The University Of Sheffield.

Programme Specification

A statement of the knowledge, understanding and skills that underpin a taught programme of study leading to an award from The University of Sheffield

Programme Details

1. Programme title	Mathematical and Theoretical Physics
2. Programme code	MAST34
3. QAA FHEQ level	7
4. Faculty	Science
5. Department	School of Mathematics and Statistics
6. Other departments providing credit bearing modules for the programme	Physics and Astronomy
7. Accrediting Professional or Statutory Body	Not applicable
8. Date of production/revision	March 2019, September 2022

Awards	Type of award	Duration
9. Final award	MSc	12 months
10. Intermediate awards	PG Diploma	12 months
	PG Certificate	12 months

Programme Codes

11. JACS code(s) *Select between one and three codes from the HESA website.*	F300	G120	
12. HECoS code(s) *Select between one and three codes from the HECoS vocabulary.*	100426	100403	100402

Programme Delivery

13. Mode of study	Full-time
14. Mode of delivery	In person

15. Background to the programme and subject area

The MSc Mathematical and Theoretical Physics builds on the shared strengths of two departments in the Faculty of Science: the School of Mathematics & Statistics (SoMaS) and the Department of Physics and Astronomy.

There is a strong relationship between the disciplines of mathematics and physics, and a shared foundation between Theoretical Physics and Applied Mathematics in particular. This programme harnesses the research interests and strengths of the staff in both departments, pursuing research in areas such as: solar physics; quantum information theory, gravitational wave astronomy; neutrino physics; solid state physics, cosmology; fluid dynamics; and Einstein's theory of general relativity.

The taught part of the programme (120 credits) is based around FHEQ Level 7 modules offered across the two departments, as well as a skills module, which builds communication, teamwork, record-keeping and planning skills, and encourages reflective practice. A 60-credit research project, assessed through a written dissertation, will be supervised by a research specialist, and the student will receive 1-to-1 supervision over the second half of the academic year and in the summer period.

The programme is broad, with substantial flexibility in module choice. For example, we will offer modules in Machine Learning; Stochastic Processes and Finance; and Biological Physics, which are less typically offered in competitor programmes. The programme will aim to set up students for employment opportunities in finance, machine learning/data analysis, software, physical modelling and other careers. It will also enable them to progress onto scientific research (PhD) in Sheffield or elsewhere.

The flexibility of the proposed programme should be seen as a key strength. The programme would be a good fit, for example, for an international student who wished to take their interest in fundamental physics as far as possible; but who has (or whose sponsors have) an eye on industry or finance opportunities afterwards.

The programme will undoubtedly strengthen the link between the mathematics and physics departments, which share the Hicks building. It will lead to improved collaboration on both teaching and research sides.

The programme fits with departmental Teaching & Learning priorities such as: research-led teaching and learning; working across boundaries; employability; and internationalisation. We will aim to attract a diverse balance of home and international students. This programme would offer a further avenue for attracting good PhD students, particularly from overseas.

16. Programme aims

MSc Mathematical and Theoretical Physics aims to:	
A1	develop the student's understanding of mathematical and theoretical physics, so that they are qualified and experienced to pursue either a research degree or a career in physics or related quantitative discipline;
A2	develop the student's independent research skills so that they can investigate a topic at the forefront of their discipline effectively;
A3	provide teaching which is informed, invigorated and inspired by the research and scholarship of the staff; and to provide a stimulating intellectual environment conducive to learning and independent research;

A4	provide students with assessments of their achievements and to identify and support academic excellence;

17. Programme learning outcomes

Knowledge and understanding On successful completion of the programme, students will be able to demonstrate knowledge and understanding of:		
		Links to Aim(s)
K1	advanced topics in mathematical and theoretical physics, such as general relativity, quantum mechanics, fluid dynamics and/or solar physics;	1, 3, 4
K2	in-depth knowledge and understanding of one research topic at, or informed by, the forefront of a discipline, supervised by one or more subject specialists;	1, 4
K3	a variety of mathematical methods used for modelling physical systems;	1, 3
K4	research skills, such as literature review, report writing, planning, effective communication, and reflective practice.	2
Skills and other attributes On successful completion of the programme, students will be able to:		
S1	learn independently, using written source material at a research level, such as primary or review papers in scientific journals, as well as other appropriate sources;	2
S2	apply key concepts and physical principles in reasoning and problem-solving;	1, 2, 4
S3	formulate physics problems quantitatively; and to obtain solutions of problems using appropriate mathematical methods and physical principles;	2, 3, 4
S4	show judgement in the selection and application of techniques in mathematical and theoretical physics;	1, 2
S5	plan and carry out advanced project work in a research environment;	1, 2
S6	summarise and present the results of research-level investigations both orally and in writing;	1, 2, 4
S7	evaluate current research, to follow mathematical arguments step-by-step, and to critique methodologies.	2, 4

18. Learning and teaching methods

The mode of delivery of teaching is face-to-face, on campus, supported by online learning technologies (Blackboard).

