UNIVERSITY OF AMSTERDAM

FACULTY OF SCIENCE

EDUCATION AND EXAMINATION REGULATIONS

PART B

Academic year 2014-2015

MASTER'S PROGRAMME PHYSICS

Chapter 1. General Provisions

Article 1.1 – Definitions

In addition to part A, the following definitions are used in part B

a.	Research project	Compulsory internship/master thesis of 30 EC always resulting in a written report
b.	Personal Education Plan	An individual study plan for the student's master programme

Article 1.2 – General information master's programme

1. The Master's programme Physics, CROHO 60202 is offered on a full-time basis and the language of instruction is English. This means that the Code of Conduct governing Foreign Languages at the UvA and the provisions laid down in Section 7.2 of the Act apply.
2. The programme has a workload of 120 EC.
3. A component of the programme consist of 3 EC or multiples of this number.
4. Within the programme the following tracks are offered:
   - Advanced Matter and Energy Physics
   - Atomic Scale Modelling of Physical, Chemical and Bio-molecular Systems (AtoSim)
   - GRavitation and AstroParticle Physics Amsterdam (GRAPPA) - Particle
   - Physics of Life and Health
   - Science for Energy and Sustainability
   - Theoretical Physics.
5. In each Master track the student may choose a major or a minor from the list below (see Article 4.1).
   - Major Science Communication;
   - Major Science in Society;
   - Major Teaching;
   - Minor Tesla.
6. The student determines the content of the Master's programme in consultation with the coordinator of the Master's programme and according to the rules of Chapter 3. The coordinator of the Master's programme will lay down the content chosen by the student in a Personal Education Plan (PEP). The student submits this PEP, signed as correctly by the programme coordinator to the Examinations Board. If the student wants to change the contents of the study programme, the student promptly consults with the coordinator of the study programme. If this results in a new PEP the student submits this to the Examinations Board.

Article 1.3 – Enrolment

The programme starts at the beginning of the first semester (September) and second semester (February) of the study year. This enrolment date ensures a programme that can be expected to be completed within the official period.

Chapter 2. Aim of the programme and exit qualifications

Article 2.1 – Aim of the programme

The aim of the programme is:

The general objective of the Physics Master's programme is to provide students with such knowledge, skills and insight in the field of physics, including the necessary mathematical, experimental, computational and communicative skills, to enable them to work as a professional physicist, or to become qualified to pursue advanced training as scientific researcher. The

programme also aims at furthering the understanding of the position and role of physics in the sciences and in society, and to further a social sense of responsibility. The aim of the Master's programme in Physics is to:

a) educate students to become independent academic professionals, through conducting fundamental scientific research as well as working with current scientific knowledge, and applying this knowledge in new and continuously changing practical situations;
b) actively stimulate interdisciplinary collaboration in the development of science, based on knowledge in the field of physics;
c) offer students the possibility to develop skills, knowledge and insight in a specialisation in the field of physics, with emphasis on formulating relevant scientific questions and the approach to formulate answers to these questions;
d) provide student-oriented education that is of a high, internationally recognised quality;
e) offer students the opportunity to gain knowledge and insight in an international setting;
f) provide an inspiring academic learning environment, and to offer feasible study specialization programmes to a demanding and heterogeneously composed student population;
g) develop the ability in students to convey acquired knowledge to others.

Article 2.2 – Exit qualifications

1. The graduate of the Master's programme Physics:

a) has a thorough theoretical and practical knowledge of modern physics, including the knowledge of other disciplines required for that purpose;
b) has a thorough knowledge of theoretical and/or experimental methods and research experience in at least one sub-area within the physics discipline;
c) is able to become acquainted with other sub-areas of the physics discipline within a reasonable period of time;
d) is able to formulate a research plan based on a realistic problem definition within the physics discipline;
e) is able to analyse and formulate research results and to draw conclusions there from;
f) is able to write a scientific report or an internationally accessible scientific publication and to participate in discussions on (specialised) topics in the field of study;
g) is able to consult international professional literature in the relevant sub-areas and to apply the knowledge gained from that;
h) is able to apply one's knowledge of physics in a broader (multidisciplinary) context;
i) is employable in those positions for which knowledge and research skills in the field of physics are a prerequisite;
j) has sufficient knowledge of, and insight in the social role of physics to make a sound choice regarding one's own profession, as well as in the exertion of this profession;
k) is able to cooperate with other people, to convey knowledge to other people, and to give a presentation both to discipline specialists and to a broader audience.

