

School of Physics, Engineering & Computer Science

Title of Programme: MSc Theoretical Physics
Programme Code: PETPM

Programme Specification

This programme specification is relevant to students entering:
01 September 2021

Associate Dean of School (Academic Quality Assurance):
Dr Mariana Lilley

Signature



A programme specification is a collection of key information about a programme of study (or course). It identifies the aims and learning outcomes of the programme, lists the modules that make up each stage (or year) of the programme, and the teaching, learning and assessment methods used by teaching staff. It also describes the structure of the programme, its progression requirements and any programme-specific regulations. This information is therefore useful to potential students to help them choose the right programme of study, to current students on the programme, and to staff teaching and administering the programme.

Summary of amendments to the programme

Date	Section	Amendment
23.03.21	D	7PAM1027 adjusted from 80% exam/ 20% coursework to 100% coursework* in the academic year 021/22, due to the covid pandemic.
23.03.21	D	6PAM2002 adjusted from 50% exam/ 50% coursework to 100% coursework* in the academic year 021/22, due to the covid pandemic.
23.03.21	D	7PAM1034 adjusted from 60% exam/ 40% coursework to 100% coursework* in the academic year 021/22, due to the covid pandemic.

23.03.21	D	7PAM1033 adjusted from 50% exam/ 50% coursework to 100% coursework* in the academic year 021/22, due to the covid pandemic.
23.03.21	D	7PAM1035 adjusted from 50% exam/ 50% coursework to 100% coursework* in the academic year 021/22, due to the covid pandemic.
23.03.21	D	6PAM1061 adjusted from 80% exam/ 20% coursework to 100% coursework* in the academic year 021/22, due to the covid pandemic.
23.03.21	D	7PAM1020 adjusted from 50% exam/ 50% coursework to 100% coursework* in the academic year 021/22, due to the covid pandemic.

* Learning outcomes for this module will be assessed via coursework using alternative modes of assessment. Alternative modes of assessment include, but are not limited to, take home coursework and online timed assessments.

If you have any queries regarding the changes please email AQO@herts.ac.uk

Programme Specification MSc Theoretical Physics

This programme specification (PS) is designed for prospective students, enrolled students, academic staff and potential employers. It provides a concise summary of the main features of the programme and the intended learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. More detailed information on the teaching, learning and assessment methods, learning outcomes and content for each module can be found in Definitive Module Documents (DMDs) and Module Guides.

Section 1

Awarding Institution/Body	University of Hertfordshire
Teaching Institution	University of Hertfordshire
University/partner campuses	College Lane
Programme accredited by	N/A
Final Award (Qualification)	MSc
All Final Award titles	MSc Theoretical Physics
(Qualification and Subject)	MSc Theoretical Physics with Advanced Research

FHEQ level of award 7

UCAS code(s)

Language of Delivery English

A. Programme Rationale

This programme introduces the fundamental physical theories that govern the behaviour of space, time and matter, from scales ranging from the very smallest (in particle accelerators at e.g. CERN) to the very largest (gravity, black holes and the history of the cosmos). It provides a solid grounding in foundational topics including General Relativity and Quantum Field Theory, and in mathematical tools including Representation Theory. Beyond that core, it features a series of lectures on Recent Advances in Theoretical Physics, designed to survey areas directly relevant to contemporary research and delivered by specialists.

The Mathematical Physics Group within the Department of Physics, Astronomy and Mathematics at UH have internationally recognized research profiles across a range of topics in theoretical physics.

A theoretical physics curriculum combines advanced reasoning skills with applications to complex physical phenomena, placing the graduates in a strong position of possible diverse future specializations. The programme has a focus on key skills in academia and in industry: working collaboratively, and presenting ideas in person and in writing. Graduates are equipped both for careers in STEM areas, and for further study at PhD level leading potentially to a theoretical physics research career.

In addition to the standard 180 credit (1 year full-time, 2-year part time) masters degree, the programme provides the option of a 240 credit (2 year full-time) masters degree "with Advanced Research".

