (2011) Master's degree (1 major) Mathematical Physics (2012) Master's degree (1 major) Computational Mathematics (2012)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 270 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Modul	e title				Abbreviation	
Discre	Discrete Mathematic 10-M=VDIM-102-m01					21
Module coordinator			Module offered by			
Dean o	of Studi	es Mathematik (Mathe	ematics)	Institute of Mathem	natics	
ECTS	Metho	od of grading	Only after succ. cor	Only after succ. compl. of module(s)		
5	nume	rical grade				
Durati	on	Module level	Other prerequisites	<b>i</b>		
1 semester graduate even of a semester graduate even of a semester the to c cert the exe ses ass gist will ste		Registration for the ning of the course of the specified registr to qualify for admis certain percentage the respective detai exercise will be con sessment. If studen assessment over th gistration for assess will be admitted to ster. For assessmen lification for admiss	Registration for the exercise must be made via SB@home at the begin- ning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be met to qualify for admission to assessment (e. g. successful completion of a certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise will be considered a declaration of will to seek admission to as- sessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their re- gistration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent seme- ster. For assessment at a later date, students will have to obtain the qua-			
Conto		<u> </u>				
Advan graph Recom Basic I Intend The stu Course	ced met theory of mende (nowled ed lear udent is es (type, r no info	thods and results in a or combinatorics) d previous knowledge dge of the contents of f ning outcomes acquainted with adva number of weekly contact hou rmation on SWS (week	selected field of discret : the module "Introductio inced results in a select rs, language – if other than Ge	e mathematics (e. g. on to Discrete Mather red topic in discrete r rman)	coding theory, crypt matics" is required. mathematics. able)	tography,
metno module i	a or ass s creditab	Sessment (type, scope, lan de for bonus)	guage — if other than German,	examination offered — if no	ot every semester, informat	ion on whether
At the examin nation Assess semes Langus	At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (60 to 90 minutes), b) oral examination of one candidate each (approx. 15 minutes), c) oral exami- nation in groups (groups of 2, approx. 20 minutes) Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.					: a) written oral exami- ubsequent
Alloca	tion of <b>j</b>	olaces				
Additi	onal inf	ormation				
Workle	oad					
Teachi	ng cycl	Δ				
Teacin	ing cyce					
Doform						
Reierr	Referred to III LPU I (examination regulations for teaching-degree programmes)					
 Mactor's	ith a main	r Physics (2010)	. ها	Ira a generated of Aug occ	• exam	Dage 274 / 296
master SV	nui i illajo	1 1 Hysics (2010)	reg. data re	cord Master (120 ECTS) Physi	k - 2010	page 2/1 / 280



# Module appears in

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) Economathematics (2011) Master's degree (1 major) Mathematical Physics (2012)

Master's with 1 major Physics (2010)	IMILWürzburg e generated 26-Aug-2024 e exam	nage 272 / 280
Master 5 With I major r hysics (2010)	Jino Wulzburg • generated 20-Aug-2024 • exam.	page 2/2/200
	reg. data record Master (120 ECTS) Physik - 2010	1

Module title			Abbreviation			
Selected Topics in Mathematical Physics				10-M=VMPH-102-m	101	
Module coordinator			Module offered by			
Dean c	of Studi	es Mathematik (Mathe	matics)	Institute of Mathem	natics	
ECTS	Meth	od of grading	Only after succ. cor	Only after succ. compl. of module(s)		
5	nume	rical grade				
Duratio	on	Module level	Other prerequisites	5		
1 semestergraduateRegistration for the exercise must be made via SB@home at th ning of the course or as announced by the lecturer in accordan the specified registration deadlines. Certain prerequisites must to qualify for admission to assessment (e. g. successful compl certain percentage of exercises). The lecturer will inform studen the respective details at the beginning of the course. Registrati exercise will be considered a declaration of will to seek admise sessment. If students have obtained the qualification for admi assessment over the course of the semester, the lecturer will p gistration for assessment into effect. Students who meet all pr will be admitted to assessment in the current or in the subsequ ster. For assessment at a later date, students will have to obtain			the begin- ance with ust be met pletion of a dents about ration for the hission to as- mission to ll put their re- prerequisites equent seme- ptain the qua-			
			lification for admiss	sion to assessment a	new.	
Conter	nts					
Recom Depen doubt, Intend The stu metho	mende ding or it is rec ed lear ident is ds in m	d previous knowledge: the content, basic and commended to consult ning outcomes acquainted with adva athematical physics ar	l advanced knowledge the lecturer. nced results in a field i nd can apply them to so	from different areas n mathematical physolve problems in physolve	of analysis is requir sics. He/She knows sics.	ed. In case of mathematical
Course	S (type, 1	number of weekly contact hour	s, language — if other than Ge	rman)		
V + Ü (	no info	rmation on SWS (weekl	y contact hours) and c	ourse language avail	able)	
<b>Metho</b> module i	<b>d of as</b> s creditab	<b>sessment</b> (type, scope, lang le for bonus)	guage — if other than German,	examination offered — if no	t every semester, informat	ion on whether:
At the examin nation Assess semes Langua	beginni nation ( in grou sment o ter, cou age of a	ng of the course, the le 60 to 90 minutes), b) o ps (groups of 2, approx ffered: Assessment off rse offered on demand ssessment: German, E	ecturer will choose one oral examination of one x. 20 minutes) ered in the semester ir l or every four semeste nglish	of the following met candidate each (app which the course is rs.	hods of assessment prox. 15 minutes), c) offered and in the s	: a) written oral exami- ubsequent
Allocat	tion of	olaces				
Additio	onal inf	ormation				
Worklo	Workload					
Teachi	ng cycl	e				
	1					
Master's w	vith 1 majo	r Physics (2010)	JMU Würzbu reg. data re	urg • generated 26-Aug-2024 cord Master (120 FCTS) Physil	• exam.	page 273 / 280

