Royal Holloway, University of London
Course specification for an undergraduate award
MSCI PHYSICS WITH PARTICLE PHYSICS (F372)

Section 1 – Introduction to your course

This course specification is a formal document, which provides a summary of the main features of your course and the learning outcomes that you might reasonably be expected to achieve and demonstrate if you take full advantage of the learning opportunities that are provided. Further information is contained in the University prospectus, and in various handbooks, all of which you will be able to access online. Alternatively, further information on the University's academic regulations and policies can be found here. Further information on the University's Admissions Policy can be found here.

Your degree course in MSci Physics with Particle Physics is delivered in four stages, each of which comprises one year of full-time study during which you must follow modules to the value of 120 national credits (which is equivalent to 60 ECTS credits[1]). For some courses there is the option of part-time study. In that case a stage may be spread over two years of study; in each part-time year you will follow modules to the value of 60 credits. The curriculum is characterised by strong progression and opportunities for specialisation throughout the course. Stages one and two provide a foundation for the later stages through a compulsory spine of modules that complete a core, discipline-specific, knowledge base. Stages three and four offer a wide range of optional modules with the latter being taught on an intercollegiate basis by members of the University of London Physics MSci consortium.

While Royal Holloway keeps all the information made available under review, courses and the availability of individual modules, especially optional modules are necessarily subject to change at any time, and you are therefore advised to seek confirmation of any factors which might affect your decision to follow a specific course. In turn, Royal Holloway will inform you as soon as is practicable of any significant changes which might affect your studies.

The following is a brief description for some of the most important terminology for understanding the content of this document:

Degree course – May also be referred to as 'degree programme' or simply 'programme', these terms refer to the qualification you will be awarded upon successful completion of your studies.
Module – May also be referred to as 'course', this refers to the individual units you will study each year to complete your degree course. Undergraduate degrees at Royal Holloway comprise a combination of modules in multiples of 15 credits to the value of 120 credits per year. On some degree courses a certain number of optional modules must be passed for a particular degree title.

[1] The European Credit Transfer and Accumulation System (ECTS) is a learner-centred system for credit accumulation and transfer. ECTS credits reflect the total workload required to achieve defined learning outcomes and their associated workload, including teaching hours and guided independent study. 15 UK credits is equivalent to 7.5 ECTS. 30 UK credits is equivalent to 15 ECTS. Further details on ECTS can be found within the ECTS User Guide 2015.

Section 2 – Course details			
Date of specification update	May 2024	**Location of study**	Egham Campus
Course award and title	MSci Physics with Particle Physics	**Level of study**	Undergraduate
Course code	2376	**UCAS code**	F372
Year of entry	2027/28	**Language(s) of Tuition**	English
Awarding body	Royal Holloway, University of London		
Department	Physical Sciences and Engineering	**Other departments involved in teaching the course**	N/A
Mode(s) of attendance	Full-time	**Duration of the course**	4 years
Accrediting Professional, Statutory or Regulatory Body requirement(s)	Institute of Physics (IOP) – successful completion of this course fully meets the educational requirement for becoming a Chartered Physicist. Students must pass PH4100 Major Project.		
Link to Coursefinder for further information:	https://www.royalholloway.ac.uk/studying-here/	**For queries on admissions:**	https://royalholloway.ac.uk/applicationquery

Section 3 – Degree course structure					
3.1 Mandatory module information **The following table summarises the mandatory modules which students must take in each year of study**					
Year	**Module code**	**Module title**	**Credits**	**FHEQ level**	**Module status (Mandatory Condonable MC or Mandatory Non-Condonable MNC)**
1	PH1110	Mathematics for Scientists 1	15	4	MNC
1	PH1120	Mathematics for Scientists 2	15	4	MNC
1	PH1140	Scientific Skills 1	15	4	MC
1	PH1150	Scientific Skills 2	15	4	MC
1	PH1320	Classical Mechanics	15	4	MC
1	PH1420	Fields and Waves	15	4	MC
1	PH1620	Classical Matter	15	4	MC
1	PH1920	Physics of the Universe	15	4	MC
2	PH2130	Mathematical Methods	15	5	MNC
2	PH2150	Scientific Computing Skills	15	5	MC
2	PH2210	Quantum Mechanics	15	5	MNC
2	PH2270	Scientific Skills for Particle Physics	15	5	MC
2	PH2310	Optics	15	5	MC
2	PH2420	Electromagnetism	15	5	MC
2	PH2610	Classical and Statistical Thermodynamics	15	5	MC
2	PH2710	The Solid State	15	5	MC

