Programme Specification: Undergraduate

For students starting in Academic Year 2022/23

1. Course Summary

Names of programme and award title(s)	BSc (Hons) Physics BSc (Hons) Physics with International Year (see Annex A for details)
Award type	Combined Honours
Mode of study	Full-time
Framework of Higher Education Qualification (FHEQ) level of final award	Level 6
Normal length of the programme	3 years; 4 years with the International Year between years 2 and 3
Maximum period of registration	The normal length as specified above plus 3 years
Location of study	Keele Campus
Accreditation (if applicable)	This subject/programme is accredited by: The Institute of Physics (IoP). For further details see the section on Accreditation below
Regulator	Office for Students (OfS)
Tuition Fees	**UK students:** Fee for 2022/23 is £9,250* **International students:** Fee for 2022/23 is £17,900** The fee for the international year abroad is calculated at 15% of the standard year fee

How this information might change: *Please read the important information at http://www.keele.ac.uk/student-agreement/. This explains how and why we may need to make changes to the information provided in this document and to help you understand how we will communicate with you if this happens.*

** These fees are regulated by Government. We reserve the right to increase fees in subsequent years of study in response to changes in government policy and/or changes to the law. If permitted by such change in policy or law, we may increase your fees by an inflationary amount or such other measure as required by government policy or the law. Please refer to the accompanying Student Terms & Conditions. Further information on fees can be found at http://www.keele.ac.uk/studentfunding/tuitionfees/*

*** We reserve the right to increase fees in subsequent years of study by an inflationary amount. Please refer to the accompanying Student Terms & Conditions for full details. Further information on fees can be found at http://www.keele.ac.uk/studentfunding/tuitionfees/*

2. What is a Combined Honours programme?

NB: all students who study a science Principal subject are candidates for the degree of Bachelor of Science (with Honours) (BSc Hons) irrespective of their second Principal subject.

Combined Honours degrees are degrees that are taken in two different subjects, resulting in an X and Y degree title. If you are taking a Combined Honours programme, these will be the two subjects you applied for. These are referred to as your Principal Subjects.

In a Combined Honours degree you must take at least 135 credits in each Principal Subject (270 credits in total), accrued over all three levels of study, with at least 45 credits at each level of study (Levels 4, 5 and 6) in each of two Principal Subjects (90 credits per year). The remaining available credits can be filled with modules from these subjects or other subjects entirely.

As a Combined Honours student you can choose to study just one subject in your final year of study, taking a minimum of 90 credits in this subject. This will result in an X with Y degree title.

Students taking the Route in *Subject X with Physics* might not necessarily be able to demonstrate that they have achieved all of the Programme's learning outcomes. Hence the *Subject X with Physics* Route will NOT be accredited by the IoP.

3. Overview of the Programme

Physics is one of the fundamental curiosity-driven science subjects that has been known to widely contribute to other areas of sciences and a range of industries such as power, nuclear, electronics, telecommunications, medical, pharmaceutical and food technology. In addition to the subject knowledge, Physics curriculum incorporates a number of transferable skills that can be widely exploited in research, education and in a wide variety of industrial sectors. This is evidenced by the wide range of positions being held by Keele Physics graduates.

The three year Combined Honours Physics programme at Keele aims to cover all of the topics which are defined as "Core Physics" by Institute of Physics (IOP) for all undergraduate Physics degrees in the UK. On successful completion of the Physics programme at Keele, students will be equally qualified and well prepared for postgraduate studies or graduate level employment.

All the required instruction in Mathematics and Computing to study Physics is incorporated within the Physics modules. We operate an open-door policy which enables students to have excellent and flexible access to staff to seek advice or feedback on their work. Activities in year 1 and 2 Laboratories are designed such that students should be able to develop necessary competence in laboratory activities by the end of year 2 and be able to undertake individual project in year 3.

4. Aims of the programme

The broad aims of the programme are to enable you to:

- achieve a knowledge and understanding of the fundamentals of Physics and be able to apply this knowledge and understanding to solving problems;
- develop competence in the application of mathematics and computing to physical problems;
- develop competence in laboratory activities by the end of year 2 and have undertaken project work both individually and within a team by the end of year 3;
- acquire a range of subject-specific skills including how to formulate and tackle problems in Physics; how to plan, manage, execute and report the results of an investigation; how to use mathematics to describe the physical world; and how to deploy these skills to tackle issues within the subject;

You will acquire a range of cognitive, generic and transferable skills including problem-solving skills, investigative skills, analytic skills, communication skills, IT skills, time management skills and interpersonal skill.

5. What you will learn

The intended learning outcomes of the programme (what students should know, understand and be able to do at the end of the programme), can be described under the following headings:

- Subject knowledge and understanding
- Subject specific skills
- Intellectual skills
- Key or transferable skills (including employability skills)

Subject knowledge and understanding

The subject knowledge in the Combined Honours Physics programme is underpinned by a core curriculum as set out by the Institute of Physics and includes the fundamentals of classical and quantum mechanics, electromagnetism, optics, thermodynamics, solid state, atomic and nuclear physics, together with the

mathematics that is used to describe them. Successful students will be able to demonstrate:

- knowledge of the fundamental principles of Physics and competence in applying these principles to diverse areas of the subject;
- the ability to solve problems in Physics using appropriate mathematical tools including the ability to make sensible approximations;
- the ability to execute, and analyse critically, an experiment or investigation and draw valid conclusions. You will be able to estimate the level of uncertainty in your results and compare these results with expected outcomes, theoretical predictions or with published data. You will be able to evaluate the significance of your results in this context;
- If you specialise in Physics, via major honours, in your final year you develop a wider knowledge and understanding of advanced topics and their applications and acquire skills in the critically reading and understanding published work in Physics.