B. Educational Aims of the Programme

The programme has been devised in accordance with the University's graduate attributes of programmes of study as set out in [UPR TL03](#).

Additionally this programme aims to:

- provide students with a systematic knowledge of the central topics of contemporary theoretical physics, informed by new insights and work at the cutting edge of the field;

- provide students a conceptual understanding that enables them to evaluate critically current research in theoretical physics;
- offer students a platform which will enable them to embark on further study in theoretical physics and adjacent disciplines in academia;
- develop the qualities and transferable skills necessary for employment requiring complex decision-making, originality and self-direction.

C. Intended Learning Outcomes

The programme provides opportunities for students to develop and demonstrate knowledge and understanding, skills and other attributes in the following areas. The programme outcomes are referenced the Frameworks for Higher Education Qualifications of UK Degree-Awarding Bodies (2014), and relate to the typical student. Additionally, the SEEC Credit Level Descriptors for Further and Higher Education (2016) have been used as a guiding framework for curriculum design.

Knowledge and Understanding:	Teaching/learning methods & strategies	Assessment
A1- The concepts, ideas and theories of theoretical physics at a deep and systematic level A2- The mathematical theory, formalisms and techniques arising in the theoretical physics context, to an advanced level	Acquisition of knowledge and understanding is through a combination of lectures, participation in seminars, small group tutorials, and coursework. Throughout, the learner is encouraged to undertake independent study both to supplement and consolidate what is being taught/learnt and to broaden their individual knowledge and understanding of the subject.	Knowledge and understanding are assessed through a combination of unseen examinations (A1, A2) and in-course assessments (A1-A2).
Intellectual skills:	Teaching/learning methods & strategies	Assessment
B1- Formulate and tackle problems in theoretical physics using advanced approaches. B2-Work with highly abstract and mathematical ideas relevant to physics. B3-Design, execute and report on a substantial investigation on an area of recent research. B4 (with Advanced Research Pathway only) Carry out scientific peer-review of others' written work	Intellectual skills are developed through the methods and strategies outlined in section A, above. Learning outcomes B1-B4 are developed through tutorial exercises, coursework, seminars, project work, study of the literature, and project work. Throughout, the learner is encouraged to develop intellectual skills further by independent study	Intellectual skills are assessed through a combination of unseen examinations (B1-B2) assessed individual assignments (B1-B2, B4) and the project report (B3).
Practical skills:	Teaching/learning methods & strategies	Assessment
C1- Perform advanced calculations in the settings of various physical theories. C2-Flexibly apply appropriate analytical and problem-solving techniques to problems in mathematical and	Practical skills are developed through active participation in seminars and tutorials, through group and through project work. Throughout, the learner is expected to consolidate their development of practical computing skills by use of	Practical skills are assessed through coursework and written assignments (C1-C3) and the project report (C1-C3).

theoretical physics C3- Synthesise complex material from multiple sources in the scientific literature, and present findings in cogent form	computers available in the Learning Resources Centre.	
Transferable skills:	Teaching/learning methods & strategies	Assessment
D1- Communicate subtle and complex ideas, both in clear written prose and real-time spoken presentations. D2-Work effectively in a team on intellectually demanding tasks. D3-Demonstrate time-management and IT skills. D4 (with Advanced Research Pathway only) Give constructive feedback on others' technical work	Transferable skills are developed through coursework reports (D1-D3), oral presentations (D1), project reports (D1) and collaborative work in seminars and tutorial (D2,D4) Throughout, the learner is encouraged to develop transferable skills by maintaining a record of evidence and completing a personal development plan.	Transferable skills are assessed through a range of assignments built into the curriculum - coursework reports (D1,D4), oral presentations (D2,D4), project reports (D1, D2), project management work (D3).

D. Programme Structures, Features, Levels, Modules, and Credits

The programme is offered in the following modes

- Full-time (1 year), leading to the award of MSc Theoretical Physics
- Part-time (2 years), leading to the award of MSc Theoretical Physics
- Full-time (2 years), leading to the award of MSc Theoretical Physics with Advanced Research

Entry is at Level 7. Intake is in semester A (September).

