Programme Title: BSc Physics with Particle Physics

# Programme Specification

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| Awarding Body/Institution | Queen Mary University of London |
| Teaching Institution | Queen Mary University of London |
| Name of Final Award and Programme Title | BSc Physics with Particle Physics |
| Name of Interim Award(s) | |
| Duration of Study / Period of Registration | Three Years |
| QM Programme Code / UCAS Code(s) | F392 |
| QAA Benchmark Group | Physics |
| FHEQ Level of Award | Level 6 |
| Programme Accredited by | Institute of Physics |
| Date Programme Specification Approved | 18 January 2018 |
| Responsible School / Institute | School of Physics and Astronomy |

| Schools which will also be involved in teaching part of the programme |
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| Institution(s) other than Queen Mary that will provide some teaching for the programme |
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## Programme Outline

The Physics with Particle Physics Programme closely follows the core physics programme but with an emphasis on experimental particle physics. In particular, some modules that are options in F300 are required in this programme: Statistical Data Analysis, Quantum Mechanics B, and Radiation Detectors. The extended physics project will normally be under the supervision of an academic member of staff from the Particle Physics Research Centre.

## Aims of the Programme

We aim to:
teach physics with particle physics to a high standard within an excellent research environment;
recruit students able to benefit from a university education;
enable students with a variety of educational backgrounds to pursue physics in particle physics;

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enable students to tailor their studies to their own needs and interests;
instill in students an understanding of the working of the physical world, in particular particle physics;
encourage students to develop transferable skills that are applicable to a variety of careers;
provide a programme that prepares students for a range of professional careers in physics.
provide opportunities for students to appreciate the beauty of physics with particle physics and to develop a desire for learning.

## What Will You Be Expected to Achieve?

All programmes share a set of common learning outcomes.
Students successfully completing this programme will:

| Academic Content: | |
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| A1 | Have acquired a core knowledge of physics with particle physics. |
| A2 | Have seen and understood the application of core physics to particle physics |
| A3 | Have acquired an understanding of the workings of the physical world, in particular particle physics |
| A4 | Have acquired an understanding of scientific measurement and associated uncertainties |

| Disciplinary Skills - able to: | |
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| B1 | effectively communicate core knowledge of physics and particle physics in written reports and oral presentation |
| B2 | effectively use computers for: document preparation, spreadsheet computing, data acquisition, manipulation and analysis |
| B3 | use high-level programming languages |
| B4 | apply scientific methods to the analysis of problems |

| Attributes: | |
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| C1 | To acquire and apply knowledge in a rigorous way. |
| C2 | To connect information and ideas within their field of study. |
| C3 | To adapt their understanding to new and unfamiliar settings. |
| C4 | To develop the ability to reflect upon and assess their own progress. |
| C5 | To engage with the professional world. |

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| C 6 | To acquire new learning in a range of ways, both individually and collaboratively. |
| C 7 | To possess the skills to influence, negotiate and lead. |
| C 8 | To use quantitative data confidently and competently. |
| C 9 | To show respect the opinions of others an a readiness to act inclusively. |
| C 10 | To obtain transferable key skills to help them with their career goals and their continuing education. |
| C 11 | To develop effective spoken and written English. |
| C 12 | To explain and argue clearly and concisely. |
| C 13 | To use communication technologies competently. |
| C 14 | To apply their analytical skills to investigate unfamiliar problems. |
| C 15 | To work individually and in collaboration with others. |
| C 16 | To use information for evidence-based decision-making and creative thinking. |

| QMUL Model Learning Outcomes - Level 4: | |
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| D 1 | Identify and discuss their own career aspirations or enterprise skills and knowledge and how they impact on others |
| D 2 | |
| D 3 | |

## How Will You Learn?

Our programme is constructed within a modular course structure in which each student takes eight or nine modules per year. Our overall strategy is to achieve a balance, appropriate to the aims of each course unit, between teaching
- lectures
- practical laboratory work
- small-group tutorials

and learning by students
- peer discussion
- exercise classes
- coursework
- essay assignments
- independent work in laboratories and computer studies
- teach-yourself computer packages and the Internet
- videos
- textbooks and supplementary reading.

Exercise classes or laboratories are provided for all compulsory modules which are used to develop the specific skills needed. Two general physics laboratories are used to develop experimental skills, including the acquisition of data and the analysis of

uncertainties of observation. In addition students learn to write a scientific account of their experimental observation. Finally, review and experimental projects are used to develop students' investigative skills. Students studying Physics with Particle Physics normally undertake their project under the supervision of a member of the Particle Physics Research Centre.

