Assessment plan for the curriculum of the Master's degree programme in Physics, 2026-2027

Programme director: prof.dr. S. Hoekstra

Date of advice by the Board of Examiners: April 30, 2026

Date approval Faculty Board:

1. Vision on assessment

Objectives
The vision behind the Master of Physics programme is to train excellent researchers in the fields of materials science, subatomic and isotope physics, or theoretical physics. The programme offers three distinct tracks: Quantum Universe (QU), Advanced Materials (AM), and Science, and Business and Policy (SBP). The QU track emphasizes the relations between Theoretical Physics, Particle Physics and Astronomy in the study of nature on the different scales. The AM track places the main emphasis on the design and study of materials with a focus on achieving specific functionalities. The SBP track integrates cutting-edge physics knowledge with a comprehensive understanding of both business and policy aspects in science. The MSc Physics programme traditionally targets students aspiring to pursue research careers, with a substantial portion of graduates proceeding to enroll in PhD programs. At the same time, the programme also prepares graduates for a broader career in society. A significant number of students continue on diverse career paths, such as consultancy firms, process management, financial sectors, or pursuing teaching positions. This broad range of opportunities arises because the programme equips students not only with specialized knowledge but also with versatile competences and skills that enhance their adaptability and suitability for various professional roles.

Assessment vision statement:
- Assessment guides and evaluates student learning in a diverse manner, emphasizing content knowledge and essential skills, including problem-solving, group work, practical application, and relevance to real-world scenarios.
- Assessment motivates students by offering constructive feedback, promoting active learning from mistakes, and encouraging the integration of specific knowledge and skills.
- Assessment serves as a guiding principle for lifelong learning and as an instrument in shaping students' future careers by facilitating skill enhancement, adaptive growth, and decision-making.
- All assessments and feedback, final and day-to-day, are provided in English to prepare students for a career with an international job market.

2. Assessment guidelines

Guidelines for assessment quality:
- The course assessment scheme should be communicated to the students during the introduction to the course at the first lecture, and also included in the course webpage and Ocasys. The assessment scheme may not be changed during the course.
- The courses are assessed through written or oral exams as assigned in the assessment plan. For resits, the examiner can always choose for oral examination.
- If the course includes several parts taught by different instructors, the course coordinator determines how these components are integrated into the final assessment and their respective contributions to the overall grade.
- Written exams must contain the following information on the first page: the course title and code, when and where the exam takes place, the number of questions/pages, exam conditions (what is allowed and not allowed to use) and the grading scheme
- A clear and explicit rubric or a comprehensive grading scheme is drawn up by the course coordinator to promote fairness and transparency in the grading process.
- For courses with a written exam, a mock exam (for example, an exam from a previous year) must be available from the start of the course.
- Oral exams are graded using the dedicated oral exam grading form. At the beginning of the exam, the student should be informed of the topics to be examined (pre-indicated in the grading form). An independent observer (preferably the preassigned second examiner) must be present during the full exam. The examination material (photos of the blackboard or paper sheets with student's answers) should be collected and added to the examination form.
- For courses with hands-on practicals, the grade of the report might be a (weighted) part of the final grade. The grade might also be binary (pass/no pass); a pass grade is required to be

admitted to the exam.

- If the practical work is performed in teams, the team report might be handed in and graded for the whole team unless there are exceptional circumstances (e.g., a student did not participate in report writing). Individual reports might also be requested by the course coordinator. This should be clearly communicated to the students during the first lecture.
- All practicals are assessed through a written report with feedback to the students on development points. This is provided as explicit feedback written for each individual student on the grading form.
- To impart to students the practical significance of meeting deadlines and guarantee equitable grading, a Fail grade is assigned to reports not handed in on time.

