

2.4 List of Modules

Token	Module name	CP
M-E1	Experimental solid state physics	9
M-E2	Experimental quantum optics	9
M-E3	Experimental particle physics	9
M-T1	Quantum information theory	9
M-T2	Foundations of quantum mechanics	9
M-T3	Theoretical particle physics I	9
M-T4	Theoretical particle physics II	9
M-WA1	Statistical methods for data analysis	9
M-WA2	Electronics lab course	6
M-WA3	Detector physics	6
M-WA4	Accelerator physics II	3
M-WB1	Modern methods of X-ray scattering	6
M-WB2	Solid state physics in nanoscience	6
M-WB3	Theoretical solid state physics	6
M-WC1	Laser spectroscopy	6
M-WC2	Nano optics	6
M-WC3	Experimental methods of quantum and nano optics	6
M-WC4	Quantum theory of light	6
M-WC5	Mathematics of quantum mechanics	3
M-WC6	Quantum effects and quantum paradoxa	6
M-WD1	Astroparticle physics	6
M-WD2	Cosmology	6
M-WD3	Physics at the Pierre Auger Observatory	6
M-WD4	Physics at the LHC	6
M-WE1	Flavour physics	6
M-WE2	Hadron physics	6
M-WE3	Collider physics	6
M-WE4	Higgs physics	6
M-WF1	Physics beyond the Standard Model	6
M-WF2	Effective field theories	6
M-WF3	Tools for the calculation of loop diagrams	6
M-WF4	Specific topics in quantum field theory	3
M-P	Master lab course	9
M-S	Master seminar	6
M-AV	Research preparation project	15
M-AE	Thesis training project	15
M-A	Master thesis	30

3 Exemplary curricula

The freedom of choice in the specialization area and the free elective modules allow individual specialization in the research fields of the department. Note, however, that the weight of experimental modules (as measured by their CPs) in the

specialization area and the free electives, needs to be at least 9CP in total. Analogously, the theoretical courses also need to have a minimum weight of 9 CPs. In the following, some exemplary curricula are listed.

Specialization: Experimental quantum optics and quantum information processing

1. Semester	2. Semester	3. Semester	4. Semester
Electives Laser spectroscopy 2Lec/2Ex (6)	Core module Exp. Quantum optics 4Lec/2Ex (9)	Exam Exp. Quantum optics (–)	
	Core module Quantum inform. theory 4Lec/2Ex (9)		
Electives Exp. methods of QO/NO 2Lec/2Ex (6)	Electives Nano optics 2Lec/2Ex (6)		
Electives Data analysis 3Lec/3Ex (9)			
Master lab course 4P (9)	Master seminar Quantum Optics 2S (6)	Prep.+training for master thesis (15+15)	Master thesis Exp. Quantum optics (30)
(30)	(30)	(30)	(30)

Specialization: Experimental particle and astro-particle physics

1. Semester	2. Semester	3. Semester	4. Semester
Core module Exp. particle physics 4Lec/2Ex (9)	Electives Detector physics 2Lec/2Ex (6)	Exam Exp. particle physics (–)	
Core module Theo. particle physics I 4Lec/2Ex (9)			
Electives Physics at the LHC 2Lec/2Ex (6)	Electives Data analysis 3Lec/3Ex (9)		
	Electives Astroparticle physics 2Lec/2Ex (6)		
Master seminar Particle physics 2S (6)	Master lab course 4P (9)	Prep.+training for master thesis (15+15)	Master thesis Exp. particle physics (30)
(30)	(30)	(30)	(30)

Specialization: Experimental solid state physics

1. Semester	2. Semester	3. Semester	4. Semester
Core module Exp. solid state physics 4Lec/2Ex (9)	Electives SSP of nano structures 2Lec/2Ex (6)	Exam Exp. solid state physics (-)	
	Core module Quantum inform. theory 4Lec/2Ex (9)		
Electives X-ray physics 2Lec/2Ex (6)	Electives Condensed matter theory 2Lec/2Ex (6)		
Electives Nano optics 2Lec/2Ex (6)	Electives Accelerator physics II 1Lec/1Ex (3)		
Master lab course 4P (9)	Master seminar Festkörperphysik 2S (6)	Prep.+training for master thesis (15+15)	Master thesis Exp. solid state physics (30)
(30)	(30)	(30)	(30)