## How Will You Be Assessed?

Assessment is by a mixture of continuous assessment and formal written examinations at the end of each year. We use a variety of in-course assessments to enable students to get quick feedback as to their performance. These include weekly coursework (marked and returned on a weekly basis), essay assignments, mid-term tests carried out in a lecture slot, performance in exercise classes and tutorials, laboratory and project reports. These in-course assessments are combined with formal final written examination results and oral examinations (on project reports) to produce the final mark for each course unit. The precise mixture of in-course and final exam marks to give the overall mark varies between different course units and is specified in the detailed course unit description given in the Student Handbook.

## How is the Programme Structured?

Please specify the full time and part time programme diets (if appropriate).

The programme consists of compulsory and elective modules. All undergraduate students at Queen Mary take 120 credits a year. A BSc degree consists of 360 credits. Most modules are worth 15 credits which means that students normally take 8 modules a year. In your third year students normally study for a project worth 30 credits. Students are required to take all modules marked as 'compulsory'. Where modules are indicated as "elective" or "suggested" or "optional" students may choose whether or not to take the module. Where there is space in the curriculum, level 5 and 6 students make take up to 15 credits per academic year from another
School at Queen Mary. Students who chose this option are responsible for finding their own modules and complying with all registration requirements. Students at level 4 should choose from one of the SPA level 4 modules available. Finally, the programme includes one compulsory non credit bearing (study only) module in the first, second and third years: SPA3000 Basic Mathematical Techniques (N.B. from September 2018), SPA5000 Communication Skills for Physicists and SPA6300 Synoptic Physics.

## QMUL Model

Students are required to undertake the equivalent of one module (15 credits in 2017/18) per year of study which has been identified as meeting the requirements of the QMUL Model. Each of these modules has been designed to combine the best of QMUL's academic excellence with your ability to identify and develop your skills, networks and experience. This will help to ensure you become a graduate who can undertake further study or secure graduate employment in areas that interest you, and will support your ability to position yourself to find the right job or opportunity for you. The relevant module for your first year of study in 2017/18 is indicated below.

Where more than one module is specified, this is because pertinent elements from these modules have been identified as being appropriate to the QMUL Model and when studied together, deliver the equivalent content of one 15-credit QMUL Model module.

The QMUL Model modules for future years and associated Learning Outcomes will be identified as your studies continue.

Should Professional, Statutory and Regulatory Body requirements apply to your programme of study, these will be taken into account in the specification of QMUL Model requirements.

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Academic Year of Study FT - Year 1

| Module Title | Module Code | Credits | Level | Module Selection Status | Academic Year of Study | Semester | QMUL Model |
|---|---|---|---|---|---|---|---|
| Professional Skills for Scientists | SPA4601 | 15 | 4 | Compulsory | 1 | Semester 1 | Yes |
| Mathematical Techniques 1 | SPA4121 | 15 | 4 | Compulsory | 1 | Semester 1 | No |
| Classical Physics | SPA4401 | 15 | 4 | Compulsory | 1 | Semester 1 | No |
| Scientific Measurement | SPA4103 | 15 | 4 | Compulsory | 1 | Semester 1 | No |
| Modern Physics | SPA4402 | 15 | 4 | Compulsory | 1 | Semester 2 | No |
| Electric and Magnetic Fields | SPA4210 | 15 | 4 | Compulsory | 1 | Semester 2 | No |
| Mathematical Techniques 2 | SPA4122 | 15 | 4 | Compulsory | 1 | Semester 2 | No |
| Our Universe | SPA4101 | 15 | 4 | Elective | 1 | Semester 2 | No |
| Introduction to Energy and Environmental Physics | SPA4250 | 15 | 4 | Elective | 1 | Semester 2 | No |
| Basic Mathematical Techniques | SPA3000 | 0 | 4 | Compulsory | 1 | Semesters 1 & 2 | No |

Academic Year of Study FT - Year 2

| Module Title | Module Code | Credits | Level | Module Selection Status | Academic Year of Study | Semester | QMUL Model |
|---|---|---|---|---|---|---|---|
| Thermodynamics | SPA5219 | 15 | 5 | Compulsory | 2 | Semester 1 | No |
| Quantum Mechanics A | SPA5319 | 15 | 5 | Compulsory | 2 | Semester 1 | No |
| Nuclear Physics and Astrophysics | SPA5302 | 15 | 5 | Elective | 2 | Semester 1 | No |