Subject specific skills

Successful students will have:

- the ability to work safely in a laboratory and to have a knowledge and awareness of standard safety procedures;
- a sound familiarity with laboratory apparatus and techniques;
- competent use of appropriate IT packages/systems for the analysis of data and the retrieval of information;
- an ability in numerical manipulation and estimation and the ability to present and interpret information graphically;
- an ability to use mathematical techniques and analysis to model physical behaviour;
- an ability to record and communicate scientific information, in particular through clear and accurate scientific reports;
- an ability to question, learn and assimilate knowledge and to evolve your views of the world in response to that new knowledge;
- an ability to contribute through research to the development of knowledge in Physics;
- (if you Major in Physics in your final year) an ability to acquire knowledge and understanding of science for yourself, and to work productively on scientific problems on an individual basis.

Intellectual skills

Successful students will be able to:

- analyse and solve problems;
- evaluate evidence and make critical judgements;
- interpret and critique text;
- interpret and critique mathematical and numerical information;
- abstract and synthesise information;
- develop a reasoned argument;
- assess contrasting theories, explanations and policies;
- take responsibility for your own learning and critique that learning.

Key or transferable skills (including employability skills)

Successful students will have:

- the ability to manage your own learning and to make appropriate use of textbooks, research-based materials and other learning resources;
- the ability to find information and make responsible use of it;
- the ability to listen;
- the ability to make effective written and oral presentations;
- the ability to work with numerical data;
- the ability to make sensible estimates;
- an awareness of the costs and benefits of your actions;
- the ability to work effectively with a variety of types of Information Technology;
- the ability to plan, manage, execute and report an investigation;
- the ability to learn and gain understanding;
- the ability to work effectively both as an individual and as part of a team;
- the ability to sustain motivation for an extended period of time;
- a recognition of your responsibilities as an individual and as part of a team, an organisation.

Keele Graduate attributes

Engagement with this programme will enable you to develop your intellectual, personal and professional capabilities. At Keele, we call these our ten Graduate Attributes and they include independent thinking, synthesizing information, creative problem solving, communicating clearly, and appreciating the social, environmental and global implications of your studies and activities. Our educational programme and learning environment is designed to help you to become a well-rounded graduate who is capable of making a positive and valued contribution in a complex and rapidly changing world, whichever spheres of life you engage in after your studies are completed.

Further information about the Keele Graduate Attributes can be found here: http://www.keele.ac.uk/journey/

6. How is the programme taught?

Learning and teaching methods used on the programme vary according to the subject matter and level of the module. They include the following:

- Lectures
- Tutorials
- Laboratory Classes
- Exercise/Problem-Solving Classes
- Individual Progress Interviews
- Problem Sheet Assignments
- Group and Individual projects
- Directed Reading and Independent Study
- Use of e-learning/the Keele Learning Environment (KLE)

Apart from these formal activities, students are also provided with regular opportunities to talk through particular areas of difficulty, and any special learning needs they may have, with their Personal Tutors or module lecturers on a one-to-one basis.

These learning and teaching methods enable students to achieve the learning outcomes of the programme in a variety of ways.

7. Teaching Staff

The Physics academic staff exhibit a research profile with two main areas of expertise; astrophysics and condensed matter physics. Keele performs internationally renowned work in the fields of exoplanets, stellar physics (both observational and theoretical), high energy extragalactic astrophysics and in the study of soft condensed matter such as polymers and biological molecules. All research-active staff play a role in teaching and most also undertake administrative roles, either within our teaching or research activities. The teaching and research profiles of the staff that currently deliver the Physics programme can be found at http://www.keele.ac.uk/physics/people/. Timetabled teaching is always lead by academic staff.

The University will attempt to minimise changes to our core teaching teams, however, delivery of the programme depends on having a sufficient number of staff with the relevant expertise to ensure that the programme is taught to the appropriate academic standard.

Staff turnover, for example where key members of staff leave, fall ill or go on research leave, may result in changes to the programme's content. The University will endeavour to ensure that any impact on students is limited if such changes occur.

8. What is the structure of the Programme?

The academic year runs from September to June and is divided into two semesters. The number of weeks of teaching will vary from programme to programme, but you can generally expect to attend scheduled teaching sessions between the end of September and mid-December, and from mid-January to the end of April. Our degree courses are organised into modules. Each module is usually a self-contained unit of study and each is usually assessed separately with the award of credits on the basis of 1 credit = 10 hours of student effort. An outline of the structure of the programme is provided in the tables below.

There are three types of module delivered as part of your programme. They are:

- Compulsory modules - a module that you are required to study on this course;
- Optional modules - these allow you some limited choice of what to study from a list of modules;
- Elective modules - a free choice of modules that count towards the overall credit requirement but not the number of subject-related credits.

A summary of the total credit requirements per year is as follows, with a minimum of 90 subject credits

(compulsory plus optional) required for each year across both of your Principal Subjects. This document has information about *Physics* modules only; please also see the document for your other subject.

For further information on the content of modules currently offered, including the list of elective modules, please visit: https://www.keele.ac.uk/recordsandexams/modulecatalogue/

Year	Compulsory	Optional		Electives	
		Min	Max	Min	Max
Level 4	60	0	0	0	0
Level 5	60	0	0	0	0
Level 6	30	30	30	0	0

In year 3 there is the option to choose to specialise in one of your subjects, taking a minimum of 90 credits in this subject rather than taking modules from both subjects

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Module Lists

Level 4

At level 4, Physics and Astrophysics students require a common knowledge and skills base. Therefore, many of the modules taught at level 4 are common to Physics and Astrophysics disciplines. You will study FOUR lecture-based modules of core Physics.