Specialization: Experimental physics

1. Semester	2. Semester	3. Semester	4. Semester
Core module Exp. Quantum optics 4Lec/2Ex (9)	Electives Exp. methods of QO/NO 2Lec/2Ex (6)	Exam Exp. Quantum optics (-)	
	Core module Exp. solid state physics 4Lec/2Ex (9)		
Core module Exp. particle physics 4Lec/2Ex (9)	Core module Theo. particle physics I 4Lec/2Ex (9)		
Electives Accelerator physics II 1Lec/1Ex (3)			
Master seminar Experimental Physics 2S (6)	Master lab course 4P (9)	Prep.+training for master thesis (15+15)	Master thesis Exp. Quantum optics (30)
(27)	(33)	(30)	(30)

Specialization: Theoretical quantum optics

Remark: One of the core modules 'Quantum information theory' (M-T1) and 'Foundations of quantum mechanics' (M-T2) may already be completed in the sixth semester of the bachelor program.

1. Semester	2. Semester	3. Semester	4. Semester
Electives Quantum theory of light 2Lec/2Ex (6)	Core module Quantum inform. theory 4Lec/2Ex (9)	Exam Theo. Quantum optics (-)	
	Core module Exp. Quantum optics 4Lec/2Ex (9)		
Electives Laser spectroscopy 2Lec/2Ex (6)	Electives Cosmology 2Lec/2Ex (6)		
Electives Condensed matter theory 2Lec/2Ex (6)	Electives Mathematics of QM 1Lec/1Ex (3)		
Master lab course 4P (9)	Master seminar Quantum Optics 2S (6)	Prep.+training for master thesis (15+15)	Master thesis Theo. Quantum optics (30)
(27)	(33)	(30)	(30)

Specialization: Theoretical particle physics

Remark: The course 'Theoretical particle physics I' (M-T3) may already be completed in the sixth semester of the bachelor program.

1. Semester	2. Semester	3. Semester	4. Semester
Core module Theo. particle physics II 4Lec/2Ex (9)	Electives Flavour physics 2Lec/2Ex (6)	Exam Theo. particle physics (-)	
	Core module Exp. particle physics 4Lec/2Ex (9)		
Electives Hadron physics 2Lec/2Ex (6)	Electives Physics at the LHC 2Lec/2Ex (6)		
Electives Detector physics 2Lec/2Ex (6)	Electives Special topics of QFT 1Lec/1Ex (3)		
Master lab course 4P (9)	Master seminar Particle physics 2S (6)	Prep.+training for master thesis (15+15)	Master thesis Theo. particle physics (30)
(30)	(30)	(30)	(30)

Specialization: Theoretical physics

1. Semester	2. Semester	3. Semester	4. Semester
Core module Theo. particle physics II 4Lec/2Ex (9)	Electives Collider physics 2Lec/2Ex (6)	Exam Theo. particle physics (-)	
	Core module Quantum inform. theory 4Lec/2Ex (9)		
Electives Higgs physics 2Lec/2Ex (6)	Core module Exp. particle physics 4Lec/2Ex (9)		
Electives Physics beyond the SM 2Lec/2Ex (6)			
Master lab course 4P (9)	Master seminar Theoretical Physics 2S (6)	Prep.+training for master thesis (15+15)	Master thesis Theo. particle physics (30)
(30)	(30)	(30)	(30)

Specialization: Mathematical physics

1. Semester	2. Semester	3. Semester	4. Semester
Electives Quantum theory of light 2Lec/2Ex (6)	Core module Fundamentals of QM 4Lec/2Ex (9)	Exam Theo. Quantum optics (-)	
	Core module Exp. Quantum optics 4Lec/2Ex (9)		
Electives Mathematics of QM 1Lec/1Ex (3)	Electives Functional analysis II 4Lec/2Ex (9)		
Electives Functional analysis I 4Lec/2Ex (9)			
Master lab course 4P (9)	Master seminar Theoretical Physics 2S (6)	Prep.+training for master thesis (15+15)	Master thesis Theo. Quantum optics (30)
(27)	(33)	(30)	(30)