3	PH3010	Advanced Skills	15	6	MNC
3	PH3210	Quantum Theory	15	6	MC
3	PH3520	Particle Physics	15	6	MC
4	PH4100	Major Project	30	7	MNC
4	PH4110	Research Review	15	7	MC

This table sets out the most important information for the mandatory modules on your degree course. These modules are central to achieving your learning outcomes, so they are compulsory, and all students on your degree course will be required to take them. You will be automatically registered for these modules each year. Mandatory modules fall into two categories: 'condonable' or 'non-condonable'.

In the case of mandatory 'non-condonable' (MNC) modules, you must pass the module before you can proceed to the next year of your course, or to successfully graduate with a particular degree title. In the case of mandatory 'condonable' (MC) modules, these must be taken but you can still progress or graduate even if you do not pass them. Please note that although Royal Holloway will keep changes to a minimum, changes to your degree course may be made where reasonable and necessary due to unexpected events. For example: where requirements of relevant Professional, Statutory or Regulatory Bodies have changed and course requirements must change accordingly, or where changes are deemed necessary on the basis of student feedback and/or the advice of external advisors, to enhance academic provision.

The topic of the Major Project PH4100 will be related to the specific degree course.

3.2 Optional modules

In addition to mandatory modules, there will be a number of optional modules available during the course of your degree. Although Royal Holloway will keep changes to a minimum, new options may be offered or existing ones may be withdrawn. For example, where reasonable and necessary due to unexpected events, where requirements of relevant Professional, Statutory or Regulatory Bodies (PSRBs) have changed and course requirements must change accordingly, or where changes are deemed necessary on the basis of student feedback and/or the advice of External Advisors, to enhance academic provision. There may be additional requirements around option selection; please contact the Department for further information.

In stage three, you must choose five 15 credit modules (75 credits) from the options offered under Year 3, including no more than 30 credits of PH2xxx (FHEQ level 5) modules. Options taken in the second year may not be taken again in the third year. In stage four, you must choose five 15 credit modules (75 credits) from the options offered under Year 4. When choosing option modules you must be sure to satisfy any prerequisites. At least one of the 15 credit module options must be from the Particle Physics Strand as defined by the Department of Physics.

Section 4 - Progressing through each year of your degree course

For further information on the progression and award requirements for your degree, please refer to Royal Holloway's Academic Regulations.

Progression throughout the year/s is monitored through performance in summative or formative coursework assignments. Please note that if you hold a Student Visa and you choose to leave (or are required to leave because of non-progression) or complete early (before the course end date stated on your CAS), then this will be reported to UKVI.

All first year undergraduate students are required to take and pass the non-credit bearing Moodle-based Academic Integrity module SS1001 in order to progress into the second year of study (unless their course includes the alternative mandatory SS1000 module). The pass mark for the module assessment is stated in the on-line Academic Integrity Moodle module. Students may attempt the assessment as often as they wish with no penalties or capping. Students who meet the requirements for progression as stipulated in the University's Undergraduate Regulations (Section: Conditions for progression to the next stage) but fail to pass the Moodle-based Academic Integrity module will not be permitted to progress into their second year of academic study at the University.

If after Stage 3 you fail to progress onto Stage 4 and also fail to graduate with a BSc degree but passes PH3010 you are exempt from taking the Experimental or Theoretical Project (PH3110) if you retake Stage 3 as a BSc student.