Master research project:

- The first examiner may delegate daily supervision, but is ultimately responsible for the smooth flow and outcome of the research project.
- To ensure standardized and fair grading, the master research project should be assessed by the first examiner and an independent second examiner. They should not be from the same research unit, and not closely involved in the master project.
- For the research project, midterm assessment with specific feedback on development points and self-reflection of the student must be provided.
- In research projects, regular progress meetings (at least every week) with the daily supervisor should take place, in which the student is given feedback and instructions on the day-to-day research. Progress meetings (at least every four weeks) with the supervisor should also take place, in which the students will be given clear feedback on their progress.
- Examiners should provide feedback on at least one full draft version of the master thesis, provided the student meets the agreed deadline for handing in the full draft.
- The master thesis must be checked by the supervisor for plagiarism before grading.
- The students should be instructed on the possible use and misuse of AI and online information tools with the focus on ethics and critical thinking. The use of such tools may not be explicitly recognized in the acknowledgment section.
- If the research project is awarded a negative grade or there is a substantial delay, a remediation trajectory should be drawn by the supervisor and the student. The programme management should be informed promptly about this development.

3. Learning outcomes of the degree programme

Learning Outcome:	
A. Knowledge and understanding	
A1	A Physics master's graduate understands the advanced concepts of physics, including the necessary mathematics and computer science, at a level which permits admission to a PhD programme;
A2	A Physics master's graduate is familiar with the advanced quantitative character of physics and with the relevant research methods;
A3	A Physics master's graduate who took: ● the Advanced Materials track has a thorough understanding of the current state of the art in materials science, more specifically of structure, functional properties and characterization of advanced materials; ● the Quantum Universe track has a thorough understanding of the main fields and presently active topics in theoretical physics, more specifically in the fields of general relativity, statistical mechanics, quantum mechanics, particle physics and radiation processes; ● the Science, Business and Policy track has operational knowledge of, and insight into, the present functioning of companies and administrations, as well as the relevant legislation, in relation to physics oriented working areas.
B. Application of knowledge and understanding	
B1	A Physics master's graduate is capable of carrying out research, aimed at the understanding of physical phenomena and their description in scientific terms;
B2	A Physics master's graduate is capable of analyzing a (new) complex physical problem, and to use modelling skills to develop a structured and well-planned research approach;
B3	A Physics master's graduate is capable of applying his/her specific knowledge and mathematical, experimental, and computer skills to solve physical problems in his/her own and related subject areas and fields;
B4	A Physics master's graduate is capable of collaborating in a (multi-disciplinary) team.
C. Judgement	
C1	A Physics master's graduate is capable of obtaining relevant information using modern information channels, and to interpret this information critically;
C2	A Physics master's graduate is capable of managing and judging his/her and others' actions within a highly scientific and professional context, taking societal and ethical aspects into account;
C3	A Physics master's graduate is able to draw conclusions on the basis of limited or incomplete information, and is able to realize and formulate the limitations of such conclusions.

D. Communication skills	
D1	A Physics master's graduate is capable of communicating clearly in English, both verbally and in writing, on his/her subject and relevant applications, at a level which is understandable to experts and non-experts, and using modern communication tools;
E. Learning skills	
E1	A Physics master's graduate is capable of addressing issues inside as well as outside his/her main subject area, therefore and thereby gaining new knowledge and skills.

4. Overview of assessment methods, test moments for course units, and examiners

The abbreviations for the relevant teaching methods are explained in the legend of the table. Examples of assessment methods include:

- *Written Exam (WE)*
- *Midterm (MT)*
- *Multiple Choice (MC)*
- *Oral Exam (OR)*
- *Report (R)*
- *Presentation (P)*
- *Practical Work (PR)*
- *Assignment (AST)*

Advanced Materials track (core programme)