The lecture-based modules are supported by problem classes and assessed problem sheets with an end of semester examination in each. These modules also include lectures, problems classes and tutorials in mathematics, and laboratory classes, which are an essential part of physics. The module descriptors provide detailed synopses of each module with suggested study reading and are available on the KLE.

Compulsory modules	Module Code	Credits	Period
Mechanics, Gravity and Relativity	PHY-10022	15	Semester 1
Nature of matter	PHY-10024	15	Semester 1
Oscillations and Waves	PHY-10020	15	Semester 2
Electricity and Magnetism	PHY-10021	15	Semester 2

Level 5

At level 5 you continue to be taught the fundamentals of Physics. Modules are common to Physics and Astrophysics in the first semester of the second year, but diverge significantly from the second semester of the second year onwards.

In the first semester you take an Optics Laboratory and a short series of classes in developing your mathematical skills. In the second semester you take an instrumentation and measurement laboratory incorporating a mini-project.

Compulsory modules	Module Code	Credits	Period
Quantum Mechanics	PHY-20006	15	Semester 1
Optics and Thermodynamics	PHY-20027	15	Semester 1
Nuclear and Particle Physics	PHY-20009	15	Semester 2
Statistical Mechanics and Solid State Physics	PHY-20026	15	Semester 2

Level 6

Compulsory modules	Module Code	Credits	Period
Electromagnetism	PHY-30012	15	Semester 1
Physics Project - ISP	PHY-30007	15	Semester 1-2

Optional modules	Module Code	Credits	Period
Polymer Physics	PHY-30010	15	Semester 1
Binary Stars and Extrasolar Planets	PHY-30024	15	Semester 1
Computational Methods in Physics and Astrophysics	PHY-30026	15	Semester 1
Data Analysis and Model Testing	PHY-30027	15	Semester 1
Particle Physics and Accelerators	PHY-30033	15	Semester 1
Two-Dimensional (2D) Materials	PHY-30037	15	Semester 1
Cosmology	PHY-30001	15	Semester 2
The Physics of Interstellar Medium	PHY-30002	15	Semester 2
The Physics of Compact Objects	PHY-30003	15	Semester 2
Quantum Physics of Atoms and Molecules	PHY-30009	15	Semester 2
Life in the Universe	PHY-30025	15	Semester 2
Quantum Mechanics II	PHY-30029	15	Semester 2
Physics of Fluids	PHY-30030	15	Semester 2
Atmospheric Physics	PHY-30031	15	Semester 2
Plasma Physics	PHY-30032	15	Semester 2
General Relativity, Black Holes and Gravitational Waves	PHY-30035	15	Semester 2

If you choose to specialise in this subject in your final year you will study the following modules:

Compulsory modules	Module Code	Credits	Period
Electromagnetism	PHY-30012	15	Semester 1
Physics Project - ISP	PHY-30007	15	Semester 1-2
Dissertation and Communication Skills	PHY-30015	15	Semester 1-2

Optional modules	Module Code	Credits	Period
Polymer Physics	PHY-30010	15	Semester 1
Binary Stars and Extrasolar Planets	PHY-30024	15	Semester 1
Computational Methods in Physics and Astrophysics	PHY-30026	15	Semester 1
Data Analysis and Model Testing	PHY-30027	15	Semester 1
Particle Physics and Accelerators	PHY-30033	15	Semester 1
Two-Dimensional (2D) Materials	PHY-30037	15	Semester 1
Cosmology	PHY-30001	15	Semester 2
The Physics of Interstellar Medium	PHY-30002	15	Semester 2
The Physics of Compact Objects	PHY-30003	15	Semester 2
Quantum Physics of Atoms and Molecules	PHY-30009	15	Semester 2
Life in the Universe	PHY-30025	15	Semester 2
Quantum Mechanics II	PHY-30029	15	Semester 2
Physics of Fluids	PHY-30030	15	Semester 2
Atmospheric Physics	PHY-30031	15	Semester 2
Plasma Physics	PHY-30032	15	Semester 2
General Relativity, Black Holes and Gravitational Waves	PHY-30035	15	Semester 2

You may, in addition to modules listed, include in level 6 of your Physics course one suitable programme approved elective module from another Principal Course, provided that you are not taking the Principal Course from which that module is derived as part of your Combined Honours combination.

You will find that in teaching you we put emphasis on problem solving. This occurs in examples classes where you solve practice problems in physics in class with staff to assist you, in laboratory teaching where you will be expected to address practical problems and in your directed work for assessment. You are encouraged to call upon module leaders and the director of study for guidance. The staff will be willing to see you at almost any time and you will have one-to-one progress interviews each semester. The teaching team will monitor your progress and we will contact you if we find that you are not achieving all that you should and advise you on how to improve.

You will benefit from a flexible approach to learning the mathematical skills that are essential to the learning and application of Physics. You will find that the classes on mathematics in level 4 are presented in a series of blocks. An assessment test is taken at the end of the class blocks. You will also attend supplementary supporting tutorials in mathematics.

Learning Outcomes

The table below sets out what students learn in the programme and the modules in which that learning takes place. Details of how learning outcomes are assessed through these modules can be found in module specifications.