To progress into year 2 of the Advanced Research route students must pass 90 credits in year 1. If they pass 90 credits or less in year 1, they must repeat their failed modules before progressing onto year 2 modules.

UKVI requirements for over-seas students

The University welcomes international applicants on the programme. The University of Hertfordshire does not typically sponsor students on a student route visa for part-time study. For additional information, please see <https://www.herts.ac.uk/international/new-international-students/coming-to-the-uk>

Professional and Statutory Regulatory Bodies

N/A

Work-Based Learning, including Sandwich Programmes

N/A

Programme Structure

The programme structure and progression information below (Table 1a and 1b) is provided for the award. Any interim awards are identified in Table 1b. The Programme Learning Outcomes detailed above are developed and assessed through the constituent modules. Table 2 identifies where each learning outcome is assessed.

Table 1a Outline Programme Structure

	Module Code	Credit Points	Language of Delivery	% Examination	% Coursework	% Practical	Semesters
Compulsory Modules							
Module Title							
Relativity and Field Theory	7PAM1027	15	English	0	100	0	A
Group and Representation Theory (level 6)	6PAM2002	15	English	0	100	0	A
Quantum Field Theory	7PAM1034	15	English	0	100	0	B
General Relativity	7PAM1033	15	English	0	100	0	B
Recent Advances in Theoretical Physics I	7PAM2006	30	Error! Bookmark not defined .English	0	100	0	AB
Theoretical Physics Research Project	7PAM2009	60	Error! Bookmark not defined .English	0	100	0	C/AB
Optional Modules							
Module Titles							
Statistics and Analysis	7PAM1035	15	English	0	100	0	A
Lagrangian Dynamics (level 6)	6PAM1061	15	English	0	100	0	A
High Energy Astrophysics	7PAM1020	15	English	0	100	0	B
Physics of Elementary Particles (level 6)	6PAM1051	15	English	0	100	0	B
Additional Modules on the “with Advanced Research” Degree							
Module Titles							
Research Seminar	7PAM2008	30	English	0	100	0	AB
Recent Advances in Theoretical Physics II	7PAM2007	30	English	0	100	0	AB

The award of an MSc degree requires 180 credit points including at least 150 credit points from level 7 modules which must include the Theoretical Physics Research Project, together with up to 30 credit points from level 6 modules.

The award of an MSc with Advanced Research degree requires 240 credit points including at least 180 credits from level 7 modules which must include the modules Theoretical Physics Research Project and Research

Seminar, together with up to 60 credits from level 6 modules.

Study Patterns:

MSc Theoretical Physics 180 Credits Mode of Study: One Year Full Time	Year 1		
	Semester A	Semester B	Semester C
	Relativity and Field Theory (15 Credits)	Quantum Field Theory (15 Credits)	
	Groups and Representations (15 Credits)	General Relativity (15 Credits)	
	Recent Advances in Theoretical Physics (30 Credits)		Theoretical Physics Research Project (60 Credits)
Statistics and Analysis (15 Credits) Or Lagrangian Dynamics (15 Credits)	High Energy Astrophysics (15 Credits) Or Physics of Elementary Particles (15 Credits)		

MSc Theoretical Physics 180 Credits Mode of Study: Two Years Part Time	Year 1			Year 2		
	Semester A	Semester B	Semester C	Semester A	Semester B	Semester C
	Relativity and Field Theory (15 Credits)	Quantum Field Theory (15 Credits)	Vacation Period	Recent Advances in Theoretical Physics I (30 Credits)		Vacation Period
	Groups and Representations (15 Credits)	General Relativity (15 Credits)				
	Statistics and Analysis (15 Credits) Or Lagrangian Dynamics (15 Credits)	High Energy Astrophysics (15 Credits) Or Physics of Elementary Particles (15 Credits)				
		Theoretical Physics Research Project (60 Credits)				

