

Mr **Simon Klüttermann**  
 born on June 14, 1997  
 in Mönchengladbach  
 has passed the **Master Examination**  
 in accordance with the provisions  
 of the syllabus for **Physics**  
 and has obtained the overall mark **good (1.6)**

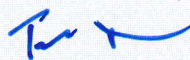
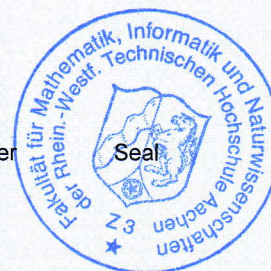
Master Thesis		Credits	Mark
Topic of Master Thesis	Deep learning for new physics mining at the LHC	25.00	good (1.7)
	Master's Defence Colloquium	5.00	very good (1.3)
Examiner	Univ.-Prof. Dr. rer. nat. Michael Krämer		

The degree program has been completed within the regular period of study.

Aachen, November 12, 2020

Chair of the Examination Board

Univ.-Prof. Dr. rer. nat. Thomas Günter Taubner

**Simon Klüttermann**, born on June 14, 1997 in Mönchengladbach has achieved the following individual results:

	Credits	Mark
<b>Astroparticle Physics and Cosmology</b>	<b>30.00</b>	<b>good (1.9)</b>
Particle Physics I	10.00	good (1.7)
Theory of Relativity and Cosmology	10.00	good (2.3)
Astroparticle Physics	10.00	good (1.7)
<b>Elective Courses</b>	<b>30.00</b>	<b>very good (1.3)</b>
Laboratory Course Particle Physics	10.00	good (1.7)
Deep Learning in Physics Research	5.00	passed
Statistics and Data Analysis	5.00	very good (1.3)
Advanced Cosmology	10.00	very good (1.0)
<b>Research Phase</b>		
Master's Seminar	15.00	passed
Master's Practical	15.00	passed
<b>Additional Examinations</b>		
Particle Physics II	10.00	satisfactory (3.0)
Astronomy and Astrophysics	10.00	good (1.7)
Quantum Field Theory of Particle Physics II	10.00	good (2.0)
Quantum Field Theory of Particle Physics I	10.00	good (2.3)
Laboratory Course Astronomy and Astrophysics	5.00	very good (1.3)
Neutron Stars, Black Holes and Ultra-high Energy Cosmic Rays	5.00	satisfactory (2.7)
Computational Physics	10.00	good (2.0)

This certificate has also been issued in a German version.

A credit point represents an estimated workload of approximately 30 hours.

This Diploma Supplement follows the model developed by the European Commission, Council of Europe and UNESCO/CEPES. The purpose of the supplement is to provide sufficient independent data to improve the international "transparency" and fair academic and professional recognition of qualifications (diplomas, degrees, certificates etc.). It is designed to provide a description of the nature, level, context, content and status of the studies that were pursued and successfully completed by the individual named on the original qualification to which this supplement is appended. It should be free from any value-judgements, equivalence statements or suggestions about recognition. Information in all eight sections should be provided. Where information is not provided, an explanation should give the reason why.

## 1. HOLDER OF THE QUALIFICATION

### 1.1 Family Name / 1.2 First Name

Klüttermann, Simon

### 1.3 Date, Place of Birth

June 14, 1997, Mönchengladbach

### 1.4 Student ID Number or Code

357067

## 2. QUALIFICATION

### 2.1 Name of Qualification (full, abbreviated, in original language)

The Master degree corresponds to qualification level 7 of the German Qualifications Framework / European Qualifications Framework.

### Title Conferred (full, abbreviated, in original language)

Master of Science RWTH Aachen University (M. Sc. RWTH)

### 2.2 Main Field(s) of Study

Physics  
Astroparticle Physics and Cosmology

### 2.3 Institution Awarding the Qualification (in original language)

Rheinisch-Westfälische Technische Hochschule Aachen (RWTH Aachen)

### Status (Type / Control)

University of the Federal State of North Rhine-Westphalia Germany / State Institution Federal State of North Rhine-Westphalia

### 2.4 Institution Administering Studies (in original language)

See 2.3

### Status (Type / Control)

See 2.3

### 2.5 Language(s) of Instruction / Examination

English

### 3. LEVEL OF THE QUALIFICATION

#### 3.1 Level

Second Degree Study Program

#### 3.2 Official Length of Program

2 years (4 semesters, 120 ECTS Credits)

#### 3.3 Access Requirements

Admission to the course requires the applicant to hold a recognized first university degree. Details on adequate qualifications can be found in the published examination rules.