Level 4

In Year 1 (Level 4) and Year 2 (Level 5) these learning outcomes are achieved in the compulsory modules which all students are required to take. Some of these outcomes may also be achieved or reinforced in elective modules together with other outcomes not stated here. In Year 3 (Level 6) the stated outcomes are achieved by taking any of the modules offered in each semester.

Subject Knowledge and Understanding	
Learning Outcome	**Module in which this is delivered**
Understand basic concepts in mechanics, nature of matter, oscillation and waves and electricity and magnetism.	Mechanics, Gravity and Relativity - PHY-10022 Electricity and Magnetism - PHY-10021 Oscillations and Waves - PHY-10020 Nature of matter - PHY-10024
Demonstration of this understanding by solving physical problems.	Mechanics, Gravity and Relativity - PHY-10022 Electricity and Magnetism - PHY-10021 Oscillations and Waves - PHY-10020 Nature of matter - PHY-10024
Understanding of mathematical techniques necessary for application to physics.	Mechanics, Gravity and Relativity - PHY-10022 Electricity and Magnetism - PHY-10021 Oscillations and Waves - PHY-10020 Nature of matter - PHY-10024
Perform practical work and keep accurate accounts of it, including professionally maintained records of purpose, methodology, and results.	Mechanics, Gravity and Relativity - PHY-10022 Electricity and Magnetism - PHY-10021 Oscillations and Waves - PHY-10020 Nature of matter - PHY-10024
Communicate the process and results of practical work in formal, written presentations. Enter, manipulate, and present data with the aid of computer tools.	Mechanics, Gravity and Relativity - PHY-10022 Electricity and Magnetism - PHY-10021 Oscillations and Waves - PHY-10020 Nature of matter - PHY-10024

Subject Specific Skills	
Learning Outcome	**Module in which this is delivered**
The ability to work safely in a laboratory and a knowledge and awareness of standard safety procedures.	Mechanics, Gravity and Relativity - PHY-10022 Electricity and Magnetism - PHY-10021 Oscillations and Waves - PHY-10020 Nature of matter - PHY-10024
A sound familiarity with laboratory apparatus and techniques.	Mechanics, Gravity and Relativity - PHY-10022 Electricity and Magnetism - PHY-10021 Oscillations and Waves - PHY-10020 Nature of matter - PHY-10024
Competency in the use of appropriate IT packages/systems for the analysis of data and the retrieval of information.	Mechanics, Gravity and Relativity - PHY-10022 Electricity and Magnetism - PHY-10021 Oscillations and Waves - PHY-10020 Nature of matter - PHY-10024
An ability in numerical manipulation and estimation, statistical interpretation and the ability to present and interpret information graphically.	Mechanics, Gravity and Relativity - PHY-10022 Electricity and Magnetism - PHY-10021 Oscillations and Waves - PHY-10020 Nature of matter - PHY-10024
An ability to use mathematical analysis and computational techniques to model physical behaviour.	Mechanics, Gravity and Relativity - PHY-10022 Electricity and Magnetism - PHY-10021 Oscillations and Waves - PHY-10020 Nature of matter - PHY-10024
An ability to research, record and communicate scientific information, in particular through clear and accurate scientific reports and a dissertation.	Mechanics, Gravity and Relativity - PHY-10022 Electricity and Magnetism - PHY-10021 Oscillations and Waves - PHY-10020 Nature of matter - PHY-10024
An ability to question, learn and assimilate knowledge and to evolve their views of the world in response to that new knowledge.	Mechanics, Gravity and Relativity - PHY-10022 Electricity and Magnetism - PHY-10021 Oscillations and Waves - PHY-10020 Nature of matter - PHY-10024
An ability to contribute through research to the development of knowledge in Physics.	Mechanics, Gravity and Relativity - PHY-10022 Electricity and Magnetism - PHY-10021 Oscillations and Waves - PHY-10020 Nature of matter - PHY-10024
An ability to acquire knowledge and understanding of science themselves, and to work productively on scientific problems on an individual basis or in a team.	Mechanics, Gravity and Relativity - PHY-10022 Electricity and Magnetism - PHY-10021 Oscillations and Waves - PHY-10020 Nature of matter - PHY-10024

Key or Transferable Skills (graduate attributes)	
Learning Outcome	**Module in which this is delivered**
Manage their own learning and to make appropriate use of textbooks, research-based materials and other learning resources.	Mechanics, Gravity and Relativity - PHY-10022 Electricity and Magnetism - PHY-10021 Oscillations and Waves - PHY-10020 Nature of matter - PHY-10024
Find information and make responsible use of it.	Mechanics, Gravity and Relativity - PHY-10022 Electricity and Magnetism - PHY-10021 Oscillations and Waves - PHY-10020 Nature of matter - PHY-10024

