

## MSc in Quantum Fields and Fundamental Forces

This document provides a definitive record of the main features of the programme and the learning outcomes that a typical student may reasonably be expected to achieve and demonstrate if s/he takes full advantage of the learning opportunities provided. This programme specification is primarily intended as a reference point for academic and support staff involved in delivering the programme and enabling student development and achievement, for its assessment by internal and external examiners, and in subsequent monitoring and review.

Programme Information				
Award(s)	MSc			
Programme Title	Quantum Fields and Fundamental Forces			
Programme code	F3UG, F3UG24			
Awarding Institution	Imperial College London			
Teaching Institution	Imperial College London			
Faculty	Natural Sciences			
Department	Physics			
Associateship	Royal College of Science			
Mode and Period of Study	MSc: 1 calendar year full-time (12 months) MSc: 2 calendar years part-time (24 months)			
Cohort Entry Points	Annually in October			
Relevant <a href="#">QAA Benchmark Statement(s)</a> and/or other external reference points	Master's Awards in Physics, Astronomy and Astrophysics			
Total Credits	ECTS:	90 - 94	UK Credits:	180 – 188
<a href="#">FHEQ Level</a>	Level 7 - Master's			
<a href="#">EHEA Level</a>	2 <sup>nd</sup> cycle			
External Accreditor(s)	N/A			
Specification Details				
Student cohorts covered by specification	2016-17 entry			
Person Responsible for the specification	Prof Kellogg Stelle			
Date of introduction of programme				
Date of programme specification/revision	August 2016			

## Description of Programme Contents

The programme has four compulsory modules:

- Particle Symmetries;
- Quantum Electrodynamics;
- Quantum Field Theory;
- Unification/the Standard Model.

And the following optional modules:

- Advanced Quantum Field Theory;
- Black Holes;
- Cosmology and Particle Physics;
- Differential Geometry;
- the Standard Model and Beyond;
- String Theory;
- Supersymmetry.

And the following undergraduate modules (students may take no more than two)

- Foundations of Quantum Mechanics;
- General Relativity;
- Group Theory
- Quantum Information;
- Quantum Theory of Matter.

The examinations for all the modules are in May-June. After the exams there are a series of special topics lectures, in which postdocs and staff members talk about their research interests.

By the beginning of July students shall have chosen the topic of their dissertation, which is submitted in late September.

Part time students are assessed on a minimum of one compulsory module and two optional modules in the first year. In the second year the rest of the modules are examined and the project is submitted in September.

## Learning Outcomes

### Knowledge and Understanding of :

- The most fundamental laws and principles of theoretical physics; along with their application (some at the forefront of the discipline);
- Research techniques which might include research and summation of the literature, designing appropriate mathematical models and computations to test physical principles and presenting their results making their assumptions and approximations explicit;
- How to use mathematical tools to describe the physical world.

### Intellectual Skills

- Apply theoretical knowledge of physical principles and mathematical techniques to problems in the field;
- Use mathematical techniques and interpret mathematical models of physical behaviour;
- Demonstrate the ability to plan, undertake, and report on a programme of original work.
- Research and examine critically the scientific literature.

### Professional Skills Development

- Problem-solving skills;
- Investigative skills;
- Communication skills;
- Analytical skills;
- IT skills;
- Personal skills.

The Imperial Graduate Attributes are a set of core competencies which we expect students to achieve through completion of any Imperial College degree programme. The Graduate Attributes are available at: [www.imperial.ac.uk/students/academic-support/graduate-attributes](http://www.imperial.ac.uk/students/academic-support/graduate-attributes)

### Entry Requirements

Academic Requirement	The minimum qualification for admission is normally a First class Honours degree in Physics or a relevant scientific discipline from a UK academic institution or an equivalent overseas qualification.
English Language Requirement	Standard Requirements: IELTS 6.5 with a minimum of 6.0 in each element or equivalent

The programme's competency standards documents can be found at: <http://www.imperial.ac.uk/natural-sciences/departments/physics/students/current-students/taught-postgraduates/>

### Learning & Teaching Strategy

Scheduled Learning & Teaching Methods	The MSc uses lectures, problem classes and e-learning to support student learning.
E-learning & Blended Learning Methods	The MSc uses Blackboard (and Panopto recording of lectures for some modules) to supplement the material taught in the lectures.
Project and Placement Learning Methods	The project will ensure that the student demonstrates their theoretical understanding to address a current research problem in physics in the College or with an external research organisation.