### 4. CONTENTS AND RESULTS GAINED

#### 4.1 Mode of Study

Full time

#### 4.2 Program Requirements / Qualification Profile of the Graduate

The master-degree study in physics imparts deepened knowledge and skills in the field of physics. It should guide the students to high scientific qualification and autonomy and enable them to a critical placement of scientific results and to responsible practice. It provides an intensive deepened education in a sub-area of physics. In a subsidiary subject connections are given to adjacent parts of science or to applications of physics in engineering or medicine.

#### 4.3 Program Details

See "Transcript of Records" for list of courses and grades and "Prüfungszeugnis" (Final Examination Certificate) for subjects taken in written and oral examinations and topic of thesis, including evaluations.

#### 4.4 Grading Scheme

General Mark Scheme (see Section 8.6)

#### 4.5 Overall Classification

good (1.6)

Based on the accumulation of grades received during the study program and the final thesis; cf. Prüfungszeugnis (Final Examination Certificate).

### 5. FUNCTION OF THE QUALIFICATION

#### 5.1 Access to Further Study

Qualifies to apply for admission to doctoral studies.

#### 5.2 Professional Status

The academic degree of Master of Science is a professional qualification which entitles the graduate to hold the academic title of Master of Science.

## 6. ADDITIONAL INFORMATION

### 6.1 Additional Information

not specified

### 6.2 Further Information Sources

On the institution and study programs  
<http://www.rwth-aachen.de>

## 7. CERTIFICATION


This Diploma Supplement refers to the following original documents:

Urkunde über die Verleihung des Master of Science RWTH Aachen University (M. Sc. RWTH)  
vom November 12, 2020

Prüfungszeugnis vom November 12, 2020

Transcript of Records vom February 05, 2021

Certification Date: February 05, 2021

  
Univ.-Prof. Dr. rer. nat. Thomas Günter Taubner  
Chair of the Examination Board



## 8. NATIONAL HIGHER EDUCATION SYSTEM

The information on the national higher education system on the following pages provide a context for the qualification and the type of higher education that awarded it.

**8. INFORMATION ON THE GERMAN HIGHER EDUCATION SYSTEM<sup>1</sup>**

**8.1 Types of Institutions and Institutional Status**

Higher education (HE) studies in Germany are offered at three types of Higher Education Institutions (HEI):<sup>2</sup>

- *Universitäten* (Universities) including various specialized institutions, offer the whole range of academic disciplines. In the German tradition, universities focus in particular on basic research so that advanced stages of study have mainly theoretical orientation and research-oriented components.

- *Fachhochschulen* (Universities of Applied Sciences) concentrate their study programmes in engineering and other technical disciplines, business-related studies, social work, and design areas. The common mission of applied research and development implies an application-oriented focus of studies, which includes integrated and supervised work assignments in industry, enterprises or other relevant institutions.

- *Kunst- und Musikhochschulen* (Universities of Art/Music) offer studies for artistic careers in fine arts, performing arts and music; in such fields as directing, production, writing in theatre, film, and other media; and in a variety of design areas, architecture, media and communication.

Higher Education Institutions are either state or state-recognized institutions. In their operations, including the organization of studies and the designation and award of degrees, they are both subject to higher education legislation.

**8.2 Types of Programmes and Degrees Awarded**

Studies in all three types of institutions have traditionally been offered in integrated "long" (one-tier) programmes leading to *Diplom-* or *Magister Artium* degrees or completed by a *Staatsprüfung* (State Examination).

Within the framework of the Bologna-Process one-tier study programmes are successively being replaced by a two-tier study system. Since 1998, two-tier degrees (Bachelor and Master) have been introduced in almost all study programmes. This change is designed to provide enlarged variety and flexibility to students in planning and pursuing educational objectives, they also enhance international compatibility of studies.

