

MSc 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 intended as a reference point for prospective students, current students, external examiners and academic and support staff involved in delivering the programme and enabling student development and achievement.

Programme Information			
Programme Title	Quantum Fields and Fundamental Forces		
Award(s)	MSc		
Programme Code	F3UG (1YFT)	F3UG24 (2YPT)	
Associateship	None		
Awarding Institution	Imperial College London		
Teaching Institution	Imperial College London		
Faculty	Faculty of Natural Sciences		
Department	Department of Physics		
Main Location of Study	South Kensington Campus		
Mode and Period of Study	1 academic year, full-time or 2 academic years, part-time		
Cohort Entry Points	Annually in October		
Relevant QAA Benchmark Statement(s) and/or other external reference points	Master's Awards in Physics, Astronomy and Astrophysics		
Total Credits	ECTS:	90 - 94	CATS: 180 – 188
FHEQ Level	Level 7		
EHEA Level	2 nd cycle		
Specification Details			
Student cohorts covered by specification	2019-20 entry		
Person responsible for the specification	Prof Kellogg Stelle		
Date of introduction of programme			
Date of programme specification/revision	October 2019		

Programme Overview

This renowned MSc course is designed to prepare students for PhD study in fundamental theoretical physics by bridging the gap between an undergraduate course in physics or mathematics and the research frontier. The origins of the programme date back to the founding of the Theoretical Physics Group by Abdus Salam, one of Imperial's Nobel Laureates. The Theoretical Physics Group is internationally recognised for its contribution to our understanding of the unification of fundamental forces, the early universe, quantum gravity, supersymmetry, string theory, and quantum field theory.

The course attracts around thirty to forty students annually. Full-length lecture courses, of which students choose eight for examination, occupy the year up to June. Many of these courses are often also taken by postgraduate students from Imperial and other London colleges and by visiting European exchange students. They are followed by two weeks of short courses on topics of current interest. The students then spend the summer working on a supervised project in a specialist area. This can involve original research and leads to the writing of a dissertation.

Learning Outcomes

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

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:

- Research and computational skills are taught by the project work, which requires students to design and undertake a theoretical analysis and prepare assessed technical reports and presentations.

Entry Requirements

Academic Requirement

Normally a First class (1st) UK Bachelor's Degree with Honours in Physics or Mathematics with Theoretical Physics options (or a comparable qualification recognised by the College).

English Language Requirement

[Standard requirement](#)
IELTS score of 6.5 overall (minimum 6.0 in all elements)

The programme's competency standards document can be found at:

<http://www.imperial.ac.uk/physics/students/current-students/taught-postgraduates/>

Learning & Teaching Strategy

Scheduled Learning & Teaching Methods

- Lectures
- Problem classes

E-learning & Blended Learning Methods

- Blackboard VLE
- Panopto

Project and Placement Learning Methods

- Independent research project

Assessment Strategy

Assessment Methods

- Written examinations
- Reports

Academic Feedback Policy

The feedback policy will follow the guidelines of the Department of Physics, where written feedback for minor pieces of coursework should be provided to the student within two weeks of the work being submitted. For major pieces of coursework feedback should be provided in four weeks, although marks may not be returned until after the Board of Examiners meeting. Many of the lecture modules have classworks, which allow students to work through problems under the guidance of the lecturer.

Re-sit Policy

In line with College policy, students who are unsuccessful in any of their examinations may usually be allowed an opportunity to re-sit at the discretion of the Board of Examiners.

Specific information regarding re-sits for Taught Master's degrees can be found in the relevant Academic Regulations available at: <https://www.imperial.ac.uk/about/governance/academic-governance/regulations/>

Mitigating Circumstances Policy

Students may be eligible to apply for mitigation if they have suffered from serious and unforeseen circumstances during the course of their studies that have adversely affected their ability to complete an assessment task and/or their performance in a piece of assessment.