Part-time study – a stage may be spread over two years of study; in each part-time year you will follow modules to the value of 60 credits.

Stage 1a
PH1110 Mathematics for Scientists 1 MNC
PH1120 Mathematics for Scientists 2 MNC
PH1320 Classical Mechanics
PH1420 Fields and Waves

Stage 1b
PH1140 Scientific Skills 1
PH1150 Scientific Skills 2
PH 1920 Physics of the Universe
PH1620 Classical Matter

Stage 2a
PH2130 Mathematical Methods (MNC)
PH2210 Quantum Mechanics (MNC)
PH2310 Optics
PH2610 Classical and Statistical Thermodynamics

Stage 2b
PH2150 Scientific Computing Skills
PH2420 Electromagnetism
PH2270 Scientific Skills for Particle Physics
PH2710 The Solid State

Stages 3a & b
PH3010 Advanced Skills
PH3210 Quantum Theory
PH3520 Particle Physics
PH3530 Particle Detectors and Accelerators
PH3930 Particle Astrophysics

You will also choose three optional 15 credit modules (45 credits) from the list of stage 3 electives offered by the department. In choosing options you may take no more than a total of 30 credits of PH2xxx (FHEQ Level 5) modules in the third year. When choosing option modules you must be sure to satisfy any prerequisites.

Stages 4a & b
PH4100 Major Project
PH4110 Research Review
You will also choose five optional 15 credit modules (75 credits) from the list of Stage 4 (Level 7) electives offered by the department. When choosing option modules you must be sure to satisfy any prerequisites.

In Stages 3 and 4 you may choose, with advice, the order in which you take the modules in the relevant stage. This is largely a matter of personal choice, although a balance of modules between the first and second terms must be ensured.

Section 5 – Educational aims of the course

The aims of this course are:

- to impart an advanced knowledge of the fundamental elements of Physics and a critical awareness of current problems in the discipline;
- to develop a high level of competence in the use of appropriate techniques in physics and mathematics;
- to develop the skills and knowledge required for experimentation and/or theoretical modelling at postgraduate level;
- to promote oral and written communication skills to a professional level;
- to teach the effective use of information technology and computing facilities for the treatment and presentation of complex experimental data;
- to provide a critical awareness of safety procedures and environmental issues;
- to develop critical problem solving abilities to a professional level;
- to provide a strong foundation for postgraduate research in the physical sciences, for advanced entry into a wide range of both scientific and non-vocational careers, and for continuing professional development.

Section 6 - Course learning outcomes

In general terms, the courses provide opportunities for students to develop and demonstrate the following learning outcomes. (*Categories – Knowledge and understanding (K), Skills and other attributes (S), and Transferable skills (*)*)

Theme	Course learning outcome	Level 4	Level 5	Level 6	Level 7
Core physics knowledge	1: Apply the core areas of physics, i.e., electromagnetism, quantum and classical mechanics, statistical physics and thermodynamics, wave phenomena and the properties of matter.	1.4.1: Understand some core areas of classical physics. 1.4.2: Show awareness of non-classical phenomena.	1.5.1: Apply core areas of classical physics including its basic laws and principles. 1.5.2: Understand some areas of non-classical physics.	1.6.2: Apply the core areas of non-classical physics including its basic physical laws and principles.	
Advanced physics knowledge	2: Apply core physics principles to evaluate diverse areas of Particle Physics, some of which are			2.6.1: Apply core physics principles to diverse areas of Particle Physics.	2.7.1: Apply core physics principles to evaluate areas informed by the forefront of Particle Physics.