Key or Transferable Skills (graduate attributes)	
Learning Outcome	**Module in which this is delivered**
Make effective written presentations.	Mechanics, Gravity and Relativity - PHY-10022 Electricity and Magnetism - PHY-10021 Oscillations and Waves - PHY-10020 Nature of matter - PHY-10024
Work with numerical and statistical data.	Mechanics, Gravity and Relativity - PHY-10022 Electricity and Magnetism - PHY-10021 Oscillations and Waves - PHY-10020 Nature of matter - PHY-10024
Make sensible estimates.	Mechanics, Gravity and Relativity - PHY-10022 Nature of matter - PHY-10024 Oscillations and Waves - PHY-10020 Electricity and Magnetism - PHY-10021
Evaluate the costs and benefits of their actions.	Electricity and Magnetism - PHY-10021 Oscillations and Waves - PHY-10020 Nature of matter - PHY-10024 Mechanics, Gravity and Relativity - PHY-10022
Work effectively with a variety of types of Information Technology.	Electricity and Magnetism - PHY-10021 Oscillations and Waves - PHY-10020 Nature of matter - PHY-10024 Mechanics, Gravity and Relativity - PHY-10022
Formulate a problem and solve it using computational methods.	Nature of matter - PHY-10024 Mechanics, Gravity and Relativity - PHY-10022 Oscillations and Waves - PHY-10020 Electricity and Magnetism - PHY-10021
Plan, manage, execute and report an investigation.	Mechanics, Gravity and Relativity - PHY-10022 Nature of matter - PHY-10024 Oscillations and Waves - PHY-10020 Electricity and Magnetism - PHY-10021
Learn and gain understanding and to pass on that understanding to others.	Oscillations and Waves - PHY-10020 Electricity and Magnetism - PHY-10021 Nature of matter - PHY-10024 Mechanics, Gravity and Relativity - PHY-10022
Work effectively both as an individual and as part of a team.	Electricity and Magnetism - PHY-10021 Mechanics, Gravity and Relativity - PHY-10022 Nature of matter - PHY-10024 Oscillations and Waves - PHY-10020
Sustain motivation for an extended period.	Oscillations and Waves - PHY-10020 Nature of matter - PHY-10024 Mechanics, Gravity and Relativity - PHY-10022 Electricity and Magnetism - PHY-10021
Recognise their responsibilities as an individual and as part of a team or an organisation.	Mechanics, Gravity and Relativity - PHY-10022 Nature of matter - PHY-10024 Electricity and Magnetism - PHY-10021 Oscillations and Waves - PHY-10020

Level 5

Subject Knowledge and Understanding	
Learning Outcome	**Module in which this is delivered**
Comprehensive understanding of the relevant theoretical and experimental background of quantum mechanics, optics, thermodynamics, nuclear physics, particle physics, statistical mechanics and solid state physics.	Quantum Mechanics - PHY-20006 Optics and Thermodynamics - PHY-20027 Statistical Mechanics and Solid State Physics - PHY-20026 Nuclear and Particle Physics - PHY-20009
Can use range of established techniques for critical analysis of numerical calculations in connection with problems in quantum mechanics, optics, thermodynamics, nuclear physics, particle physics, statistical mechanics and solid-state physics.	Nuclear and Particle Physics - PHY-20009 Optics and Thermodynamics - PHY-20027 Quantum Mechanics - PHY-20006 Statistical Mechanics and Solid State Physics - PHY-20026
Extended abilities in the execution and reporting of laboratory work within the context of physics.	Optics and Thermodynamics - PHY-20027
Experience of working in a team on a short physics project.	Nuclear and Particle Physics - PHY-20009

Subject Specific Skills	
Learning Outcome	**Module in which this is delivered**
The ability to work safely in a laboratory and a knowledge and awareness of standard safety procedures.	Optics and Thermodynamics - PHY-20027 Nuclear and Particle Physics - PHY-20009
A sound familiarity with laboratory apparatus and techniques.	Nuclear and Particle Physics - PHY-20009 Optics and Thermodynamics - PHY-20027
Competency in the use of appropriate IT packages/systems for the analysis of data and the retrieval of information.	Optics and Thermodynamics - PHY-20027 Nuclear and Particle Physics - PHY-20009
An ability in numerical manipulation and estimation, statistical interpretation and the ability to present and interpret information graphically.	Optics and Thermodynamics - PHY-20027 Nuclear and Particle Physics - PHY-20009
An ability to research, record and communicate scientific information, in particular through clear and accurate scientific reports.	Optics and Thermodynamics - PHY-20027 Nuclear and Particle Physics - PHY-20009
An ability to question, learn and assimilate knowledge and to evolve their views of the world in response to that new knowledge.	Optics and Thermodynamics - PHY-20027 Nuclear and Particle Physics - PHY-20009
An ability to contribute through research to the development of knowledge in Physics.	Nuclear and Particle Physics - PHY-20009 Optics and Thermodynamics - PHY-20027
An ability to acquire knowledge and understanding of science themselves, and to work productively on scientific problems on an individual basis or in a team.	Nuclear and Particle Physics - PHY-20009 Optics and Thermodynamics - PHY-20027
Competency in the use of appropriate IT packages/systems for the analysis of data and the retrieval of information.	Statistical Mechanics and Solid State Physics - PHY-20026 Optics and Thermodynamics - PHY-20027 Quantum Mechanics - PHY-20006 Nuclear and Particle Physics - PHY-20009

Subject Specific Skills	
Learning Outcome	**Module in which this is delivered**
An ability in numerical manipulation and estimation, statistical interpretation and the ability to present and interpret information graphically.	Optics and Thermodynamics - PHY-20027 Statistical Mechanics and Solid State Physics - PHY-20026 Nuclear and Particle Physics - PHY-20009 Quantum Mechanics - PHY-20006
An ability to use mathematical analysis and computational techniques to model physical behaviour.	Nuclear and Particle Physics - PHY-20009 Optics and Thermodynamics - PHY-20027 Quantum Mechanics - PHY-20006 Statistical Mechanics and Solid State Physics - PHY-20026
An ability to question, learn and assimilate knowledge and to evolve their views of the world in response to that new knowledge.	Statistical Mechanics and Solid State Physics - PHY-20026 Nuclear and Particle Physics - PHY-20009 Quantum Mechanics - PHY-20006 Optics and Thermodynamics - PHY-20027
An ability to contribute through research to the development of knowledge in Physics.	Nuclear and Particle Physics - PHY-20009 Optics and Thermodynamics - PHY-20027 Quantum Mechanics - PHY-20006 Statistical Mechanics and Solid State Physics - PHY-20026
An ability to acquire knowledge and understanding of science themselves, and to work productively on scientific problems on an individual basis or in a team.	Statistical Mechanics and Solid State Physics - PHY-20026 Quantum Mechanics - PHY-20006 Optics and Thermodynamics - PHY-20027 Nuclear and Particle Physics - PHY-20009