Year	Period	Course	EC	Assessment methods	Incl. Formative Assessment?	Test moment(s)	First examiner	Second examiner
1	1A	Computational Physics (WMPH007-05)	5	R	Yes	continuous assessment, exam week	P.R. Onck	A. Giuntoli
1	1B	Structure at Macro, Meso and Nano Scale (WMPH020-05)	5	AST, WE	Yes	continuous assessment, exam week	L. Protesescu	B.J. Kooi
1	1B	Advanced Quantum Mechanics (WMPH032-05)	5	AST, WE	Yes	continuous assessment, exam week	M.V. Mostovoy	R.G.E. Timmermans
1	2A	Mathematical Methods of Physics (WMPH016-05)	5	AST	Yes	continuous assessment, exam week	C. Simsek	D. Boer
1	2A	Properties of Functional Materials (WMPH051-05)	5	WE	Yes	continuous assessment, exam week	J. Ye	R. lo Conte
1	2A	Characterisation of Materials (WMPH021-05)	5	WE	Yes	exam week	G.R. Blake	B.J. Kooi
1	2A	Statistical Mechanics (WMPH029-05)	5	AST, WE	Yes	continuous assessment, exam week	T. La Cour Jansen	T.A. Schlathölter
2	-	Physics Master Research Project (WMPH902-60)	60	R, P	Yes	continuous assessment	*R. Hildner, see list examiners research projects below*	

Advanced Materials track (optional courses)

Year	Period	Course	EC	Assessment methods	Incl. Formative Assessment?	Test moment(s)	First examiner	Second examiner
1	1A	Atomic and (Bio-)Molecular Interactions (WMPH046-05)	5	WE, PR	Yes	continuous assessment, exam week	S. Bari	R.A. Hoekstra
1	1A	Physics of Lasers (WMPH027-05)	5	WE, AST, R, PR	Yes	continuous assessment, exam week	R. Hildner	M. S. Pchenitchnikov
1	1B	Bioinspired Designer Materials (WMCH009-05)	5	WE, P	Yes	exam week	M.M.G. Kamperman	G. Portale
1	1B	Mechanical Properties (WMPH023-05)	5	AST, PR, P, R	Yes	continuous assessment, exam week	P.R. Onck	A. Giuntoli
1	1B	Oriëntatie op Onderwijs in de Bètawetenschappen voor Masterstudenten (WMEC013-05)	5	OR, R, P	Yes	continuous assessment, exam week	J.E. van der Laan	G. Roorda
1	1B	Quantum Technology (WMPH057-05)	5	AST, P	Yes	continuous assessment	S.A. Jones	L. Willmann
1	1B	Science and the Public (WMEC009-05)	5	AST, P	Yes	continuous assessment	L. Avraamidou	L.T.J. Kraan
1	2	Neem regie (TEM0110-24)	10	WE	Yes	continuous assessment	J.E. van der Laan	G. Roorda
1	2A	Supramolecular Chemistry (WMCH020-05)	5	WE, PR, P	Yes	continuous assessment, exam week	S. Otto	R.C. Chiechi
1	2A	Theoretical Condensed Matter Physics (WMPH031-05)	5	WE	Yes	continuous assessment	M.V. Mostovoy	J.L. Slawinska
1	2B	Biophysical Imaging & Manipulation Techniques (WMPH047-05)	5	WE/OR, P, R	Yes	continuous assessment, exam week	W.H. Roos	M.S. Pchenitchnikov
1	2B	Many-particle systems (WMPH036-05)	5	WE	Yes	continuous assessment, exam week	M.V. Mostovoy	J.L. Slawinska
1	2B	Nanoelectronics and Mesoscopic Physics (WMPH058-05)	5	AST, WE, P	Yes	continuous assessment, exam week	B.J. van Wees	C.H. van der Wal

Year	Period	Course	EC	Assessment methods	Incl. Formative Assessment?	Test moment(s)	First examiner	Second examiner
1	2B	Nanoscale Material Modeling (WMPH053-05)	5	WE, AST	Yes	continuous assessment, exam week	A. Giuntoli	J.L. Slawinska
1	2B	Physics with Industry (WMPH041-05)	5	AST, P, R	Yes	continuous assessment, exam week	R.A. Hoekstra	P.R. Onck
1	2B	Surfaces and Interfaces (WMPH014-05)	5	AST, WE	Yes	continuous assessment, exam week	A. Grubisic-Cabo	P. Rudolf