	informed by the forefront or the discipline and show awareness of research-level material.			2.6.2: Show awareness of recent developments in physics.	2.7.2: Show awareness of research-level material.
Mathematical and numerical modelling skills	3: Apply mathematical and computational techniques to model, describe and predict physical behaviour including current research and applications in physics.	3.4.1: Understand mathematical techniques. 3.4.2: Recall how to interpret information from numerical manipulation graphically.	3.5.1: Apply mathematical techniques to model, describe and predict physical behaviour. 3.5.2: Apply computational techniques to model, describe and predict physical behaviour.		3.7.1: Apply mathematical techniques in current research and applications. 3.7.2: Apply computational techniques in current research and applications.
Problem solving skills	4: Formulate and solve complex problems including advanced research-informed problems in physics.	4.4.1: Identify and use relevant principles and laws when dealing with simple problems.	4.5.1: Solve problems by selecting and using appropriate mathematical and physical techniques and by making appropriate approximations.	4.6.1: Formulate and solve complex problems in unrehearsed contexts by applying physics knowledge across topic boundaries.	4.7.1: Solve advanced research-informed problems in physics.
Practical and investigative skills	5: Plan, design and safely execute an extended effective experiment or investigation that includes the use of techniques applicable to current research or applications in physics, and critically analyse its results.	5.4.1: Safely execute an experiment. 5.4.2: Analyse its results by evaluating their level of uncertainty.	5.5.1: Design and safely execute an experiment. 5.5.2: Analyse its results and compare them with expected outcomes, theoretical and computational models.	5.6.1: Plan, design and safely execute an effective experiment or investigation. 5.6.2: Critically analyse its results, evaluate their significance and set them in context by comparison with published data.	5.7.1: Plan, design and safely execute an extended effective experiment or investigation that includes the use of techniques applicable to current research or applications in physics.
ICT skills	6: Exploit ICT including appropriate software packages/ systems for the analysis of data and simulation of physical systems, and use ICT for the retrieval of appropriate	6.4.1: Show awareness of appropriate software packages/ systems for the analysis of data and simulation of physical systems.	6.5.1: Use appropriate software packages/ systems for the analysis of data and simulation of physical systems.	6.6.1: Exploit appropriate software packages/ systems for the analysis of data and simulation of physical systems. 6.6.2: Use bibliographic search tools.	

	information, word processing and presentation preparation.	6.4.2: Show awareness of bibliographic search tools and use software for word processing and presentation preparation.			
Scientific project skills	7: Plan and execute a substantial open-ended research project that demonstrates creativity and some originality, mastering of research grade techniques, and that involves the evaluation of current research and the proposal of future directions.			7.6.1: Show creativity to carry out independent investigative work of an open-ended nature. 7.6.2: Use new techniques in a theoretical, computational, or experimental context.	7.7.1: Plan and execute a substantial open-ended research project that demonstrates some originality. 7.7.2: Master new techniques, including the competent use of specialised equipment or research grade software or methods. 7.7.3: Understand and evaluate current research at the forefront of the discipline and suggest realistic future directions.
Personal and investigative skills	8: Work independently, manage their own learning and critically evaluate complex information including mathematical descriptions of physical phenomena and research-based materials.	8.4.1: Work independently by being organised and meeting deadlines. 8.4.2: Show awareness of investigative skills including curiosity. 8.4.3: Make use of information including appropriate texts and learning materials.	8.5.1: Work independently by taking the initiative. 8.5.2: Use investigative skills including the ability to adapt their own learning. 8.5.3: Make sense of information including learning materials.	8.6.1: Manage their own learning. 8.6.2 Show the ability to focus. 8.6.3 Manage and use research-based materials.	8.7.2: Interpret and contextualise mathematical descriptions of physical phenomena.
Analytical thinking skills	9: Tackle intricate problems logically and accurately.	9.4.1: Use logical arguments.	9.5.1: Construct logical arguments.	9.6.1: Manipulate precise and intricate ideas.	

		9.4.2: Pay attention to detail.	9.5.2: Use technical language correctly.		
Communication skills	10: Communicate complex scientific content clearly, concisely and accurately.	10.4.1: Communicate basic scientific information accurately and with some clarity to your peers.	10.5.1: Communicate scientific information clearly, concisely and accurately to your peers.	10.6.1: Communicate scientific information clearly, concisely and accurately, including through scientific reports, to a scientific or other professional audience.	Communicate informatively complex scientific content including the conclusions of an experiment, investigation or project to a scientific or other professional audience.
Teamwork skills	11: Work as part of a team.	11.4.1: Work in a group.	11.5.1: Interact constructively as part of a team.	11.6.1: Work in a group and interact constructively as part of a team and by taking the lead.	
Integrity and further professional skills	12: Work and behave professionally including with integrity.	12.4.1: Work with integrity.		12.6.1: Work with empathy.	