Key or Transferable Skills (graduate attributes)	
Learning Outcome	**Module in which this is delivered**
Manage their own learning and to make appropriate use of textbooks, research-based materials and other learning resources.	Statistical Mechanics and Solid State Physics - PHY-20026 Nuclear and Particle Physics - PHY-20009 Quantum Mechanics - PHY-20006 Optics and Thermodynamics - PHY-20027
Find information and make responsible use of it.	Statistical Mechanics and Solid State Physics - PHY-20026 Optics and Thermodynamics - PHY-20027 Quantum Mechanics - PHY-20006 Nuclear and Particle Physics - PHY-20009
Make effective written and oral presentations.	Statistical Mechanics and Solid State Physics - PHY-20026 Nuclear and Particle Physics - PHY-20009 Optics and Thermodynamics - PHY-20027 Quantum Mechanics - PHY-20006
Work with numerical and statistical data.	Quantum Mechanics - PHY-20006 Optics and Thermodynamics - PHY-20027 Nuclear and Particle Physics - PHY-20009 Statistical Mechanics and Solid State Physics - PHY-20026
Make sensible estimates.	Quantum Mechanics - PHY-20006 Statistical Mechanics and Solid State Physics - PHY-20026 Nuclear and Particle Physics - PHY-20009 Optics and Thermodynamics - PHY-20027

Key or Transferable Skills (graduate attributes)	
Learning Outcome	**Module in which this is delivered**
Evaluate the costs and benefits of their actions.	Nuclear and Particle Physics - PHY-20009 Statistical Mechanics and Solid State Physics - PHY-20026 Quantum Mechanics - PHY-20006 Optics and Thermodynamics - PHY-20027
Work effectively with a variety of types of Information Technology.	Optics and Thermodynamics - PHY-20027 Statistical Mechanics and Solid State Physics - PHY-20026 Nuclear and Particle Physics - PHY-20009 Quantum Mechanics - PHY-20006
Formulate a problem and solve it using computational methods.	Quantum Mechanics - PHY-20006 Statistical Mechanics and Solid State Physics - PHY-20026 Optics and Thermodynamics - PHY-20027 Nuclear and Particle Physics - PHY-20009
Plan, manage, execute and report an investigation.	Statistical Mechanics and Solid State Physics - PHY-20026 Nuclear and Particle Physics - PHY-20009 Optics and Thermodynamics - PHY-20027 Quantum Mechanics - PHY-20006
Learn and gain understanding and to pass on that understanding to others.	Nuclear and Particle Physics - PHY-20009 Statistical Mechanics and Solid State Physics - PHY-20026 Optics and Thermodynamics - PHY-20027 Quantum Mechanics - PHY-20006
Work effectively both as an individual and as part of a team.	Optics and Thermodynamics - PHY-20027 Nuclear and Particle Physics - PHY-20009 Statistical Mechanics and Solid State Physics - PHY-20026 Quantum Mechanics - PHY-20006
Sustain motivation for an extended period.	Quantum Mechanics - PHY-20006 Optics and Thermodynamics - PHY-20027 Statistical Mechanics and Solid State Physics - PHY-20026 Nuclear and Particle Physics - PHY-20009
Recognise their responsibilities as an individual and as part of a team or an organisation.	Nuclear and Particle Physics - PHY-20009 Quantum Mechanics - PHY-20006 Optics and Thermodynamics - PHY-20027 Statistical Mechanics and Solid State Physics - PHY-20026

Level 6

Subject Knowledge and Understanding	
Learning Outcome	**Module in which this is delivered**
Successful students will have gained an understanding of the central role played by the theory of electromagnetism in describing the universe and the world around them and be able to tackle problems and calculations in electromagnetism at a level appropriate to a final year honours degree course.	Electromagnetism - PHY-30012