2. The graduate in the regular programme curriculum:
   - must be able to, in the case that an experimental Master's programme has been chosen, independently design experiments including the corresponding controls, conducting and evaluating these within a given period of time;
   - is able to compare and incorporate obtained research results and conclusions within the framework of the results of other scientists;
   - is able to form a vision on the development of scientific research in the field of physics;
   - is able to quantitatively and qualitatively analyse physics processes, to incorporate data in existing or new models and to present the results at various levels of abstraction.

3. In addition to paragraph 1 and 2, the student who has completed the track Advanced Matter and Energy Physics has obtained the following track-specific qualifications:
   a. a well-founded knowledge of the theoretical background behind experimental physics in the sub-disciplines: (hard and soft) condensed matter physics; atomic and laser physics;
   b. a well-founded knowledge of experimental approaches of relevance in modern research into at least one of the following research fields:
      - emergent materials, strongly correlated electron systems and unconventional superconductivity;
      - energy materials and processes for (solar) energy conversion;
      - complex liquids, granular and soft bio-matter;
      - ultracold quantum gases, state-of-the-art lasers, quantum information and simulation with ultracold atoms.
   c. proficiency in applying the theoretical knowledge learned to enable the interpretation of the results from experimental work - executed by the graduate at least in part as an independent 'principal investigator' - in a research project in a field within or close to those given in §2 above.
4. In addition to paragraph 1 and 2, the student who has completed the track Atomic Scale Modelling of Physical, Chemical and Bio-molecular Systems (AtoSim) has obtained the following track-specific qualifications:
   a. a thorough scientific knowledge of the field of atomic scale modeling;
   b. proficiency in analyzing and solving scientific problems in the field of atomic scale modeling;
   c. the ability to communicate with others about questions and problems in the field of atomic scale modeling.
5. In addition to paragraph 1 and 2, the student who has completed the track GRavitation and AstroParticle Physics Amsterdam (GRAPPA) - Particle has obtained the following track-specific qualifications:
   a. a well-founded theoretical knowledge in particle physics and/or astroparticle physics and/or cosmology;
   b. a well-founded knowledge of experimental or theoretical approaches in at least one of the following research fields:
      - Standard Model and Beyond the Standard Model Physics;
      - Dark Matter;
      - Gravitational Waves and tests of Gravity;
      - Cosmic Messengers;
      - (Astro-)Particle Physics Detector R&D.
6. In addition to paragraph 1 and 2, the student who has completed the track Physics of Life & Health has obtained the following track-specific qualifications:
   a. a well-founded knowledge of the physics background behind processes on a cellular or organ level
   b. a well-founded knowledge of experimental or simulation approaches into at least one of the following research fields:
      - Novel imaging modalities;
      - Novel therapeutic applications;
      - Cellular biophysics;
      - Organ biophysics;
   c. proficiency in applying the theoretical knowledge learned to enable the interpretation of the results from experimental work - executed by the graduate at least in part as an independent, principal investigator - in a research project in a field within or close to those given in 2.1.2.12 above.

7. In addition to paragraph 1 and 2, the student who has completed the track Science for Energy and Sustainability has obtained the following track-specific qualifications:
   a. a thorough knowledge of the scientific, technological and societal challenges for our future associated with energy and sustainability problems;
   b. proficiency in analyzing and evaluating the current energy and sustainability problems;
   c. proficiency in applying the acquired theoretical and practical insights in day-to-day practice at an institution, company or organization, strongly focused on providing scientific solutions to current and future energy and sustainability problems;
   d. has good receptive and written productive skills in the English language.
8. In addition to paragraph 1 and 2, the student who has completed the track Theoretical Physics has obtained the following track-specific qualifications:
   a. a well-founded and working knowledge of Quantum Field Theory for particle physics as well as many body physics;
   b. a thorough knowledge of the fundamental aspects in modern statistical physics and condensed matter theory;
   c. is informed about basic theoretical concepts as second quantization, path integrals;
   d. is capable of finding the appropriate theoretical framework for a wide range of physics problems.