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| Module Title | Module Code | Credits | Level | Module Selection Status | Academic Year of Study | Semester | QMUL Model |
|---|---|---|---|---|---|---|---|
| Physics Laboratory | SPA5201 | 15 | 5 | Compulsory | 2 | Semester 2 | No |
| Condensed Matter A | SPA5228 | 15 | 5 | Compulsory | 2 | Semester 2 | No |
| Electromagnetic Waves and Optics | SPA5222 | 15 | 5 | Compulsory | 2 | Semester 2 | No |
| Mathematical Techniques 3 | SPA5218 | 15 | 5 | Elective | 2 | Semester 1 | No |
| Planetary Systems | SPA5241 | 15 | 5 | Elective | 2 | Semester 1 | No |
| Stars | SPA5307 | 15 | 5 | Elective | 2 | Semester 2 | No |
| Physical Dynamics | SPA5304 | 15 | 5 | Elective | 2 | Semester 2 | No |
| Communication Skills for Scientists | SPA5000 | 0 | 5 | Compulsory | 2 | Semester 1 | No |
| Introduction to Energy and Environmental Physics | SPA4250 | 15 | 4 | Elective | 2 | Semester 2 | No |
| Our Universe | SPA4101 | 15 | 4 | Elective | 2 | Semester 2 | No |
| Introduction to Scientific Computing | SPA5666 | 15 | 5 | Elective | 2 | Semester 1 | Yes |
| Introduction to Scientific Computing | SPA5666 | 15 | 5 | Elective | 2 | Semester 2 | Yes |

Academic Year of Study FT - Year 3

| Module Title | Module Code | Credits | Level | Module Selection Status | Academic Year of Study | Semester | QMUL Model |
|---|---|---|---|---|---|---|---|
| Synoptic Physics | SPA6300 | 0 | 6 | Compulsory | 3 | Semester 1 | No |
| Statistical Physics | SPA6403 | 15 | 6 | Compulsory | 3 | Semester 2 | No |
| Extended Independent Project | SPA6776 | 30 | 6 | Compulsory | 3 | Semesters 1 & 2 | No |

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| Module Title | Module Code | Credits | Level | Module Selection Status | Academic Year of Study | Semester | QMUL Model |
|---|---|---|---|---|---|---|---|
| Statistical Data Analysis | SPA6328 | 15 | 6 | Compulsory | 3 | Semester 1 | No |
| Radiation Detectors | SPA6309 | 15 | 6 | Compulsory | 3 | Semester 2 | No |
| Quantum Mechanics B | SPA6413 | 15 | 6 | Elective | 3 | Semester 1 | No |
| Elementary Particle Physics | SPA6306 | 15 | 6 | Compulsory | 3 | Semester 1 | No |
| Physical Cosmology | SPA6311 | 15 | 6 | Elective | 3 | Semester 2 | No |
| Group Project for Physicists | SPA6543 | 15 | 6 | Elective | 3 | Semester 2 | No |
| Quantum Mechanics and Symmetry | SPA6325 | 15 | 6 | Elective | 3 | Semester 2 | No |
| Computational Condensed Matter Physics | SPA6315 | 15 | 6 | Elective | 3 | Semester 1 | No |

## What Are the Entry Requirements?

Entry requirements are in common with the F300 Physics programme.

Overall tariff score required: 320 points.

A-level: grade A or B in physics and mathematics or viceversa and a B in any other subject expect General Studies.

International Baccalaureate: 32 points overall with 6 in both HL(Higher Level) Physics and HL Mathematics.

European Baccalaureate: 75 % overall 7/6 in maths/physics in any order.

Access courses to HE (Higher Education) with speciality in Maths, Physics or Science: 60 credits overall, to include 45 credits at level 3, with al least 30 at Distict and 15 at Merit, which must include both Maths and Physics.

## How Do We Listen and Act on Your Feedback?

The Staff-Student Liaison Committee provides a formal means of communication and discussion between schools/institutes and its students. The committee consists of student representatives from each year in the school/institute together with appropriate representation from staff within the school/institute. It is designed to respond to the needs of students, as well as act as a forum for discussing programme and module developments. Staff-Student Liaison Committees meet regularly throughout the year.