	Year 1			Year 2		
	Semester A	Semester B	Semester C	Semester A	Semester B	Semester C
MSc Theoretical Physics with Advanced Research 240 Credits Mode of Study Two Years Full Time	Relativity and Field Theory (15 Credits)	Quantum Field Theory (15 Credits)	Vacation Period	Recent Advances in Theoretical Physics II (30 Credits)	Vacation Period	Vacation Period
	Groups and Representations (15 Credits)	General Relativity (15 Credits)		Research Seminar (30 credits)		
	Recent Advances in Theoretical Physics I (30 Credits)					
	Statistics and Analysis (15 Credits) Or Lagrangian Dynamics (15 Credits)	High Energy Astrophysics (15 Credits) Or Physics of Elementary Particles (15 credits)		Theoretical Physics Research Project (60 Credits)		

Table 1b Final and interim awards available

The programme provides the following final and interim awards:

Final Award	Award Title	Minimum requirements	Available at end of (normally):	Programme Learning Outcomes developed (see above)
Masters with Advanced Research	Theoretical Physics	240 credit points with at most 60 at level 6 and the remainder at level 7. In addition, students must pass the modules Theoretical Physics Research Project and Research Seminar.	4 Semesters	All programme learning outcomes (see Table 2)
Masters	Theoretical Physics	180 credit points with at most 30 at level 6 and the remainder at level 7. In addition students must pass the module Theoretical Physics Research Project	3 Semesters	All programme learning outcomes other than B4 and D4 (see Table 2)

Interim Award	Award Title	Minimum requirements	Available at end of Level	Programme Learning Outcomes developed (see above)
Postgraduate Diploma	Theoretical Physics	120 credit points, including at least 90 at level 7	2, 3 Semesters	A1, A2, B1, B2, C1
Postgraduate Certificate	Theoretical Physics	60 credit points, including at least 45 at level 7	1-2 Semesters	A1, A2, B1, C1

Masters and Diploma awards can be made "with Distinction" or "with Commendation" where criteria as described in [UPR AS14](#), Section D and the students' handbook are met.

Programme-specific assessment regulations

The programme is compliant with the University's academic regulations (in particular, [UPR AS11](#), [UPR AS12](#) and [UPR AS14](#)) with the exception of those listed below, which have been specifically approved by the University:

The award of the MSc Theoretical Physics with Advanced Research degree requires 240 credit points, as detailed in Table 1b above.

Further points of clarification and interpretation relevant to this specific programme are given below:

- A pass grade in the Theoretical Physics Research Project is required for the award of the MSc Theoretical Physics degree.
- A pass grade in both the Theoretical Physics Research Project and Research Seminar is required for the award to the MSc Theoretical Physics with Advanced Research degree.

E. Management of Programme & Support for student learning

Management

The programme is managed and administered through:

- A Programme Leader, who has overall responsibility for the effective operationalization of the programme, and ensuring that academic standards are maintained and an effective student learning experience is provided. The Programme Leader also has overall responsibility for the quality assurance and enhancement of the programme providing advice and guidance to programme staff as appropriate. In addition the Programme Leader advises students about programme structure and regulations.
- Module Leaders to advise students about module-specific issues.
- An Admissions Tutor with specific responsibility for open days and selection.
- Student representatives and advocates who are members of a Programme Committee.
- A Student Handbook and Programme Canvas site, to explain the programme, the student support services that are available, and to provide a calendar describing the time-line of the programme within the academic year.
- Head of Department.
- Associate Dean (AQA).
- Associate Dean (L&T).
- Dean of School

Support

Students are supported by:

- A personal tutor, allocated to the student on entry.
- An induction week at the beginning of each new academic session.
- An Overseas Orientation Programme at the beginning of each new academic session, including English language support.
- The Physics, Astronomy & Mathematics (PAM) Industrial Training Placements Officer.
- The School of Physics, Engineering and Computer Science (SPECS) computing laboratories.
- StudyNet, a versatile on-line virtual learning environment.
- Guided student-centred learning on StudyNet module sites.
- Access to extensive digital and print collections of information resources.
- Attractive modern study environments in Learning Resources Centres.
- Help Desks in both the Learning Resources Centres.
- A Mathematics Support Service.
- A Department Equality Committee.
- A Careers and Employment Service for all current students and graduates to advise on opportunities for industrial placement, further study and employment.
- A substantial Student Centre that provides advice on issues such as finance, University regulations, legal matters, accommodation, international student support, etc.
- A Student Counseling Service that offers counseling and advice, runs workshops to help with examination worries and other concerns, and sets up Study Needs Agreements to help students with special-needs related study issues.
- Office of Dean of Students, incorporating Chaplaincy, Counseling and Nursery.
- The University Medical Centre.
- The University Disability Advisors.
- The Students' Union.

F. Other sources of information

In addition to this Programme Specification, the University publishes guidance to registered students on the programme and its constituent modules:

- A Programme (or Student) Handbook;
- A Definitive Module Document (DMD) for each constituent module;
- A Module Guide for each constituent module.

The [Ask Herts](#) website provides information on a wide range of resources and services available at the University of Hertfordshire including academic support, accommodation, fees, funding, visas, wellbeing services and student societies.

As a condition of registration, all students of the University of Hertfordshire are required to comply with the University's rules, regulations and procedures. These are published in a series of documents called 'University Policies and Regulations' (UPRs). The University requires that all students consult these documents which are available on-line, on the UPR web site, at: <http://www.herts.ac.uk/secreg/upr/>. In particular, [UPR SA07](#) 'Regulations and Advice for Students' Particular Attention - Index' provides information on the UPRs that contain the academic regulations of particular relevance for undergraduate and taught postgraduate students.

In accordance with section 4(5) of the Higher Education and Research Act 2017 (HERA), the UK Office for Students (OfS) has registered the University of Hertfordshire in the register of English higher education providers. The Register can be viewed at: <https://www.officeforstudents.org.uk/advice-and-guidance/the-register/the-ofs-register/>. Furthermore, the OfS has judged that the University of Hertfordshire delivers consistently outstanding teaching, learning and outcomes for its students. It is of the highest quality found in the UK. Consequently, the University received a Gold award in the 2018 Teaching Excellence and Student

Outcomes (TEF) exercise. This award was made in June 2018 and is valid for up to 3 years. The TEF panel's report and conclusions can be accessed at: <https://www.officeforstudents.org.uk/advice-and-guidance/teaching/tef-outcomes/#/provider/10007147>

G. Entry requirements

The normal entry requirements for the programme are a 2.1 or above Honours degree (or equivalent) in physics, mathematics or a closely related subject, where the degree is accredited by a Professional Statutory Regulatory Body such as the IoP (or a body of equivalent standing in a related subject or overseas).

Students who wish to join the course with a 2.2 may be considered on a case-by-case basis, where entry may be possible based on additional information and/or an interview.

It is not possible for students who have already obtained the MPhys (Physics) degree (PMMPHY) or MPhys (Astrophysics) degree (PMMPHYAP) to register on the Theoretical Physics MSc.

The programme is subject to the University's Principles, Policies and Regulations for the Admission of Students to Undergraduate and Taught Postgraduate Programmes (in [UPR SA03](#)), along with associated procedures. These will take account of University policy and guidelines for assessing accredited prior certificated learning (APCL) and accredited prior experiential learning (APEL).

If you would like this information in an alternative format please contact: Hutton Hub Administration Student Administration: hhaq@herts.ac.uk

If you wish to receive a copy of the latest Programme Annual Monitoring and Evaluation Report (AMER) and/or the External Examiner's Report for the programme, please email a request to aqo@herts.ac.uk

Table 2: Development of Intended Programme Learning Outcomes in the Constituent Modules

This map identifies where the programme learning outcomes are assessed in the constituent modules. It provides (i) an aid to academic staff in understanding how individual modules contribute to the programme aims (ii) a checklist for quality control purposes and (iii) a means to help students monitor their own learning, personal and professional development as the programme progresses.