Chapter 3. Admission to the programme

Article 3.1 – Entry requirements

1. Students who have successfully completed the following degrees may be admitted:
   - a Bachelor's degree in Physics and Astronomy, in Physics, in Technical Physics, or in Astronomy, awarded by a Dutch University;
   - a Bachelor's Degree in *Beta-gamma met een Natuurkunde Major* (Liberal Arts and Sciences with a Physics Major), awarded by the University of Amsterdam;
2. Without prejudice to the provisions of paragraph 1, the Examination Board may grant admission to the study programme when concluding, that the previous education of the candidate is equivalent to the Bachelor's degree referred to paragraph 1.
3. Without prejudice to the provisions of paragraphs 1 and 2 the Examination Board may grant admission to a student whose previous education does not meet aforementioned requirements for admission to the study programme, when concluding that the candidate is able to meet the admission requirements within a reasonable period of time. At the request of a candidate, and if the Examination Board has decided additional education feasible, the Examination Board may draw up a programme of maximum 30 EC as an admission requirement, a so called 'conversion programme'. After completion of this conversion programme a letter of admission will be issued, exclusively for the stated Master's programme (and track).
4. For admission to the AtoSim track a candidate must have done a Bachelor research project of at least 24 EC in the subject of Physics.
5. When the programme commences, the student must have fully completed the Bachelor's programme allowing admission to this programme.

Article 3.2 – Premaster's programme

Not applicable

Article 3.3 – Restrictions on the number of students admitted to the Master's programme

Not applicable

Article 3.4 – Intake dates
A request for admission to the Master's programme starting in September must be received before 1 April in the case of EU students (including Dutch students) and before 1 February in the case of non-EU students. For the programme starting in February, applications must be received before 1 December for EU students (including Dutch students) and before 1 October for non-EU students. Under exceptional circumstances, the Examinations Board may consider a request submitted after this closing date.

Article 3.5 – English Language Requirements
1. Admission to the programme requires sufficient command of the English language. A student may take one of the following tests to establish language competence:
   - IELTS: 6.5
   - TOEFL paper based test: 580
   - TOEFL internet based test: 92-93
   - Cambridge Advanced English: C
2. Those possessing a Bachelor's degree from a Dutch university satisfy the requirement of sufficient command of the English language

Article 3.6 – Free curriculum
1. Subject to certain conditions, the student has the option of compiling a curriculum of his/her own choice which deviates from the curricula mentioned in article 4.1 of these Regulations. The concrete details of such a curriculum require permission of the Examinations Board.
2. In order to be considered for a degree of this programme, at least one half of the proposed curriculum has to consist of components of the regular study programme.

Chapter 4. Content and organisation of the programme

Article 4.1 – Organisation of the programme
The study programme is offered in collaboration with the VU University Amsterdam. Depending of the specialization programme the study programme is composed of components according to tables 1 and 2. On the certificate the chosen specialization programme will be stated.
A complete list of courses provided by the Master's programme can be found in Appendix 2. Every component will be tested. Within the Master's programme different types of testing and different types of teaching methods are used. These are described per component in the course catalogue.

Table 1

Components	**Regular programme**	**Major**	**Minor**
Compulsory components	12 EC	Total: 24 EC	12 EC
Elective components discipline	24 EC		18 EC
Compulsory Orientation project/seminar/literature study	6 EC		6 EC
Preparation research project	6* EC	6 EC	6 EC
Research Project	48* EC	24 EC	42 EC
Master Thesis and Colloquium	6 EC	6 EC	6 EC
Free elective components	12 EC		
Academic skills in the Master	6 EC		

Major or minor programme		60 EC	30 EC
Total EC	120 EC	120 EC	120 EC

[*] *These components are combined for the for the specialization programs Advanced Matter and Energy Physics and Physics of Life and Health.*

Table 2

Components track AtoSim	**EC**
Compulsory components	48 EC
Elective components discipline[#]	30 EC
Orientation project/seminar/literature study	12 EC
Research Project	30 EC
Total Study Load	120 EC

[#] *Total of physics courses has to be at least 36 EC. See study guide for the relevant physics courses.*