The learning spaces and facilities are matched to the type of teaching, with lectures typically occur in lecture theatres, problem classes in classroom spaces, and IT instruction (e.g., introduction to LaTeX) in computer rooms. Project supervision occurs in staff offices or other suitable smaller spaces.

Each module is led by a permanent member of academic staff in SoMaS and P&A. Typically, the module leader also gives the lectures and additional teaching, and coordinates the online learning environment (Blackboard).

Lectures. The standards required of a postgraduate in the physical sciences include the acquisition of a substantial body of knowledge. This is conveyed principally through traditional lectures where key points from the lecture notes are explained and illustrated, with computer demonstrations when appropriate. Lectures are recorded by default by the lecture capture system Encore, and are available for viewing online via Blackboard.

Problems classes.
Students will attend problems classes as part of several modules. Structured problem sheets and worked solutions are designed to help students to understand and apply the lecture material.

Assignments
Several taught modules include assignments and/or elements of continuous assessment, to promote the integration of theory with practical skills. These include Advanced Electrodynamics, Machine Learning, Mathematical Methods and Modelling of Natural Systems, Topics in Advanced Fluid Dynamics and Advanced Particle Physics.

Blackboard
The module materials will be made available through Blackboard. Support is available from a designated personal tutor, from the individual module lecturers, and from the Course Director via email or telephone. By default, lectures are recorded and made available to view online via Blackboard.

Personal Tutorials
Each student will be assigned a Personal Tutor from either SoMaS or P&A. Both SoMaS and P&A run a personal tutorial system conforming to the guidelines in the University's Students' Charter. The system is essentially pastoral. Tutors are available to provide personal support and general academic guidance.

Self-directed Learning
The core skills module helps students become self-directed learners, via continuous assessment activities including a weekly diary and reflective exercises. We have designated space for MSc students in an MSc study room (I21) and computing rooms in both departments.

Dissertation
Teaching for the dissertation is through supervision by one or more members of staff who are active researchers, or experts in their field. Students will experience the key phases of a relatively large piece of work: planning to a deadline; researching background information; acquisition and validation of data where appropriate; problem specification; carrying out of relevant analyses; and reporting, both at length through the dissertation and in summary through a presentation.

Libraries
Students have access to two libraries on campus, and the larger of these is open 24 hours a day, all year round.

19. Assessment and feedback methods

The principal method of summative assessment for the taught modules is through examinations, held in two periods at the end of the first and second semesters. The summative assessment for the project module, is a final dissertation of 10-20,000 words which is supported formatively by regular one to one meetings with the supervisor, where feedback and direction is given. There are also a few optional modules with a continuous assessment elements, such as assignments.

The provision of feedback through formative assessment varies between modules, according to learning outcomes. For example, some modules use problems classes to work through formative problems, where appropriate. Others use weekly marked homeworks, based on a set of structured problem sheets that align with the lecture material.

20. Programme structure and student development

Students take 105 credits of modules, made up from 15- and 30-credit modules across the two departments, some of which are core to the programme and others which may be chosen from a restricted list of modules offered by the two departments. In addition, students take a 60-credit research project/dissertation and a 15-credit research skills module. There is roughly a 50:50 split between core and optional units, and the broad choice in the latter will offer students appropriate flexibility to specialise.

The award of qualifications will follow University Regulations. For an MSc the candidate should obtain 180 credits, i.e., a pass standard (grade 50) in all elements of the course.

An attractive feature of the curriculum is the breadth offered in the non-core module choice. For example, a student can take modules in Finance and in Machine Learning, to broaden their curriculum for employment opportunities.

Detailed information about the structure of programmes, regulations concerning assessment and progression and descriptions of individual modules are published in the University Calendar available online at http://www.sheffield.ac.uk/calendar/.

21. Criteria for admission to the programme

Detailed information regarding admission to programmes is available from the University's On-Line Prospectus at http://www.shef.ac.uk/courses/.

22. Reference points

The learning outcomes have been developed to reflect the following points of reference:

Subject Benchmark Statements
https://www.qaa.ac.uk/quality-code/subject-benchmark-statements

Framework for Higher Education Qualifications (2014)
https://www.qaa.ac.uk/docs/qaa/quality-code/qualifications-frameworks.pdf

University Strategic Plan
http://www.sheffield.ac.uk/strategicplan

Learning and Teaching Strategy (2016-21)
https://www.sheffield.ac.uk/polopoly_fs/1.661828!/file/FinalStrategy.pdf

23. Additional information

This specification represents a concise statement about the main features of the programme and should be considered alongside other sources of information provided by the teaching department(s) and the University. In addition to programme specific information, further information about studying at The University of Sheffield can be accessed via our Student Services web site at http://www.shef.ac.uk/ssid.