Subject Knowledge and Understanding	
Learning Outcome	**Module in which this is delivered**
Demonstrate good comprehension, planning and execution of a project. Ability to give a short presentation on the progress of the project.	Physics Project - ISP - PHY-30007
Production of a clear, accurate and informative project report.	Physics Project - ISP - PHY-30007
Demonstrate a good understanding of the literature associated with the project theme.	Physics Project - ISP - PHY-30007
A successful student will be familiar with cosmological observations and be able to apply basic physics principles to the universe as a whole.	Cosmology - PHY-30001
A successful student will be able to calculate conditions in the universe at different times and use mathematics to relate the theory with the observations.	Cosmology - PHY-30001
Knowledge of the contents of the ISM. Understand and appreciate the impact of stars on the ISM. Carry out quantitative calculations to support the above	The Physics of Interstellar Medium - PHY-30002
How the above is determined, observationally and by the application of basic Physics	The Physics of Interstellar Medium - PHY-30002
Understand the interaction between different components of this ISM	The Physics of Interstellar Medium - PHY-30002
Successful students will be able to demonstrate that they understand the properties of degenerate matter and that they appreciate the difference between normal and compact stars. They will understand how microscopic physical laws can be applied to macroscopic systems.	The Physics of Compact Objects - PHY-30003
They will appreciate how observations of compact stars can be used to probe physical laws at very high densities and be aware of the most recent research on the subject.	The Physics of Compact Objects - PHY-30003
They will appreciate how observations of compact stars can be used to probe physical laws at very high densities and be aware of the most recent research on the subject.	The Physics of Compact Objects - PHY-30003
A detailed understanding the quantum behaviour of atoms in external electric and magnetic fields.	Quantum Physics of Atoms and Molecules - PHY-30009
The ability to solve a range of time-dependent quantum mechanical problems.	Quantum Physics of Atoms and Molecules - PHY-30009
The ability to understand aspects of atomic and molecular spectroscopy in a semi-quantitative fashion.	Quantum Physics of Atoms and Molecules - PHY-30009
An understanding of the nature of molecular wave-functions.	Quantum Physics of Atoms and Molecules - PHY-30009
An understanding of the links between classical and quantum physics.	Quantum Physics of Atoms and Molecules - PHY-30009
An understanding of the links between classical and quantum physics.	Quantum Physics of Atoms and Molecules - PHY-30009
An understanding of crystallinity and molecular orientation in polymer materials; application of physical techniques to determine the crystallinity and molecular orientation in polymer materials.	Polymer Physics - PHY-30010

Subject Knowledge and Understanding	
Learning Outcome	**Module in which this is delivered**
An understanding of macrostructure in polymer materials; application of small angle x-ray scattering (SAXS) techniques to probe macrostructure in polymer materials.	Polymer Physics - PHY-30010
An understanding of microstructure in polymer materials; application of wide-angle x-ray scattering (WAXS) techniques to probe microstructure in polymer materials.	Polymer Physics - PHY-30010
An understanding of mechanical properties of polymer materials and their yield behaviour.	Polymer Physics - PHY-30010
An understanding of mechanical properties of polymer materials and their yield behaviour.	Polymer Physics - PHY-30010
Successful students will be able to collect information on physics topics and present to a peer group by an oral presentation and poster presentation.	Dissertation and Communication Skills
Successful students will be able to assemble and review information on a specific topic and produce a substantial, detailed dissertation.	Dissertation and Communication Skills
Detail the ingredients and physical structure of the Standard Model; analyse the relativistic dynamics of particles in interactions and of particle beams in accelerators; compare and contrast the operation, design and relative advantages of different types of particle accelerator; describe and calculate key phenomena in lepton physics; explain and apply the quark model to classify hadrons and account quantitatively for their measured properties; understand and apply some of the key ideas and empirical foundations of quantum field theories for the fundamental forces.	Particle Physics and Accelerators - PHY-30033
Have acquired coherent and detailed knowledge of the methods used to discover and characterise of extrasolar planets and some knowledge of recent developments as the forefront of these subjects.	Binary Stars and Extrasolar Planets - PHY-30024
Be able to apply established techniques of analysis to data from primary sources for eclipsing extrasolar planets and binary stars. To make judgements regarding the quality of the data and the limits of the information that can be extracted from the data.	Binary Stars and Extrasolar Planets - PHY-30024
Be able to apply established techniques of analysis to data from primary sources for eclipsing extrasolar planets and binary stars. To make judgements regarding the quality of the data and the limits of the information that can be extracted from the data.	Binary Stars and Extrasolar Planets - PHY-30024
Coherent and detailed knowledge of the possibilities and limitations of searches for extra-solar planets and extra-terrestrial Life.	Life in the Universe - PHY-30025
Skills to exercise initiative in designing and executing an experiment, and to communicate ideas related to the experiment's context and objective.	Life in the Universe - PHY-30025
Be able to critically evaluate the possibilities and limitations of interstellar travel and communication.	Life in the Universe - PHY-30025
Be able to critically evaluate the possibilities and limitations of interstellar travel and communication.	Life in the Universe - PHY-30025

Subject Knowledge and Understanding	
Learning Outcome	**Module in which this is delivered**
Students will acquire the knowledge to identify the appropriateness of computational and numerical approaches in a variety of situations and able to deploy them appropriately.	Computational Methods in Physics and Astrophysics - PHY-30026
To acquire skills in using a high-level computational language to implement and apply numerical techniques to physical and astrophysical problems.	Computational Methods in Physics and Astrophysics - PHY-30026
To demonstrate the ability to communicate the results of numerical calculations in written and graphical formats.	Computational Methods in Physics and Astrophysics - PHY-30026
To demonstrate the ability to communicate the results of numerical calculations in written and graphical formats.	Computational Methods in Physics and Astrophysics - PHY-30026
Has conceptual understanding that enables the student to solve data analysis problems and to interpret scientific data, using statistical ideas and modern analysis techniques.	Data Analysis and Model Testing - PHY-30027
Can critically evaluate data from primary sources to make and communicate judgements by applying established numerical analysis techniques to physical/astrophysical data.	Data Analysis and Model Testing - PHY-30027
Can critically evaluate data from primary sources to make and communicate judgements by applying established numerical analysis techniques to physical/astrophysical data.	Data Analysis and Model Testing - PHY-30027
Describe the main concepts and results in a recent peer-reviewed journal article the application or interpretation of quantum physics.	Quantum Mechanics II - PHY-30029
Analyse the rotation-vibration spectrum or Raman spectrum of a diatomic molecule.	Quantum Mechanics II - PHY-30029
Describe and explain phenomena such as quantum entanglement and quantum teleportation.	Quantum Mechanics II - PHY-30029
Discuss the merits of and problems with different proposed interpretations of quantum mechanics in the light of experimental results.	Quantum Mechanics II - PHY-30029
Describe applications of quantum mechanics such as quantum dots and quantum cryptography and quantum computing.	Quantum Mechanics II - PHY-30029
Interpret and apply Dirac bra-ket notation.	Quantum Mechanics II - PHY-30029
Calculate the results of simple physical processes involving electrons using Pauli spin matrices.	Quantum Mechanics II - PHY-30029
Calculate the results of simple physical processes involving electrons using Pauli spin matrices.	Quantum Mechanics II - PHY-30029
Apply the laws of fluid dynamics to specific topics found in nature and space (e.g. tsunamis)	Physics of Fluids - PHY-30030
Use computer programs to solve basic problems in fluid dynamics	Physics of Fluids - PHY-30030
Manipulate the equations of fluid dynamics in an applied context and numerically solve related problems	Physics of Fluids - PHY-30030