The College's Policy on Mitigating Circumstances is available at:

<https://www.imperial.ac.uk/about/governance/academic-governance/academic-policy/exams-and-assessment/>

Programme Structure			
Full-time	Term One	Term Two	Term Three
Core Modules	4	0	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
Assessment Dates & Deadlines			
Written Examinations	April - May. There is a voluntary test on several of the compulsory modules in January.		
Coursework Assessments	N/A		
Project Deadlines	September		
Practical Assessments	None		
Assessment Structure			
Marking Scheme			

Pass

- In order to be awarded a result of pass, a candidate must achieve an aggregate weighted mark of at least 50% per cent in the core modules, the elective modules and the dissertation.

Merit

- In order to be awarded a result of merit, a candidate must normally achieve a weighted aggregate mark of 60% or higher AND a mark of 60% or higher for all the core modules AND the elective modules AND the dissertation.

Distinction

- In order to be awarded a result of distinction a candidate must normally achieve a weighted aggregate mark of 70% or higher AND at least 70 per cent weighted aggregate mark across the core modules AND the elective modules, AND the dissertation mark above 70%.

Module Weighting	
Module	% Module Weighting
Particle Symmetries	10%
Quantum Electrodynamics	10%
Quantum Field Theory*	10%
Unification*	10%
4 x elective modules	10% each
Research Project	20%

* Students must replace these modules if they have already taken these modules as undergraduate students.

Indicative Module List											
Code	Title	Core/ Elective	L&T Hours	Ind. Study Hours	Place- ment Hours	Total Hours	% Written Exam	% Course- work	% Practical	FHEQ Level	ECTS
PT4.6	Unification	Core*	57	143	0	200	100%	0%	0%	7	8
PT4.4	Quantum Field Theory	Core*	57	143	0	200	100%	0%	0%	7	8
PH9.FQED	Quantum Electrodynamics	Core	30	170	0	200	100%	0%	0%	7	8
PH9.FPS	Particle Symmetries	Core	30	170	0	200	100%	0%	0%	7	8
PH9.FAQFT	Advanced Quantum Field Theory	Elective	30	170	0	200	100%	0%	0%	7	8
PH9.FAGR	Black Holes	Elective	30	170	0	200	100%	0%	0%	7	8
PH9.FCPP	Relativity and Cosmology	Elective	30	170	0	200	100%	0%	0%	7	8
PH9.FDG	Differential Geometry	Elective	30	170	0	200	100%	0%	0%	7	8
PH9.FSMB	Standard Model and Beyond	Elective	30	170	0	200	100%	0%	0%	7	8
PH9.FST	String Theory	Elective	30	170	0	200	100%	0%	0%	7	8
PH9.FSS	Supersymmetry	Elective	30	170	0	200	100%	0%	0%	7	8
PT3.1	Foundations of Quantum Mechanics	Elective	57	93	0	150	100%	0%	0%	6	6
PT3.2	Group Theory	Elective	57	93	0	150	100%	0%	0%	6	6
PT4.2	General Relativity	Elective	57	93	0	150	100%	0%	0%	7	6

Indicative Module List											
Code	Title	Core/ Elective	L&T Hours	Ind. Study Hours	Place- ment Hours	Total Hours	% Written Exam	% Course- work	% Practical	FHEQ Level	ECTS
PT4.8	Quantum Information	Elective	57	93	0	150	100%	0%	0%	7	6
PT4.5	Quantum Theory of Matter	Elective	57	93	0	150	100%	0%	0%	7	6
PH9.FPRJ	Independent Research Project	Core	0	750	0	750	0%	100%	0%	7	30

* Students who have already taken these modules as part of the UG programme will replace these modules with appropriate elective modules.

Supporting Information

The Programme Handbook is available at: <http://www.imperial.ac.uk/natural-sciences/departments/physics/students/current-students/taught-postgraduates/>

The Module Handbook is available at: <http://www.imperial.ac.uk/natural-sciences/departments/physics/students/current-students/taught-postgraduates/>

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

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

The College's Academic and Examination Regulations can be found at: <https://www.imperial.ac.uk/about/governance/academic-governance/regulations>

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

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