Section 7 - Teaching, learning and assessment

Teaching and learning on your course is closely informed by the active research of staff, particularly in the areas of Physics. In general terms, the course provides an opportunity for you to develop and demonstrate the learning outcomes detailed herein.

Teaching is mostly by means of lectures, seminars, laboratory practical classes and problem-solving sessions; the latter generally providing a forum for you, with the support of your instructors, to work through problem sets and applications in a smaller and more interactive setting. Learning is through participation in lectures and seminars, designated reading, completion of problem sets and guided independent study and research. You are expected to meet basic standards in information technology, for which training is provided by the University Computer Centre. Assessment of knowledge and understanding is mainly by formal, unseen written examination; coursework exercises, laboratory reports, oral and poster presentations and a Project dissertation are also assessed. A detailed mapping of the ways in which particular modules and modules achieve the courses' learning outcomes may be found in the Department of Physics Student Handbook. Full details of the assessments for individual modules can be obtained from the Department.

Contact hours come in various forms and may take the form of time spent with a member of staff in a lecture or seminar with other students. Contact hours may also be laboratory or, studio-based sessions, project supervision with a member of staff, or discussion through a virtual learning environment (VLE). These contact hours may be with a lecturer or teaching assistant, but they may also be with a technician, or specialist support staff.

The way in which each module on your degree course is assessed will also vary. Assessments designated as 'summative' will receive a mark which will count towards your overall mark for the module, and potentially your degree classification, depending on your year of study. On successful completion of the module you will gain the credits listed.

More detailed information on modules, including teaching and learning methods, and methods of assessment, can be found via the online Royal Holloway Curriculum Catalogue. The accuracy of the information contained in this document is reviewed regularly by the university, and may also be checked routinely by external agencies.

Section 8 – Additional costs

There are no single associated costs greater than £50 per item on this degree course.

These estimated costs relate to studying this particular degree course at Royal Holloway. General costs such as accommodation, food, books and other learning materials and printing etc., have not been included, but further information is available on our website.

Section 9 – Indicators of quality and standards	
QAA Framework for Higher Education Qualifications (FHEQ) Level	4-7
Your course is designed in accordance with the FHEQ to ensure your qualification is awarded on the basis of nationally established standards of achievement, for both outcomes and attainment. The qualification descriptors within the FHEQ set out the generic outcomes and attributes expected for the award of individual qualifications. The qualification descriptors contained in the FHEQ exemplify the outcomes and attributes expected of learning that results in the award of higher education qualifications. These outcomes represent the integration of various learning experiences resulting from designated and coherent courses of study.	
QAA Subject benchmark statement(s)	http://www.qaa.ac.uk/quality-code/subject-benchmark-statements
Subject benchmark statements provide a means for the academic community to describe the nature and characteristics of courses in a specific subject or subject area. They also represent general expectations about standards for the award of qualifications at a given level in terms of the attributes and capabilities that those possessing qualifications should have demonstrated.	

Section 10– Intermediate exit awards (where available)		
You may be eligible for an intermediate exit award if you complete part of the course as detailed in this document. Any additional criteria (e.g. mandatory modules, credit requirements) for intermediate awards is outlined in the sections below.		
Award	**Criteria**	**Awarding body**
Diploma in Higher Education (DipHE)	Pass in 210 credits of which at least 90 must be at or above FHEQ Level 4 and at least 120 of which must be at or above FHEQ Level 5	Royal Holloway and Bedford New College
Certificate in Higher Education (CertHE)	Pass in 120 credits of which at least 90 must be at or above FHEQ Level 4	Royal Holloway and Bedford New College