

University of Tübingen exam regulations for the study program in Advanced Quantum Physics culminating in an examination for a Master of Science (M. Sc.) – Special Provisions –

In accordance with §§ 19 paragraph (1) sentence 2 nos. 7 and 9, 32 paragraph (3) of the law governing institutions of higher education, LHG of 1 January 2005 (GBl. p. 1), in the version published 1 April 2014 (GBl. p. 99) most recently amended by article 1 of the law dated 24 June 2020 (GBl. p. 426), the University of Tübingen Senate on ... passed the Special Provisions of these exam regulations for the study program in Advanced Quantum Physics at the University of Tübingen culminating in an examination for a Master of Science (M. Sc.) degree.

Approved by the President and Vice-Chancellor on ...

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A. Validity of General Provisions and Admission Requirements

§ 1 Validity of General Provisions

The General Provisions of the University of Tübingen exam regulations for Master's degree programs culminating in an examination for a Master of Science (M.Sc.) degree - Sc.) / Master of Arts (M. A.) as amended are part of these exam regulations, insofar as no other special regulations have been made.

§ 2 Requirements for admission to program

(1) ¹For the Master of Science program (M. Sc.) in Advanced Quantum Physics (hereinafter: Master's program) is a Bachelor's degree in the subject of Physics, in a related program covering basically the same material, or an equivalent degree, with a grade of 2.5 or better respectively, is required. ²Furthermore, the applicant must demonstrate an above-average performance in the following subjects in particular in his/her Bachelor's studies:

- Quantum mechanics
- Atomic physics
- Condensed matter physics

³The respective examination board will decide on the equivalency of a degree and on whether the prerequisite in sentence 2 above has been met. ⁴The board may transfer this decision revocably to the head of the board. ⁵If there is a set number for admission, the statutes may specify that the selection committee formed for the relevant selection process decides instead.

(2) To take part in the Master's program, applicants must also document knowledge of English at least at the level of B2 of the Common European Framework of Reference for Languages (CEFR).

B. Goals, content and structure of the program

§ 3 Goals and contents of program, regular duration of study, scope of program

(1) ¹Studies in this Master's degree program enable students to acquire the specific qualifications, competencies, knowledge, skills and abilities required in the subject of Quantum under § 7 (1) of the General Provisions of these exam regulations. ²The objective of the Master of Science degree program is to deepen or expand the knowledge acquired in the Bachelor's degree program, thus providing the basis for the development and/or application of the student's own ideas (application or research-oriented); graduates possess a broad, detailed and critical understanding at the cutting edge of knowledge in one or more specialized fields and are able to apply their knowledge and understanding as well as their problem-solving skills in new and unfamiliar situations related to their field of study in a wider or multidisciplinary context (instrumental competencies),

- to integrate knowledge and deal with complexity,
- and to make scientifically sound decisions on the basis of incomplete or limited information, taking into account social, scientific and ethical findings resulting from the application of their knowledge and from their decisions,
- to acquire new knowledge and skills independently and to carry out largely self-directed and/or autonomous independent research- or application-oriented projects (systemic competencies)
- to communicate their conclusions and the information and motives underlying them to expert representatives and laypersons in a clear and unambiguous manner, to exchange information, ideas, problems and solutions with both experts and laypersons on a scientific level and to assume prominent responsibility in a team (communicative competencies).

³Further details of the course objectives are set out in the module handbook.

(2) ¹Die regular duration of study for this degree program is 4 semesters. (4) ¹The program comprises 120 credit points (CP).

(3) ¹Over and above the number of credit points prescribed for the degree program according to these regulations, students may obtain no more than a 15 additional credit points from the modules of the degree program specified in § 5, para. (1); in all other respects, § 2, para. (4) of the General Provisions of these regulations applies.

§ 4 Academic degree

The academic degree "Master of Science" (abbr. "M.Sc.") is awarded on the basis of a successful completion of a Master of Science examination (hereinafter: M. Sc.).

C. Master's degree program

§ 5 Structure of the Master's program

¹Students complete a program to earn credit points as set out in § 3 para. (2); the program consists of the following modules:

Semester no.	Module no.	P/WP	Module description	Work for assessment	CP
Basic Modules in Advanced Quantum Physics					
1	AQP101	P	Experimental Quantum Optics	foP	6
1	AQP102	P	Theoretical Quantum Optics	foP	9
1	AQP103	P	Quantum Lab I – Lasers and Elements of Quantum Optics	foP	6
2	AQP104	P	Discussing Comprehensive Problems of Quantum Science	mP	9
Specialization					
1	AQP201	WP	Quantum Matter	mP	3
1	AQP202	WP	Laser Cooling and Quantum Gases	R	6
1	AQP203	WP	Lasers and Optics in Quantum Science	R	3
2	AQP204	WP	Quantum Lab II – Photons and Statistics	foP	6
1	AQP211	WP	Mathematical Quantum Theory	K or mP	9
2	AQP212	WP	Mathematical Quantum Theory	foP	9
2	AQP213	WP	Theory of Open Quantum Systems	foP	9
2	AQP214	WP	Many-Body Quantum Systems	R	6
1	AQP221	WP	Basics of Superconductivity	mP	3
2	AQP222	WP	Macroscopic Quantum Phenomena in Josephson Junctions and Related Systems	mP	3
2	AQP223	WP	Applications of Superconductivity	mP	3
2	AQP224	WP	Quantum Lab III - Superconductors	foP	3
Neighbouring Field					
2	AQP301	P	Modules from programs run by the Department of Physics or by other departments in accordance with the module handbook.	-	2
Research					
3	AQP401	P	Methods and Project Planning	-	15
3	AQP402	P	Scientific Specialization in Thesis Topic	-	15
4	AQP403	P	Master's thesis (final module)	Master's thesis	30