Quantum Universe track (core programme)

Year	Period	Course	EC	Assessment methods	Incl. Formative Assessment?	Test moment(s)	First examiner	Second examiner
1	1A	Computational Physics (WMPH007-05)	5	R	Yes	continuous assessment, exam week	P.R. Onck	A. Giuntoli
1	1A	General Relativity (WMPH009-05)	5	AST, WE	Yes	continuous assessment, exam week	E.A. Bergshoeff	D. Roest
1	1B	Particle Physics Phenomenology (WMPH026-05)	5	AST, WE	Yes	continuous assessment, exam week	K.A.M. de Bruyn	D. Boer
1	1B	Science and the Public (WMEC009-05)	5	AST, P	Yes	continuous assessment	L. Avraamidou	L.T.J. Kraan
1	1B	Advanced Quantum Mechanics (WMPH032-05)	5	AST, WE	Yes	continuous assessment, exam week	M.V. Mostovoy	R.G.E. Timmermans
1	2A	Astroparticle Physics (WMAS027-05)	5	WE	Yes	continuous assessment, exam week	M. Vecchi	S. Hoekstra
1	2A	Mathematical Methods of Physics (WMPH016-05)	5	AST	Yes	continuous assessment, exam week	C. Simsek	D. Boer
1	2A	Statistical Mechanics (WMPH029-05)	5	AST, WE	Yes	continuous assessment, exam week	T. La Cour Jansen	T.A. Schlathölter
1	2B	Student Seminar Quantum Universe (WMPH039-05)	5	P	Yes	continuous assessment, exam week	L. Willmann	E. Pallante
2	-	Physics Master Research Project (WMPH902-60)	60	R, P	Yes	continuous assessment	*R. Hildner, see list examiners research projects below*	

Quantum Universe track (optional courses)

Year	Period	Course	EC	Assessment methods	Incl. Formative Assessment?	Test moment(s)	First examiner	Second examiner
1	1A	Atomic and (Bio-)Molecular Interactions (WMPH046-05)	5	WE, PR	Yes	continuous assessment, exam week	S. Bari	R.A. Hoekstra
1	1A	Formation and Evolution of Galaxies (WMAS005-05)	5	AST, WE	Yes	continuous assessment, exam week	F. Fraternali	K.I Caputi
1	1A	Fundamental Constants (WMPH008-05)	5	AST, R	Yes	continuous assessment, exam week	L. Willmann	J. Even
1	1A	Hamiltonian Mechanics (WMMA019-05)	5	AST, P, R	Yes	continuous assessment, exam week	M. Seri	H.W. Broer
1	1A	Lie Groups in Physics (WMPH011-05)	5	WE	Yes	continuous assessment, exam week	D. Roest	D. Boer
1	1B	High-energy Astrophysics (WMAS006-05)	5	AST, PR	Yes	continuous assessment, exam week	R.M. Mendez	L.V.E. Koopmans
1	1B	Oriëntatie op Onderwijs in de Bètawetenschappen - voor Masterstudenten (WMEC013-05)	5	OR, R, P	Yes	continuous assessment, exam week	J.E. van der Laan	G. Roorda
1	1B	Quantum Field Theory (WMPH018-05)	5	WE	Yes	continuous assessment, exam week	R.G.E. Timmermans	E. Pallante
1	1B	Quantum Technology (WMPH057-05)	5	AST, P	Yes	continuous assessment	S.A. Jones	L. Willmann
1	2	Neem regie (TEM0110-24)	10	WE	Yes	continuous assessment, exam week	J.E. van der Laan	G. Roorda
1	2A	Deep Learning in Physics (WMPH054-05)	5	AST	Yes	continuous assessment	J. Aalbers	P.D Meerburg
1	2A	Exoplanets (WMAS026-05)	5	AST, PR, WE	Yes	continuous assessment	T. Lichtenberg	Q. Changeat
1	2A	Geometry and Differential Equations (WMMA017-05)	5	AST, WE, P	Yes	continuous assessment, exam week	A.V. Kiselev	J. Top