MSc Theoretical Physics

		Programme Learning Outcomes (as identified in section 1 and the following page)										
		Knowledge & Understanding		Intellectual Skills			Practical Skills			Transferable Skills		
Module Title	Module Code	A1	A2	B1	B2	B3	C1	C2	C3	D1	D2	D3
Relativity and Field Theory	7PAM1027	x	x	x	x		x	x				
Groups and Representations	6PAM2002		x		x		x					
General Relativity	7PAM1033	x	x	x	x		x	x				
Quantum Field Theory	7PAM1034	x	x	x	x		x	x				
Statistics and Analysis	7PAM1035		x					x				
Theoretical Physics Research Project	7PAM2009	x	x	x	x	x	x	x	x	x		x
Lagrangian Dynamics	6PAM1061	x	x	x	x		x	x				
The Physics of Elementary Particles	6PAM1051	x	x	x	x		x	x				
High Energy Astrophysics	7PAM1020	x		x			x	x				
Recent Advances in Theoretical Physics I	7PAM2006	x	x	x	x		x	x	x	x	x	x

MSc Theoretical Physics with Advanced Research

		Programme Learning Outcomes (as identified in section 1 and the following page)												
		Knowledge & Understanding		Intellectual Skills				Practical Skills			Transferable Skills			
Module Title	Module Code	A1	A2	B1	B2	B3	B4	C1	C2	C3	D1	D2	D3	D4
Relativity and Field Theory	7PAM1027	x	x	x	x			x	x					
Groups and Representations	6PAM2002		x		x			x						
General Relativity	7PAM1033	x	x	x	x			x	x					
Quantum Field Theory	7PAM1034	x	x	x	x			x	x					
Statistics and Analysis	7PAM1035		x						x					
Research Seminar	7PAM2008	x	x	x	x		x	x	x	x	x	x	x	x
Theoretical Physics Research Project	7PAM2009	x	x	x	x	x		x	x	x	x		x	
Lagrangian Dynamics	6PAM1061	x	x	x	x			x	x					
The Physics of Elementary Particles	6PAM1051	x	x	x	x			x	x					
High Energy Astrophysics	7PAM1020	x		x				x	x					
Recent Advances in Theoretical Physics I	7PAM2006	x	x	x	x			x	x	x	x	x	x	
Recent Advances in Theoretical Physics II	7PAM2007	x	x	x	x		x	x	x	x	x	x	x	x

KEY TO PROGRAMME LEARNING OUTCOMES

Knowledge and Understanding

A1 The concepts, ideas and theories of theoretical physics at a deep and systematic level

A2 The mathematical theory, formalisms and techniques arising in the theoretical physics context, to an advanced level

Intellectual Skills

B1 Formulate and tackle problems in theoretical physics using advanced approaches

B2 Work with highly abstract and mathematical ideas relevant to physics

B3 Design, execute and report on a substantial investigation on an area of recent research

B4 (with Advanced Research Pathway only) Carry out scientific peer-review of others' written work

Practical Skills

C1 Perform advanced calculations in the settings of various physical theories

C2 Flexibly apply appropriate analytical and problem-solving techniques to problems in mathematical and theoretical physics

C3 Synthesise complex material from multiple sources in the scientific literature, and present findings in cogent form

Transferable Skills

D1 Communicate subtle and complex ideas, both in clear written prose and real-time spoken presentations.

D2 Work effectively in a team on intellectually demanding tasks

D3 Demonstrate time-management and IT skills.

D4 (with Advanced Research Pathway only) Give constructive feedback on others' technical work

Section 2

Programme management

Relevant QAA subject benchmarking statements	Physics, Mathematics
Type of programme	Taught postgraduate
Date of validation/last periodic review	February 2021
Date of production/ last revision of PS	February 2021
Relevant to level/cohort	Level 7 entering September 2021
Administrative School	School of Physics, Engineering & Computer Science

Table 3 Course structure

Course details		
Course code	Course description	HECOS
PETPM	MSc Theoretical Physics	100426
PETARM	MSc Theoretical Physics with Advanced Research	100426