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

#### Module appears in

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 with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 274 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title					Abbreviation	
Quantum Control and Quantum Computing					10-M=VQKC-102-m	01
Module coordinator				Module offered by		
Dean of Studies Mathematik (Mathema		matics)	atics) Institute of Mathematics			
ECTS	Metho	od of grading	Only after succ. con	npl. of module(s)		
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 semester		graduate	Registration for the exercise must be made via SB@home at the begin- ning of the course or as announced by the lecturer in accordance with the specified registration deadlines. Certain prerequisites must be met to qualify for admission to assessment (e. g. successful completion of a certain percentage of exercises). The lecturer will inform students about the respective details at the beginning of the course. Registration for the exercise will be considered a declaration of will to seek admission to as- sessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their re- gistration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent seme- ster. For assessment at a later date, students will have to obtain the qua- lification for the qua-			
Conten	ts					
Contents         Basics in dynamics of quantum-mechanical systems (e. g. density operators, observables, Schrödinger equation, Liouville-von-Neumann equation), bilinear control systems in quantum mechanics (e. g. finite-dimensional spin systems and/or infinite-dimensional Schrödinger equations with external control), applications (e. g. in quantum computing or magnetic resonance spectroscopy).         Intended learning outcomes         The student is acquainted with advanced methods in quantum-mechanical control systems. He gains the ability to work on contemporary research questions in and applications of control systems in quantum mechanics.         Courses (type, number of weekly contact hours, language – if other than German)         V + Ü (no information on SWS (weekly contact hours) and course language available)         Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus)         At the beginning of the course, the lecturer will choose one of the following methods of assessment: a) written examination (60 to 90 minutes), b) oral examination of one candidate each (approx. 15 minutes), c) oral examination in groups (groups of 2, approx. 20 minutes)         Assessment offered: Assessment offered in the semester in which the course is offered and in the subsequent semester, course offered on demand or every four semesters.         Language of assessment: German, English						
Allocation of places						
Additional information Workload Teaching cycle Referred to in LPO I (examination regulations for teaching-degree programmes) Master's with 1 major Physics (2010) MU Würzburg • generated 26-Aug-2024 • exam. nage 275 / 280						
Master's wi	th 1 majoi	Physics (2010)	JMU Würzbu reg. data re	rg • generated 26-Aug-2024 cord Master (120 ECTS) Physil	• exam. < - 2010	page 275 / 280