1. The student can choose between the regular programme and a programme containing a major or a minor. These are:
   a. Major Teaching;
   b. Minor Tesla.
2. Regarding majors:
   A major consists of 60 EC. It has to be combined with disciplinary components as listed in table 1, with the general compulsory components in order to meet the general requirements of the programme. Students have to go through a separate intake procedure for admission to a major. Students first have to finish the obligatory research part of the programme before starting a major.
3. Regarding the major Teaching:
   Students who have completed an Educatieve Minor of 30 EC during their Bachelor's programme may submit a non-standard study programme for approval to the Examinations Board of the Interfacultaire Lerarenopleidingen, after discussing this non-standard study programme with the coordinator of the major Teaching and the coordinator of the Master's programme. The exit qualifications of the major can be found in Appendix 1.
4. Regarding the minor Tesla:
   The minor Tesla consists of 30 EC. It must be combined with a regular programme, comprising at least 90 EC. The minor consist of a course component and a project- based component. This project-based component has to be supervised by a Faculty of Science examiner and is subject to prior approval of appropriateness to MSc Physics by the Physics program director, as well as the Examinations Board. An examiner from the research programme has to be appointed as a second assessor. The learning objectives of this minor can be found as in Appendix 1.

Article 4.2 – Compulsory components

The regular programme includes compulsory components with a maximum study load of 12 EC. The contents and format of the compulsory components of the various programmes are further described in the Course Catalogue, stating the necessary entry requirements for successful participation in the component.

Article 4.3 – Practical components

1. In addition to, or instead of, classes in the form of lectures, the elements of the master's examination programme often include a practical component as defined in article 1.2 of part A. The UvA Course Catalogue contains information on the types of classes in each part of the programme. Attendence during practical components is mandatory .

2. When performing practical components, students must adhere to the faculty's safety regulations.
3. The programme consists of research-related components with a study load of at least 60 EC (36 in the major, 30 in AtoSim track). The research-related components always include the compulsory components:
   - a research assignment with a study load of at least 54 EC (30 in the major);
   - a final report and a scientific presentation with a study load of 6 EC.

Article 4.4 – Elective components

1. Students choose components in the field of the discipline with a study load of at least 24 EC in consultation with and accordance of the coordinator of the Master's programme and according to the rules stated the Course Catalogue of the study programme.
2. Elective components are considered to be those components in the field of the discipline stated in Appendix 2, and included in the Course Catalogue of the discipline, or of components offered by another Dutch or foreign university, being according to the Examination Board of a comparable level.
3. Course components successfully completed elsewhere or that are not included in attachment 1 during the programme may supplement the student's examination programme, subject to prior permission from the Examinations Board.
   a. The courses have to be followed at an accredited university or institute
   b. The course has to be relevant to the master chosen.
4. In exeptional cases students may choose Bachelor's-level free elective components as part of their programme. The Examinations Board will determine whether an free elective component at the Bachelor's level will be seen as part of the programme and the number of credits that will be allocated to the elective component.
5. In terms of content, elective components must not show too much similarity to other components of the student's curriculum. The acceptable degree of similarity will be decided by the Examinations Board.
6. A free elective component will only be seen as part of the programme if the Examinations Board has given its prior approval.

Article 4.5 – Sequence and admission requirements

1. Participation in a course may be restricted to students that have completed certain other programme components. Information about sequence and admission requirements can be found in the study guide.
2. In cases where the result of a component has not been determined within the time periods mentioned in Article 4.4 of part A, this component may not be required as prior knowledge for the subsequent component.

Article 4.6 – Participation practical training and tutorials

Not applicable

Article 4.7 – Exemption

1. At the written request of the student, the Examinations Board may exempt the student form taking one or more examination components, if the student:
   a. Has passed a component of an academic or higher professional education programme that is equivalent in both content and level;
   b. Has demonstrated through his/her work and/or professional experience that he/she has sufficient knowledge and skills with regard to the relevant component.

2. This exemption does not apply to the Master's thesis.
3. Exemptions from examinations (or parts therof), if granted, will be valid for the same period of examinations.
4. A maximum of 60 EC can be accumulated through granted exemptions.