Year	Period	Course	EC	Assessment methods	Incl. Formative Assessment?	Test moment(s)	First examiner	Second examiner
1	2A	Gravitational Waves (WMMA017-05)	5	AST, R	Yes	continuous assessment, exam week	E. Dimastrogiovanni	D. Roest
1	2A	Introduction to Plasma Physics (WMPH035-05)	5	AST, WE, MT	No	exam week	C.E. Rigollet	J. Even
1	2A	Star and Planet Formation (WMAS017-05)	5	AST, WE	Yes	continuous assessment, exam week	F.F.S. van der Tak	I.E.E. Kamp
1	2B	Collider Experiments (WMPH033-05)	5	WE, P	No	exam week	M. Mulder	A. Pellegrino
1	2B	Cosmic Structure Formation (WMAS004-05)	5	PR, P, WE	Yes	continuous assessment, exam week	M.A.M. van de Weijgaert	S. Zaroubi
1	2B	Elementary Particles (WMPH034-05)	5	WE	Yes	continuous assessment, exam week	E. Pallante	R.G.E. Timmermans
1	2B	Nuclear Astrophysics (WMPH038-05)	5	WE, MT, AST	No	Exam Week	C.E. Rigollet	J. Even
1	2B	Physics with Industry (WMPH041-05)	5	AST, P, R	Yes	continuous assessment	R.A. Hoekstra	P.R. Onck

Science, Business and Policy track

Year	Period	Course	EC	Assessment methods	Incl. Formative Assessment?	Test moment(s)	First examiner	Second examiner
1	1A	Computational Physics (WMPH007-05)	5	R	Yes	continuous assessment, exam week	P.R. Onck	A. Giuntoli
1	1B	Advanced Quantum Mechanics (WMPH032-05)	5	AST, WE	Yes	continuous assessment, exam week	M.V. Mostovoy	R.G.E. Timmermans
1	1	Optional courses (courses from the Advanced Materials track or the Quantum Universe track)	20	*See specific courses above*	*See specific courses above*	*See specific courses above*	*See specific courses above*	*See specific courses above*
1	2	Physics Research (WMPH005-30)	30	P, R	Yes	continuous assessment	*R. Hildner, see list examiners research projects below*	
2	-	Work Placement Business and Policy (WMSE902-40)	40	*See assessment plan of Science, Business, and Policy for details.*				
2	1	Introduction Science and Business (WMSE001-10)	10	*See assessment plan of Science, Business, and Policy for details.*				
2	1	Introduction Science and Policy (WMSE002-10)	10	*See assessment plan of Science, Business, and Policy for details.*				

Examiners for the Master's Research Project

VSI
Aalbers, dr. J.
Bergshoeff, prof.dr. E.A.
Bethlem, dr. H.L.
Boer, prof.dr. D.
Borschevsky, prof.dr. A.
Bruyn, dr. K.A.M. de
Dimastrogiovanni, dr. E.
Eijk, D. van
Even, dr. J.
Hoekstra, prof.dr. S.
Jones, dr. S.
Mazumdar, prof.dr. A.
Meerburg, dr. D.
Pallante, prof.dr. E.
Pellegrino, prof.dr. A.
Perrevoort, dr. A.
Roest, prof.dr. D.
Timmermans, prof.dr. R.G.E.
Willmann, dr. L.