## Module appears in

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 (2010) Master's degree (1 major) Mathematical Physics (2012)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 276 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title					Abbreviation	
Ultrafast Spectroscopy and Quantum Control					08-PCM4-PHY-111-m01	
Module coordinator				Module offered by		
lecturer of the seminar "Ultrakurzzeitspektroskopie a Quantenkontrolle"			oektroskopie and	d Institute of Physical and Theoretical Chemistry		
ECTS	Metho	Method of grading Only after succ. compl. of module(s)				
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites	Other prerequisites		
1 seme	ster	graduate				
Conten	ts					
This mo laser p	odule d ulses, t	liscusses advanced topic ime-resolved laser spect	s in ultrafast spectro roscopy and coheren	scopy and quantum t control.	control. It focuses on ultrashort	
Intende	ed lear	ning outcomes				
Studen plain th princip	ts are a ne theo les anc	able to describe the gene ry of time-resolved laser l applications of quantun	ration of ultrashort la spectroscopy and na n control.	ser pulses and to ch me experimental me	aracterise them. They can ex- thods. They can describe the	
Course	<b>S</b> (type, r	number of weekly contact hours, l	anguage — if other than Ger	man)		
S + Ü (r	no info	mation on SWS (weekly o	contact hours) and co	ourse language avail	able)	
Method module is	<b>d of ass</b> creditab	<b>sessment</b> (type, scope, langua le for bonus)	ge — if other than German, o	examination offered — if no	t every semester, information on whether	
written Langua	exami ge of a	nation (90 minutes) or or ssessment: German or Ei	al examination of one	e candidate each (20	o minutes) or talk (30 minutes)	
Allocat	ion of <sub>l</sub>	olaces				
Additio	nal inf	ormation				
Worklo	ad					
Teaching cycle						
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)						
Module appears in						
Master's degree (1 major) Physics (2010)						
Master's degree (1 major) Physics (2011)						
Master's degree (1 major) Nanostructure Technology (2011)						
Master	Master's degree (1 major) Nanostructure Technology (2010)					
Master	Master's degree (1 major) FORUS Physics (2010) Master's degree (1 major) FORUS Physics (2011)					
master s degree (1 major) fonds fmysics (2011)						

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 277 / 280
	reg. data record Master (120 ECTS) Physik - 2010	

Module title					Abbreviation	
Structure and Properties of Modern Materials: Experiments and Simulations 08-MW-PHY-111-mo1					08-MW-PHY-111-m01	
Module coordinator				Module offered by	· · · · · · · · · · · · · · · · · · ·	
holder of the Chair of Chemical Technology thesis			logy of Material Syn-	Chair of Chemical Technology of Material Synthesis		
ECTS	Metho	ethod of grading Only after succ. compl. of module(s)				
5	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate				
Conten	ts					
Materia simulat	al prope tions.	erties of metals and cerar	nics: correlation of st	ructure/property rel	ations through experiments and	
Intende	ed learı	ning outcomes				
Studen mance on. A s perties	ts gain cerami pecial f	an insight into the prope cs. They are introduced t ocus is on the relation be	erties of modern mate o measuring method: etween the micro/nar	rials: aerospace alu s and calculation me noscopic structure of	minium alloys and high-perfor- ethods using numerical simulati- f materials and the resulting pro-	
Course	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
V + S (r	no infor	mation on SWS (weekly o	contact hours) and co	urse language avail	able)	
Method	d of ass	essment (type, scope, langua	ge — if other than German, e	examination offered — if no	t every semester, information on whether	
module is	creditab	le for bonus)				
talk (ap	prox. Z	15 minutes)				
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						
Master's degree (1 major) Physics (2010)						
Master	Master's degree (1 major) Physics (2011)					
Master	Master's degree (1 major) Nanostructure Technology (2011)					
Master's degree (1 major) Nanostructure Technology (2010)						

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 278 / 280
	reg. data record Master (120 ECTS) Physik - 2010	





# **Thesis** (30 ECTS credits)

Master's with 1 major Physics (2010)	JMU Würzburg • generated 26-Aug-2024 • exam.	page 279 / 280
	reg. data record Master (120 ECTS) Physik - 2010	1

Module title					Abbreviation	
Master Thesis Physics					11-MA-P-072-m01	
Module coordinator				Module offered by		
chairperson of examination committee				Faculty of Physics a	nd Astronomy	
ECTS	Metho	od of grading	Only after succ. com	pl. of module(s)		
30	nume	rical grade				
Duratio	n	Module level	Other prerequisites			
1 seme	ster	graduate	Registration for assessment to be carried out electronically. Deadlines will be announced separately. Please consult with your supervisor.			
Conten	ts					
Mostly ding to	indepe known	ndent processing of an e procedures and scientifi	xperimental or theor c aspects; writing of	etical task in the fiel the thesis.	d of Physics, especially accor-	
Intende	ed learr	ning outcomes				
The stu cording	dents a to kno	are able to independently own methods and scientif	work on an experimitic aspects and to sur	ental or theoretical t nmarise their results	ask from Physics, especially ac- s in a final paper.	
Courses	<b>S</b> (type, n	umber of weekly contact hours, l	anguage — if other than Ger	man)		
no cour	rses as	signed				
<b>Method of assessment</b> (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus)						
written	thesis	(approx. 75 pages)				
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	irs in				
Master's degree (1 major) Physics (2010)						