	Each project will have identified the Imperial College members of staff who will be the supervisor and deputy and they will be responsible for monitoring the student's progress and maintaining weekly contact with the student.				
<b>Assessment Strategy</b>					
Assessment Methods	The lecture modules are assessed by written examination. The project is assessed by report.				
Academic Feedback Policy					
The feedback policy will follow the guidelines of the Department of Physics, where written feedback should be provided to the student within two weeks of the work being submitted. Many of the lecture modules have classworks, which allow students to work through problems under the guidance of the lecturer.					
Re-sit Policy					
Students will be permitted to retake written examination on one occasion only. Students will not be permitted to retake practical classes and projects.					
Mitigating Circumstances Policy					
The College's Policy on Mitigating Circumstances is available at: <a href="http://www.imperial.ac.uk/registry/exams">www.imperial.ac.uk/registry/exams</a>					
<b>Programme Structure</b>					
Full-time		Term One	Term Two	Term Three	
Core Modules		3	1	0	
Elective Modules		4		0	
Projects		0	0	1	
Part-time (Year One)		Term One	Term Two	Term Three	
Core Modules		2		0	
Elective Modules		1 - 2		0	
Projects		0	0	0	
Part-time (Year Two)		Term One	Term Two	Term Three	
Core Modules		2		0	

Elective Modules		2 - 3	0	
Projects		0	0	1
<b>Assessment Dates &amp; Deadlines</b>				
Written Examinations	April - May. There is a voluntary test on several of the compulsory modules in January.			
Coursework Assessments	Continuous			
Project Deadlines	September			
Practical Assessments	None			
<b>Assessment Structure</b>				
Programme Component		ECTS	% Weighting	
4 x Core modules		32	40%	
4 x optional modules		28 - 32	40%	
Project		30	20%	
Total		90 - 94	100%	
<b>Marking Scheme</b>				
The marking scheme for the elements and components will follow the 'Regulations for the Examinations of Masters Degrees'				

Indicative Module List												
Code	Title	Core/ Elective	Year	L&T Hours	Ind. Study Hours	Place- ment Hours	Total Hours	% Written Exam	% Course- work	% Practical	FHEQ Level	ECTS
PT4.6	Unification	Core	1 OR 2	57	143	0	200	100%	0%	0%	7	8
PT4.4	Quantum Field Theory	Core	1 OR 2	57	143	0	200	100%	0%	0%	7	8
	Quantum Electrodynamics	Core	1 OR 2	30	170	0	200	100%	0%	0%	7	8
	Particle Symmetries	Core	1 OR 2	30	170	0	200	100%	0%	0%	7	8
	Advanced Quantum Field Theory	Elective	1 OR 2	30	170	0	200	100%	0%	0%	7	8
	Black Holes	Elective	1 OR 2	30	170	0	200	100%	0%	0%	7	8
	Cosmology and Particle Physics	Elective	1 OR 2	30	170	0	200	100%	0%	0%	7	8
	Differential Geometry	Elective	1 OR 2	30	170	0	200	100%	0%	0%	7	8
	Standard Model and Beyond	Elective	1 OR 2	30	170	0	200	100%	0%	0%	7	8
	String Theory	Elective	1 OR 2	30	170	0	200	100%	0%	0%	7	8
	Supersymmetry	Elective	1 OR 2	30	170	0	200	100%	0%	0%	7	8
PT3.1	Foundations of Quantum Mechanics	Elective	1 OR 2	57	93	0	150	100%	0%	0%	6	6
PT3.2	Group Theory	Elective	1 OR 2	57	93	0	150	100%	0%	0%	6	6
PT4.2	General Relativity	Elective	1 OR 2	57	93	0	150	100%	0%	0%	7	6

Indicative Module List												
Code	Title	Core/ Elective	Year	L&T Hours	Ind. Study Hours	Place- ment Hours	Total Hours	% Written Exam	% Course- work	% Practical	FHEQ Level	ECTS
PT4.8	Quantum Information	Elective	1 OR 2	57	93	0	150	100%	0%	0%	7	6
PT4.5	Quantum Theory of Matter	Elective	1 OR 2	57	93	0	150	100%	0%	0%	7	6
	Independent Research Project	Core	1	0	750	0	750	0%	100%	0%	7	30

## Supporting Information

The Programme Handbook is available at: <http://www.imperial.ac.uk/theoretical-physics/postgraduate-study/msc-in-quantum-fields-and-fundamental-forces/>

The Module Handbook is available at: <http://www.imperial.ac.uk/theoretical-physics/postgraduate-study/msc-in-quantum-fields-and-fundamental-forces/>

The College's entry requirements for postgraduate programmes can be found at: [www.imperial.ac.uk/study/pg/apply/requirements](http://www.imperial.ac.uk/study/pg/apply/requirements)

The College's Quality & Enhancement Framework is available at: [www.imperial.ac.uk/registry/proceduresandregulations/qualityassurance](http://www.imperial.ac.uk/registry/proceduresandregulations/qualityassurance)

The College's Academic and Examination Regulations can be found at: <http://www3.imperial.ac.uk/registry/proceduresandregulations/regulations>

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<http://www.imperial.ac.uk/admin-services/secretariat/college-governance/charters-statutes-ordinances-and-regulations/>

Imperial College London is regulated by the Higher Education Funding Council for England (HEFCE) <http://www.hefce.ac.uk/reg/of/>