Zernike Institute
Banerjee, prof.dr. T.
Bari, prof.dr. S.
Chicca, prof.dr. E.
Diniz Guimaraes, dr. M.H.
Ehrler, dr. B.
Giuntoli, dr. A.
Grubisic-Cabo, dr. A.
Hildner, prof.dr. R.M.
Hoekstra, prof.dr.ir. R.A.
Jansen, dr. T.L.C.
Kooi, prof.dr.ir. B.J.
Koster, prof.dr. L.J.A.
Lo Conte, dr, R.
Loi, prof.dr. M.A.
Mostovoy, prof.dr. M.V.
Noheda Pinuaga, prof.dr. B.
Onck, prof.dr.ir. P.R.
Palasantzas, prof.dr. G.
Pchenitchnikov, prof.dr. M.S.
Protesescu, dr. L.
Roos, prof.dr. W.H.
Schlathölter, dr. T.A.
Slawinska, dr. J.L.
Vlijm, dr. R.
Wal, prof.dr.ir. C.H. van der
Wees, prof.dr.ir. B.J. van
Wel, prof.dr. P.C.A. van der
Ye, prof.dr. J.
Zaag, dr. P.J. van der

ESRIG
Bintanja, prof.dr. R.
Dee, prof.dr. M.W.
Dusek, prof.dr. U.
Kalantar-Nayestanaki, prof.dr. N.
Kavatsyuk, dr. M.
Lentink, prof.dr.ir. D.
Medjroubi, dr. W.
Meer, dr. A.A. van der
Meijer, prof.dr. H.A.J.
Miocic, dr. J.M.
Mokhov, dr. A.V.
Purushothaman Vellayani, prof.dr. A.
Schuck, dr. T.J.

PARTREC/UMCG
Dendooven, dr. P.G.
Gerbershagen, prof,dr. A.
Luijk, dr. P. van
Ortiz Catalan, dr. R.

SSE
Biegun, dr. A.K.
Blijleven, dr. J.S.
Fontana, dr. M.
Klein-Douwel, dr. R.H.J.
Rigollet, dr. C.E.
Simsek, dr, C.

An examiner for the Master’s Research Project of Applied Physics, Astronomy or Mathematics may also act as second supervisor for a Master’s Research Project in Physics.

5. Relationship between course units and details of the learning outcomes

Advanced Materials track

Learning outcomes	A1	A2	A3	B1	B2	B3	B4	C1	C2	C3	D1	E1
Advanced Quantum Mechanics	X	X										
Characterization of Materials	X		X									X
Computational Physics	X	X		X							X	
Nanomaterials Synthesis and Engineering	X		X					X			X	X
Properties of Functional Materials	X		X									X
Mathematical Methods of Physics	X	X										
Statistical Mechanics	X	X										
Structure at Macro, Micro and Nano Scale	X		X									X
Optional courses Advanced Materials	X	X	X		X			X	X	X		X
Research [4]	X	X	X	X	X	X	X	X	X	X	X	X

[4] The research project includes the compulsory modules Academic Skills, Scientific Integrity, General Physics Colloquium and Career Perspectives

Quantum Universe track

Learning outcomes	A1	A2	A3	B1	B2	B3	B4	C1	C2	C3	D1	E1
Advanced Quantum Mechanics	X	X										
Astroparticle Physics	X		X									X
Computational Physics	X	X		X							X	
General Relativity	X		X									
Mathematical Methods of Physics	X	X										
Optional courses Quantum Universe	X	X	X					X	X	X		X
Particle Physics Phenomenology	X		X									
Statistical Mechanics	X	X										
Student seminar Quantum Universe	X		X	X			X	X	X	X	X	X
Research [4]	X	X	X	X	X	X	X	X	X	X	X	X

Science, Business and Policy track

Learning outcomes	A1	A2	A3	B1	B2	B3	B4	C1	C2	C3	D1	E1
Advanced Quantum Mechanics	X	X										
Computational Physics	X	X		X							X	
Optional courses in Science	X	X	X	X	X			X	X	X	X	X
Research [4]	X	X	X	X	X	X	X	X	X	X	X	X
Introduction Science and Business			X			X	X	X	X	X	X	X
Introduction Science and Policy		X	X				X	X	X	X	X	X
Work Placement Business and Policy	X	X	X	X	X	X	X	X	X	X	X	X

[4] The research project includes the compulsory modules Academic Skills, Scientific Integrity, General Physics Colloquium and Career Perspectives