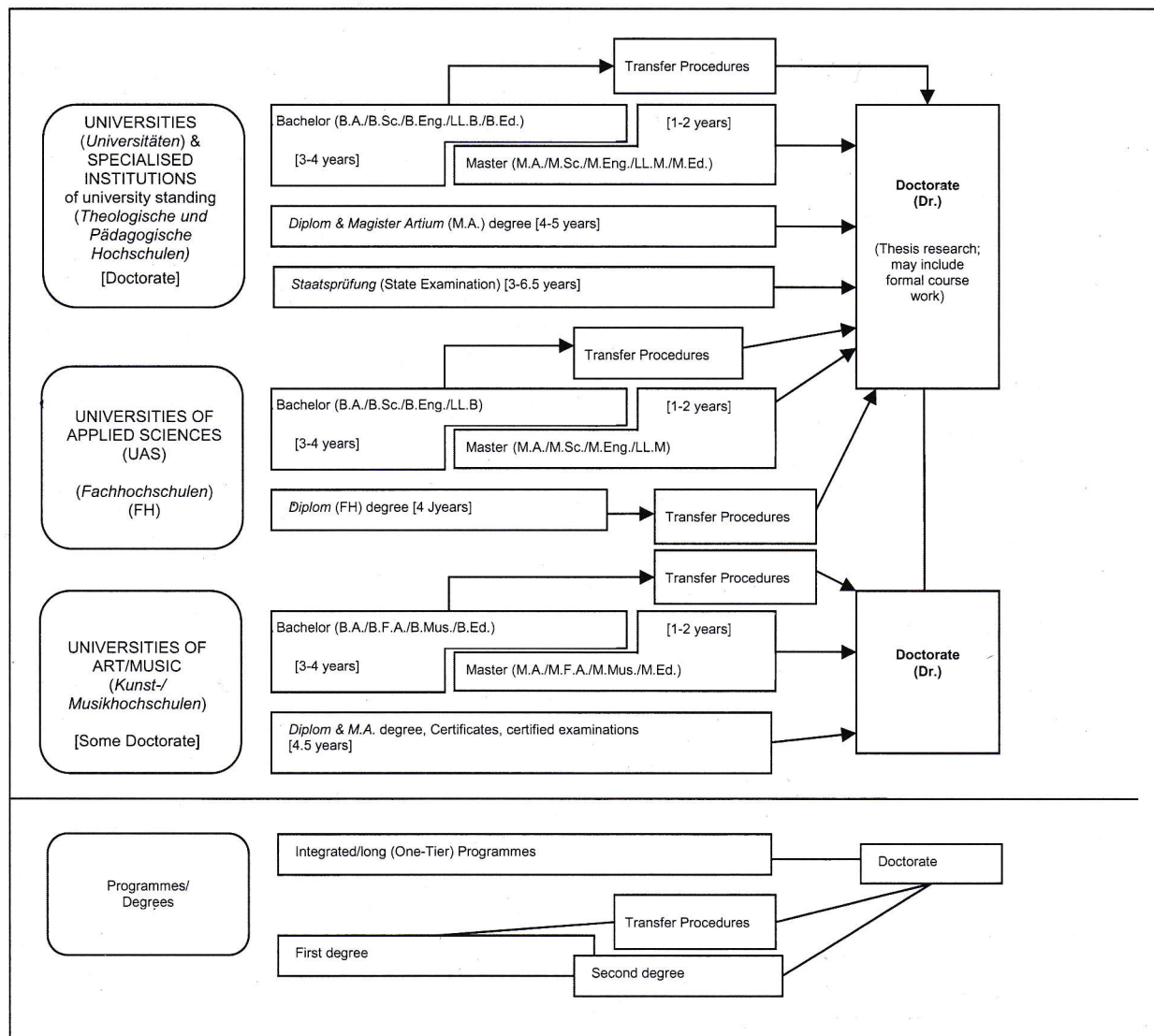
The German Qualifications Framework for Higher Education Degrees<sup>3</sup>, the German Qualifications Framework for Lifelong Learning<sup>4</sup> and the European Qualifications Framework for Lifelong Learning<sup>5</sup> describe the degrees of the German Higher Education System. They contain the classification of the qualification levels as well as the resulting qualifications and competencies of the graduates.