Article 4.8 – Validity period of examinations

1. If programmes are taken on a full-time basis, the validity period of passed examinations is three years.
2. In individual cases, the Examinations Board is authorised to extend the validity period of successfully completed examinations for a period that it determines or to decide that an additional or replacement examination must take place.
3. The validity period of passed interim examinations is until the end of the academic year (31 Aug).

Article 4.9 – Degree

A student who passes the final examination of a programme is awarded a Master of Science degree. The degree awarded is stated on the diploma.

Article 4.10 – Double Master's programme (two-year programmes)

In order to be awarded two Master's degrees or to have stated on the Master's diploma that two Master's programmes have been completed within the discipline, the following requirements must be met:

1. The total programme of the candidate should amount to at least 180 ECTS credits. The total study load of the two separate research projects, or of the integrated research project, should amount to at least 90 EC.
2. The candidate's work for the programme (lectures, research work, etc.), must be of such a standard that all the compulsory requirements of each of the two programmes have been met.
3. The candidate must have conducted separate research work for both Master's degrees. This may consist of two separate research projects with supervisors from the respective study programmes. In the case of an integrated research project, this must be supervised by two staff members appointed from the two study programmes. Both staff members must assess the work as a pass.
4. The Examinations Boards of both study programmes must approve the student's double Master's programme before the student commences on the double Master's programme.

Article 4.11 – Participation in courses and rules for priority admission

1. Every student must enrol for every component. To participate in courses, the student must enrol within the period indicated in the UvA Course Catalogue and according to procedures mentioned there. The student may be refused the opportunity to participate if he/she does not enrol or fails to enrol in time.
2. Admission to courses with limited capacity takes place based on previously established and published admission criteria and rules for priority admission, on the understanding that students enrolled in the programme are given priority over others when enrolling for courses in the compulsory part of their programme.
3. Persons who are not enrolled at the University have no right to participate in teaching and examinations.

Article 4.12 – Determining results of examination Academic Skills

1. The Academic Skills in the Master consist of components with a study load of 6 EC.

2. The English Academic Course (5524ENAC3Y) or a comparable course offered by the VU is compulsory; The Examination Board may grant exemption of this rule, e.g., for native English speakers.
3. The student may complete the Academic Skills in the Master by participating in the relevant components as described in the Course Catalogue.

Article 4.13 – Research Project and Master's Thesis and Colloquium
1. At the end of the Research Project the responsible lecturer checks on the basis of the assessment form, if the student has sufficiently achieved the set exit qualifications.
2. For the assessment of the Research Project the advice of a second staff member is always obtained.
3. In the assessment of the Master's Thesis and Colloquium and the scientific presentation of the results of the Research Project the opinion of a second staff member from a research group different from the one in which the research project has taken place will always be obtained and included in the assessment;
4. If the mark for both the Research Project and the Master's Thesis and Colloquium is 8 or higher, the supervisor and the second staff member provide the examination board with a written statement explaining their assessment results in more detail and their agreement with a potential Cum Laude.
5. Students, proficient in the Dutch language write a short non-specialist summary in Dutch; students who do not have a sufficient command of the Dutch Language write this summary in English.

Chapter 5. Transitional and final provisions

Article 5.1 – Amendments
1. The dean shall establish amendments to the part B of these Regulations by independent decision – having heard the board of studies and with due regard for the authority of the relevant advisory bodies.
2. Amendments to these regulatins take place following a recommendation by the board of studies relating to the regulations in their entirely, and with the endorsement of a joint meeting of those sections which do not relate to the subject of Article 7.13 paragraphs 2a to g, and paragraph 3 of the Act and the admission requirements for Master's programmes.
3. Amendments to the part B of these Regulations do not apply to the current academic year unless they can be reasonably assumed not to damage the student's interest.

Article 5.2 – Cancelled programme components
Not applicable

Article 5.3 - *Publication*
1. The dean shall ensure a fitting publication of part A and B of these Regulations and the rules and guideline referred to in the Act.
2. These regulations can be accessed at the website of the Faculty and the UvA Course Catalogue.