Each school/institute operates a Learning and Teaching Committee, or equivalent, which advises the School/Institute Director of Taught Programmes on all matters relating to the delivery of taught programmes at school level including monitoring the application of relevant QM policies and reviewing all proposals for module and programme approval and amendment before submission to Taught Programmes Board. Student views are incorporated in the committee's work in a number of ways, such as through student membership, or consideration of student surveys.

All schools/institutes operate an Annual Programme Review of their taught undergraduate and postgraduate provision. APR is a continuous process of reflection and action planning which is owned by those responsible for programme delivery; the main

document of reference for this process is the Taught Programmes Action Plan (TPAP) which is the summary of the school/ institute's work throughout the year to monitor academic standards and to improve the student experience. Students' views are considered in this process through analysis of the NSS and module evaluations.

## Academic Support

The School of Physics and Astronomy provides each student with an academic advisor, normally the same member of staff for the duration of a student's studies, who can provide academic and pastoral guidance. Additionally the School has a dedicated Student Support Administrator who is available to discuss any student related problem. The School runs an open door policy which encourages the students to come and talk to their advisor, other academics or the dedicated Student Support Administrator. The School also actively participates in the QMUL Peer Assisted Study Scheme (PASS).
The Senior Tutor has overall responsibility for academic support and pastoral care within the School. The Senior Tutor also has a key role in overseeing the School's attendance policy. The Senior Tutor will address any problems that cannot be resolved by a student's academic adviser or the Student Support Officer.

## Programme-specific Rules and Facts

This programme follows the standard QM progression criteria and degree classification algorithm. The final degree classification is determined by the college mark which is a weighted average of the first, second and third year averages in the ratio 1:3:6 respectively.

## Specific Support for Disabled Students

Queen Mary has a central Disability and Dyslexia Service (DDS) that offers support for all students with disabilities, specific learning difficulties and mental health issues. The DDS supports all Queen Mary students: full-time, part-time, undergraduate, postgraduate, UK and international at all campuses and all sites.

Students can access advice, guidance and support in the following areas:
• Finding out if you have a specific learning difficulty like dyslexia
• Applying for funding through the Disabled Students' Allowance (DSA)
• Arranging DSA assessments of need
• Special arrangements in examinations
• Accessing loaned equipment (e.g. digital recorders)
• Specialist one-to-one "study skills" tuition
• Ensuring access to course materials in alternative formats (e.g. Braille)
• Providing educational support workers (e.g. note-takers, readers, library assistants)
• Mentoring support for students with mental health issues and conditions on the autistic spectrum.

## Links With Employers, Placement Opportunities and Transferable Skills

The School actively participates in the South East Physics Network (SEPNet) summer internship programme as well as funding a small number of internal, paid summer internships. The School works closely with the Careers Service to provide a series of bespoke events for physics students and has also recently prepared a careers booklet, in conjunction with the Institute of Physics, detailing careers opportunities for students of physics and explaining the necessary skill sets required for each area of work. The programme also includes the third year optional module SPA6543 Group Project for Physicists which directly involves external industrial partners in setting the projects.

Many of our BSc graduates go on to further specialist study of Physics at MSc or PhD level but significant numbers aim at careers that indirectly use their physics training. Differently, almost all MSci graduates go on to further specialist study of Physics at PhD level however they may easily enter a range of other career paths that use the transferable skills gained in the MSci programme

of study.

These employment areas include teaching at secondary or tertiary level, management, finance, IT and journalism. All physics graduates with reasonable degrees are highly employable because of the skills they gain in their studies. The most important of these skills are: numeracy, familiarity with computers and IT, problem-solving skills, ability to carry out measurement and observation and to analyse the results thereof, the ability to write technical reports and the ability to give oral presentations of scientific arguments.

Recent experience from students taking a project in particle physics or a Summer internship shows that they became very enthusiastic about the subject studied and continued their studies in particle physics either with a PhD or a Master. In other instances, students moved easily to the financial sector.

## Programme Specification Approval

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| **Person completing Programme Specification** | Dr. Craig Agnor |
| **Person responsible for management of programme** | Dr. Marcella Bona |
| **Date Programme Specification produced/amended by School Learning and Teaching Committee** | 18 January 2018 |
| **Date Programme Specification approved by Taught Programmes Board** | 18 January 2018 |