For details cf. Sec. 8.4.1, 8.4.2, and 8.4.3 respectively. Table 1 provides a synoptic summary.

**8.3 Approval/Accreditation of Programmes and Degrees**

To ensure quality and comparability of qualifications, the organization of studies and general degree requirements have to conform to principles and regulations established by the Standing Conference of the Ministers of Education and Cultural Affairs of the *Länder* in the Federal Republic of Germany (KMK).<sup>6</sup> In 1999, a system of accreditation for programmes of study has become operational under the control of an Accreditation Council at national level. All new programmes have to be accredited under this scheme; after a successful accreditation they receive the quality-label of the Accreditation Council.<sup>7</sup>

**Table 1: Institutions, Programmes and Degrees in German Higher Education**



#### 8.4 Organization and Structure of Studies

The following programmes apply to all three types of institutions. Bachelor's and Master's study courses may be studied consecutively, at various higher education institutions, at different types of higher education institutions and with phases of professional work between the first and the second qualification. The organization of the study programmes makes use of modular components and of the European Credit Transfer and Accumulation System (ECTS) with 30 credits corresponding to one semester.

##### 8.4.1 Bachelor

Bachelor degree study programmes lay the academic foundations, provide methodological skills and lead to qualifications related to the professional field. The Bachelor degree is awarded after 3 to 4 years.

The Bachelor degree programme includes a thesis requirement. Study courses leading to the Bachelor degree must be accredited according to the Law establishing a Foundation for the Accreditation of Study Programmes in Germany.<sup>8</sup>

First degree programmes (Bachelor) lead to Bachelor of Arts (B. A.), Bachelor of Science (B. Sc.), Bachelor of Engineering (B. Eng.), Bachelor of Laws (LL. B.), Bachelor of Fine Arts (B. F. A.), Bachelor of Music (B. Mus.) or Bachelor of Education (B. Ed.).

The Bachelor degree corresponds to level 6 of the German Qualifications Framework/ European Qualifications Framework.

##### 8.4.2.1 Master

Master is the second degree after another 1 to 2 years. Master study programmes may be differentiated by the profile types "practice-oriented" and "research-oriented". Higher Education Institutions define the profile.

The Master degree study programme includes a thesis requirement. Study programmes leading to the Master degree must be accredited according to the Law establishing a Foundation for the Accreditation of Study Programmes in Germany.<sup>9</sup>

Second degree programmes (Master) lead to Master of Arts (M. A.), Master of Science (M. Sc.), Master of Engineering (M. Eng.), Master of Laws (LL. M.), Master of Fine Arts (M. F. A.), Master of Music (M. Mus.) or Master of Education (M. Ed.). Master study programmes which are designed for continuing education may carry other designations (e.g. MBA).

The Master degree corresponds to level 7 of the German Qualifications Framework/ European Qualifications Framework.

##### 8.4.3 Integrated "Long" Programmes (One-Tier):

###### Diplom degrees, Magister Artium, Staatsprüfung

An integrated study programme is either mono-disciplinary (*Diplom* degrees, most programmes completed by a *Staatsprüfung*) or comprises a combination of either two major or one major and two minor fields (*Magister Artium*). The first stage (1.5 to 2 years) focuses on broad orientations and foundations of the field(s) of study. An Intermediate Examination (*Diplom-Vorprüfung* for *Diplom* degrees; *Zwischenprüfung* or credit requirements for the *Magister Artium*) is prerequisite to enter the second stage of advanced studies and specializations. Degree requirements include submission of a thesis (up to 6 months duration) and comprehensive final written and oral examinations. Similar regulations apply to studies leading to a *Staatsprüfung*. The level of qualification is equivalent to the Master level.