Article 4.2 – *Effective date*
Part B of these Regulations shall come into force as of September 1st, 2014
Adopted by the dean on 30 September 2014

Appendix 1 Final attainment levels of the Major Teaching, and learning objectives minor TESLA

A. Final attainment levels of the major Teaching

Aan het eind van de opleiding moet de student beschikken over de kwaliteiten ofwel competenties op het gebied van geïntegreerde kennis, inzicht en vaardigheden behorend bij het beroep van leraar in het eerstegraads gebied van het voortgezet onderwijs. De competenties hebben betrekking op de taakgebieden waarvoor wordt opgeleid: onderwijzen, begeleiden, organiseren, ontwikkelen en onderzoeken, en professionaliseren. De competenties zijn de volgende.

• *Interpersoonlijk competent*
Je bent interpersoonlijk competent als je in het contact met leerlingen (en ook met anderen) kunt leiden, begeleiden, bemiddelen, stimuleren en confronteren. Daarmee bereik je een klimaat met open communicatie en een sfeer van samenwerking en wederzijds vertrouwen.

• *Pedagogisch competent*
Je bent pedagogisch competent als je benaderingen kunt ontwerpen, uitvoeren en evalueren om het welbevinden van leerlingen te bevorderen, om ontwikkelings- en gedragsproblemen te signaleren en om groepen en individuen te begeleiden. Daarmee bereik je een veilige leeromgeving waarin leerlingen zich kunnen ontwikkelen tot zelfstandige en verantwoordelijke personen.

• *Vakinhoudelijk en didactisch competent*
Je bent vakinhoudelijk en vakdidactisch competent als je je eigen vak gedegen beheerst, op basis daarvan aantrekkelijke, effectieve en efficiënte leeractiviteiten kunt ontwerpen, uitvoeren, begeleiden en evalueren. Daarmee bereik je een krachtige leeromgeving voor leerlingen.

• *Organisatorisch competent*
Je bent organisatorisch competent als je concrete en functionele procedures en afspraken kunt hanteren en als je de leeromgeving en het leren van leerlingen kunt organiseren en faciliteren en de planning kunt bewaken en bijstellen. Daarmee bereik je een overzichtelijke, ordelijke en taakgerichte leeromgeving.

• *Competent in het samenwerken met collega's*
Je bent competent in het samenwerken met collega's als je informatie deelt, actief bijdraagt aan overleg en samenwerkingsverbanden en deelneemt aan collegiale consultatie. Daarmee bevorder je een collegiale en harmonieuze werksfeer.

• *Competent in het samenwerken met de omgeving*
Je bent competent in het samenwerken met de omgeving als je doelmatige contacten onderhoudt met ouders (verzorgers), maar ook met andere mensen en instanties die te maken hebben met de zorg voor en de opleiding van leerlingen. Daarmee bereik je dat de ontwikkeling van leerlingen op een realistische en constructieve manier wordt ondersteund en dat eventuele problemen tijdig worden onderkend en opgelost.

• *Competent in reflectie en onderzoek ten dienste van ontwikkeling*
Je bent competent in reflectie als je je handelen planmatig kunt bijstellen op grond van ervaringen in beroepssituaties. Daarmee bereik je professioneel leren en ontwikkeling van jezelf. Je bent competent in onderzoek als je de beroepspraktijk in het algemeen en je eigen beroepspraktijk in het bijzonder kunt analyseren met distantie en met onderzoeksmatige

deskundigheid. Daarmee bereik je ontwikkeling van je school, van de didactiek van je vak en/of van jezelf.

B. Learning Objectives Tesla
Main Objective
To offer ambitious science students with a demonstrated excellent Academic and non-Academic track record the opportunity to engage in a final challenge before finishing their research master programme.

On completing the Tesla Programme the graduate has acquired the qualities to bridge Science, Society and Business within complex research and project challenges related to the own scientific background. The graduate is fit to start a career in demanding environments which require abilities to utilize the disciplinary science background (as described in OER B) in work environments within or outside of science.

These qualities will be developed while 1) working on an interdisciplinary project related to the scientific background of the graduate and 2) undergoing intensive training on a range of skills.