FS = Recommended semester (subject to availability and change, see module handbook), Module no. = current module no. or abbreviation (subject to change, see module handbook), P = Compulsory, WP = Required elective, CP = credit points, K = written exam, H = assignment; mP = oral defense; foP = formative assessed coursework; R = presentation; final module: Master's thesis and, if set out in the exam regulations or in the module handbook, an oral final examination at the end of the Master's program, an oral examination on the contents of the Master's thesis and/or a final colloquium on the Master's thesis.

²Sufficient modules must be selected from among the compulsory-elective modules - in accordance with the module handbook - so that a total of 24 credit points may be earned.

§ 6 Module coursework

¹Details of the module coursework required in each of the modules is set out in the module table in these regulations (§ 5) and in the module handbook. ²Assessment must be clearly specified as to its type and scope, if this is not done in the module table. ²For the modules AQP211 und AQP301, students may be directed to the module handbook of the respective department with which the modules originate.

§ 7 Languages of instruction and examination

¹English is the language of instruction and examination in this Master's degree program. ²Classes and module coursework may be conducted, promoted and taught in the following languages:

- German.

³Furthermore, teachers and examiners may promote and conduct classes and/or module coursework in another language for the purpose of teaching that language. ⁴Exams are usually conducted in the language in which the relevant classes were held; other assessment is usually conducted in the language in which the relevant classes were held. ⁵It is therefore assumed that students have sufficient knowledge of the relevant languages.

§ 8 Examiners

Notwithstanding § 14 para. (1) sentence 3 of the General Provisions, the following assessment takes place before at least two examiners:

- All assessment for the AQP104 module.

D. Assessment in the Master's program

I General Provisions for assessed coursework

§ 9 Requirements for admission to assessment process

In addition to other prerequisites set out in the General Provisions of these exam regulations, the prerequisites for admission to the following assessment under § 17 para. (2) sentence 1 no. 3 of the General Provisions are:

- for assessment in the AQP104 module, the student must have obtained at least 18 credit points in the following modules:
 - o one of the two modules AQP101 or AQP102,
 - o at least one of the modules with a theoretical focus offered for the first and second semesters (see module handbook),
 - o at least one of the modules with an experimental focus offered for the first and second semesters (see module handbook),

§ 10 Related programs with basically the same content as defined in § 17 paragraph (2) of the General Provisions

(1) Related programs with basically the same content as Advanced Quantum Physics defined in § 17 paragraph (2) sentence 2 of the General Provisions are:

- The program in Physics culminating in an examination for a Master of Science (M. Sc.) degree.
- The study program in Astro and Particle Physics culminating in an examination for a Master of Science (M. Sc.) degree.
- The degree program in Mathematical Physics culminating in an examination for a Master of Science (M. Sc.) degree.

(2) The examination board responsible for the Advanced Quantum Physics Master's degree program shall decide on any other related program with basically the same content as Advanced Quantum Physics.

II. Special provisions for the final module

§ 11 Final module

¹The student writes the Master's thesis in the final module; this is regulated in § 28 of the General Provisions of these exam regulations. ²In the final module, 30 credit points must be obtained.

§ 12 Subject requirements for admission

In addition to the prerequisites set out in the General Provisions of these exam regulations, the subject-related prerequisites for admission to the Master's thesis process are:

- the student must have obtained credit points in the modules required up to and including the second subject-specific semester, as set out in the module table.

E. Deadlines for examinations in the Master's degree program

§ 13 Deadlines for completion of module coursework

Deadlines for the completion of coursework or module-specific assessment are not currently provided for.

§ 14 Deadline for completion of studies

A deadline for completion of studies is not currently provided for.

F. Master's overall grade

§ 15 Calculation of the Master's overall grade

The overall grade of the Master's examination is calculated on 50% of the grade for the final module and 50% of the grade for module AQP104.

G. Closing remarks

§ 16 Effective date

¹These exam regulations come into effect on the date of their publication in the University of Tübingen's official bulletin, the Amtliche Bekanntmachungen. ²Their first semester of validity is the winter semester 2021/2022.

Tübingen,

Professor Dr. Bernd Engler
President and Vice-Chancellor