- Integrated studies at *Universitäten (U)* last 4 to 5 years (*Diplom* degree, *Magister Artium*) or 3 to 6.5 years (*Staatsprüfung*). The *Diplom* degree is awarded in engineering disciplines, the natural sciences as well as economics and business. In the humanities, the corresponding degree is usually the *Magister Artium* (M.A.). In the social sciences, the practice varies as a matter of institutional traditions. Studies preparing for the legal, medical and pharmaceutical professions are completed by a *Staatsprüfung*. This applies also to studies preparing for teaching professions of some *Länder*.

The three qualifications (*Diplom*, *Magister Artium* and *Staatsprüfung*) are academically equivalent and correspond to level 7 of the German Qualifications Framework/ European Qualifications Framework.

They qualify to apply for admission to doctoral studies. Further prerequisites for admission may be defined by the Higher Education Institution, cf. Sec. 8.5.

- Integrated studies at *Fachhochschulen (FH)*/Universities of Applied Sciences (UAS) last 4 years and lead to a *Diplom (FH)* degree which corresponds to level 6 of the German Qualifications Framework/ European Qualifications Framework.

While the *FH/UAS* are non-doctorate granting institutions, qualified graduates may apply for admission to doctoral studies at doctorate-granting institutions, cf. Sec. 8.5.

- Studies at *Kunst- and Musikhochschulen* (Universities of Art/Music etc.) are more diverse in their organization, depending on the field and individual objectives. In addition to *Diplom/Magister* degrees, the integrated study programme awards include Certificates and certified examinations for specialized areas and professional purposes.

##### 8.5 Doctorate

Universities as well as specialized institutions of university standing and some Universities of Art/Music are doctorate-granting institutions. Formal prerequisite for admission to doctoral work is a qualified Master (UAS and U), a *Magister* degree, a *Diplom*, a *Staatsprüfung*, or a foreign equivalent. Comparable degrees from universities of art and music can in exceptional cases (study programmes such as music theory, musicology, pedagogy of arts and music, media studies) also formally qualify for doctoral work. Particularly qualified holders of a Bachelor or a *Diplom (FH)* degree may also be admitted to doctoral studies without acquisition of a further degree by means of a procedure to determine their aptitude. The universities respectively the doctorate-granting institutions regulate entry to a doctorate as well as the structure of the procedure to determine aptitude. Admission further requires the acceptance of the Dissertation research project by a professor as a supervisor.

The doctoral degree corresponds to level 8 of the German Qualifications Framework/ European Qualifications Framework.

##### 8.6 Grading Scheme

The grading scheme in Germany usually comprises five levels (with numerical equivalents; intermediate grades may be given): "Sehr Gut" (1) = Very Good; "Gut" (2) = Good; "Befriedigend" (3) = Satisfactory; "Ausreichend" (4) = Sufficient; "Nicht ausreichend" (5) = Non-Sufficient/Fail. The minimum passing

grade is "Ausreichend" (4). Verbal designations of grades may vary in some cases and for doctoral degrees.

In addition, grade distribution tables as described in the ECTS Users' Guide are used to indicate the relative distribution of grades within a reference group.

##### 8.7 Access to Higher Education

The General Higher Education Entrance Qualification (*Allgemeine Hochschulreife, Abitur*) after 12 to 13 years of schooling allows for admission to all higher educational studies. Specialized variants (*Fachgebundene Hochschulreife*) allow for admission at Fachhochschulen (UAS), universities and equivalent higher education institutions, but only in particular disciplines. Access to study programmes at *Fachhochschulen* (UAS) is also possible with a *Fachhochschulreife*, which can usually be acquired after 12 years of schooling. Admission to study programmes at Universities of Art/Music and comparable study programmes at other higher education institutions as well as admission to a study programme in sports may be based on other or additional evidence demonstrating individual aptitude.