General Objectives
The graduate has:

1. The analyzing, problem-solving and synthesizing abilities in order to be able to function at the required academic level
2. The abilities to utilize his or her specific scientific background (as specified in the OER B of the Master Programme in which the student is enrolled) in settings on the interface of science, business and society
3. A series of practical professional, academic and personal skills which result in the ability to
    a. independently set up, manage and execute an interdisciplinary projects at the interface of science, business and society. Thereby utilizing scientific knowledge in contributing to a real demand of a knowledge intensive organization
    b. get acquainted with a field of study in a short period of time by self-study, to form one's own opinion and to communicate critically and effectively with different audiences on the topic
    c. deal with complex challenges and gather and structure information on different levels to enable professional action in different fields and especially the ability to utilize his/her own scientific background in a non-Academic environment
    d. Communicate effectively with different stakeholders (e.g. business professionals, policymakers) while using appropriate means (e.g. business plans, policy advice).
    e. operate effectively in interdisciplinary teams.
4. An attitude that enables the student to critically reflect on his/her own actions

In doing so the graduate should have acquired the following qualities in the fields of 'Professional Knowledge & Insight' and 'Professional Skills':

Professional Knowledge and Insight
Students should develop professional knowledge and insight regarding bringing "science to value in practice", especially in relation to their scientific background. More specifically, students should:

a. Obtain understanding of different business practices, discourses and settings with regard to bringing scientific knowledge to value.

b. Develop knowledge on scientific developments in relevant disciplines related to dealing with the societal challenges of 21th century.
c. Obtain understanding of different non-profit practices and settings with regard to bringing scientific knowledge to value
d. Obtain understanding of different governmental practices and settings with regard to bringing scientific knowledge to value.
e. Increase knowledge and insight of possible career paths and possible roles in bringing scientific knowledge to value.

Professional Skills
Students should develop professional business skills to operate effectively in organizations and groups. More specifically, students should:

f. Develop professional cooperation skills.
    i. Develop presentation skills: the abilities necessary to communicate complex information and deliver professional presentations in different environments.
    ii. Develop feedback skills
    iii. Develop meeting skills: the abilities necessary to host and guide meetings in which complex information, different opinions and positions need to be structured to effectively facilitate collection work.
    iv. Develop teamwork and leadership skills.
    v. Develop interview techniques: abilities necessary to successfully obtain information by means of an interview in different settings.
    vi. Develop reasoning and related skills to structure information: develop the abilities to test arguments and bring propositions towards implementation by convincing others.
    vii. Develop communication and influencing skills.

g. Develop project management skills.
    i. Be able to effectively manage projects on the interface of Science and Practice, including becoming familiar with:
        1. Taking Initiative
        2. Managing the workflow
            a. Preparing a project planning
            b. Use of KPIs in Planning
            c. Prioritizing & adjustment (time management, etc.)
        3. Practical Tools
            a. Effective use of communication technology
            b. Budget management
        4. Team Management
            a. Engaging your interdisciplinary team
            b. Divide and take Responsibility
            c. Solving problems
    ii. Get acquainted with consultancy analytics and tools to structure complex challenges & information.
        1. Utilizing consultancy models to structure complex challenges and transform them into workable solutions.
        2. Develop visual thinking skills: the qualities to use visual tools to structure meetings, complex information and group processes.

Appendix 2. Description of the content and Study Load of the Components

This list comprises the curriculum components of the Physics Master's programme tracks in the academic year 2014-2015. The contents of the components are described in the Course Catalogue.

Component	Code	Study load (EC)	Period
Advanced Medical Technology	53548ADM6Y	6	5
Advanced Quantum Mechanics	53548AQM6Y	6	1
Advanced Topics in Theoretical Physics	5354ATIT6Y	6	1, 2
AMEP Lab Project	5354AMLP6Y	6	1, 2, 3, 4, 5, 6
Astroparticle Physics	5354ASPH6Y	6	4
Beyond the Standard Model	5354BESM3Y	3	5
Big Issues in Atomic Quantum Physics	5354BIIA3Y	3	4
Big Issues in Emergent Energy Materials	5354BIIE6Y	6	1
Big Issues in Soft Matter	5354BISM3Y	3	4
Biomedical Optics	5354BIOP6Y	6	4
Biophotonics 3 - Practical Training	535483BI3Y	3	3
Bose Einstein Condensates	5354BOEC6Y	6	2
CERN Research Project	5354CERP6Y	6	6
CERN Summer Student Lecture Programme	5354CSLP3Y	3	6
Computational Methods	53548COM6Y	6	4
Computational Methods, extension	53548COM3Y	3	3
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