Applicants with a vocational qualification but without a school-based higher education entrance qualification are entitled to a general higher education entrance qualification and thus to access to all study programmes, provided they have obtained advanced further training certificates in particular state-regulated vocational fields (e.g. *Meister/Meisterin im Handwerk, Industriemeister/in, Fachwirt/in (IHK und HWK), staatlich geprüfte/r Betriebswirt/in, staatliche geprüfte/r Gestalter/in, staatlich geprüfte/r Erzieher/in*). Vocationally qualified applicants can obtain a *Fachgebundene Hochschulreife* after completing a state-regulated vocational education of at least two years' duration plus professional practice of normally at least three years' duration, after having successfully passed an aptitude test at a higher education institution or other state institution; the aptitude test may be replaced by successfully completed trial studies of at least one year's duration.<sup>10</sup>

Higher Education Institutions may in certain cases apply additional admission procedures.

##### 8.8 National Sources of Information

- Kultusministerkonferenz (KMK) [Standing Conference of the Ministers of Education and Cultural Affairs of the *Länder* in the Federal Republic of Germany]; Graurheindorfer Str. 157, D-53117 Bonn; Fax: +49[0]228/501-777; Phone: +49[0]228/501-0
- Central Office for Foreign Education (ZaB) as German NARIC; www.kmk.org; E-Mail: zab@kmk.org
- "Documentation and Educational Information Service" as German EURYDICE-Unit, providing the national dossier on the education system (<http://www.kmk.org/dokumentation/zusammenarbeit-auf-europaeischer-ebene-im-eurydice-informationsnetz.html>); E-Mail: eurydice@kmk.org
- Hochschulrektorenkonferenz (HRK) [German Rectors' Conference]; Ahnrstrasse 39, D-53175 Bonn; Fax: +49[0]228/887-110; Phone: +49[0]228/887-0; www.hrk.de; E-Mail: post@hrk.de
- "Higher Education Compass" of the German Rectors' Conference features comprehensive information on institutions, programmes of study, etc. ([www.higher-education-compass.de](http://www.higher-education-compass.de))

1 The information covers only aspects directly relevant to purposes of the Diploma Supplement. All information as of January 2015.

2 *Berufsakademien* are not considered as Higher Education Institutions, they only exist in some of the *Länder*. They offer educational programmes in close cooperation with private companies. Students receive a formal degree and carry out an apprenticeship at the company. Some *Berufsakademien* offer Bachelor courses which are recognized as an academic degree if they are accredited by a German accreditation agency.

3 German Qualifications Framework for Higher Education Degrees. (Resolution of the Standing Conference of the Ministers of Education and Cultural Affairs of the *Länder* in the Federal Republic of Germany of 21 April 2005).

4 German Qualifications Framework for Lifelong Learning (DQR). Joint resolution of the Standing Conference of the Ministers of Education and Cultural Affairs of the *Länder* in the Federal Republic of Germany, the German Federal Ministry of Education and Research, the German Conference of Economics Ministers and the German Federal Ministry of Economics and Technology (Resolution of the Standing Conference of the Ministers of Education and Cultural Affairs of the *Länder* in the Federal Republic of Germany of 15 November 2012). More information at [www.dqr.de](http://www.dqr.de)

5 Recommendation of the European Parliament and the European Council on the establishment of a European Qualifications Framework for Lifelong Learning of 23 April 2008 (2008/C 111/01 – European Qualifications Framework for Lifelong Learning – EQF).

6 Common structural guidelines of the *Länder* for the accreditation of Bachelor's and Master's study courses (Resolution of the Standing Conference of the Ministers of Education and Cultural Affairs of the *Länder* in the Federal Republic of Germany of 10.10.2003, as amended on 04.02.2010).

7 "Law establishing a Foundation 'Foundation for the Accreditation of Study Programmes in Germany'", entered into force as from 26 February 2005, GV. NRW. 2005, No. 5, p. 45 in connection with the Declaration of the *Länder* to the Foundation "Foundation: Foundation for the Accreditation of Study Programmes in Germany" (Resolution of the Standing Conference of the Ministers of Education and Cultural Affairs of the *Länder* in the Federal Republic of Germany of 16 December 2004).

8 See note No. 7.

9 See note No. 7.

10 Access to higher education for applicants with a vocational qualification, but without a school-based higher education entrance qualification (Resolution of the Standing Conference of the Ministers of Education and Cultural Affairs of the *Länder* in the Federal Republic of Germany of 6 March 2009).