Subject Knowledge and Understanding	
Learning Outcome	**Module in which this is delivered**
Analyse and interpret complex processes like convection in the framework of fluid dynamics theory, making reasonable approximations	Physics of Fluids - PHY-30030
Analyse and interpret complex processes like convection in the framework of fluid dynamics theory, making reasonable approximations	Physics of Fluids - PHY-30030
Use the principles of thermodynamics to determine the structure of atmospheres.	Atmospheric Physics - PHY-30031
Solve the equation of radiative transfer to evaluate the effect of radiation on atmospheric structure.	Atmospheric Physics - PHY-30031
Apply the laws of motion to describe atmospheric dynamics and waves.	Atmospheric Physics - PHY-30031
Apply the laws of motion to describe atmospheric dynamics and waves.	Atmospheric Physics - PHY-30031
Use electromagnetic theory to describe quantitatively the motion of charged particles.	Plasma Physics - PHY-30032
Use electromagnetic theory to describe quantitatively the propagation of an electromagnetic wave through a magnetised and unmagnetised plasma.	Plasma Physics - PHY-30032
Describe the nature and origin of electromagnetic and other waves that propagate in a plasma.	Plasma Physics - PHY-30032
Describe how the properties of a plasma, both natural and artificial, are determined, using techniques such as spectroscopy.	Plasma Physics - PHY-30032
Describe how plasmas arise, in both natural and artificial contexts.	Plasma Physics - PHY-30032
Describe how plasmas arise, in both natural and artificial contexts.	Plasma Physics - PHY-30032
Apply the theory of General Relativity to solve problems in solar system, stellar and black hole astrophysics, identifying the appropriate analytical or numerical tools; quantitatively assess when a General Relativistic, rather than Newtonian approach is required; Describe and explain the main planks of evidence for General Relativity and for the existence of black holes; Use General Relativity to explain the existence, propagation and generation of gravitational waves and to solve problems relating to gravitational wave sources using appropriate analytical and numerical techniques; Explain the physical nature and purpose of the design and main components of gravitational wave detectors and quantitatively describe the factors that influence detector design and sensitivity; Engage with, and assimilate knowledge from, original research material and the primary literature.	General Relativity, Black Holes and Gravitational Waves - PHY-30035

Subject Knowledge and Understanding	
Learning Outcome	**Module in which this is delivered**
Communicate effectively the key fundamental physical properties and applications of 2D materials and the differences between 2D materials and other classes of materials; Locate, evaluate and extract information from the literature related to 2D materials; Evaluate the properties and characteristics of 2D materials and apply this understanding to rationalise and predict the applications of 2D materials.	Two-Dimensional (2D) Materials - PHY-30037

Subject Specific Skills	
Learning Outcome	**Module in which this is delivered**
the ability to work safely in a laboratory and a knowledge and awareness of standard safety procedures;	Physics Project Dissertation and Communication Skills
a sound familiarity with laboratory apparatus and techniques;	Physics Project Dissertation and Communication Skills
competency in the use of appropriate IT packages/systems for the analysis of data and the retrieval of information;	Physics Project Dissertation and Communication Skills
an ability in numerical manipulation and estimation, statistical interpretation and the ability to present and interpret information graphically;	Physics Project Dissertation and Communication Skills
an ability to use mathematical analysis and computational techniques to model physical behaviour;	Physics Project Dissertation and Communication Skills
an ability to research, record and communicate scientific information, in particular through clear and accurate scientific reports and a dissertation;	Physics Project Dissertation and Communication Skills
competency in the use of appropriate IT packages/systems for the analysis of data and the retrieval of information;	All lecture modules
an ability in numerical manipulation and estimation, statistical interpretation and the ability to present and interpret information graphically;	All lecture modules
an ability to use mathematical analysis and computational techniques to model physical behaviour;	All lecture modules
an ability to question, learn and assimilate knowledge and to evolve their views of the world in response to that new knowledge;	All lecture modules
an ability to contribute through research to the development of knowledge in Physics;	All lecture modules
an ability to acquire knowledge and understanding of science themselves, and to work productively on scientific problems on an individual basis or in a team.	All lecture modules

Key or Transferable Skills (graduate attributes)	
Learning Outcome	**Module in which this is delivered**
manage their own learning and to make appropriate use of textbooks, research-based materials and other learning resources;	All modules
find information and make responsible use of it;	All modules
make effective written and oral presentations;	All modules
work with numerical and statistical data;	All modules
make sensible estimates;	All modules
evaluate the costs and benefits of their actions;	All modules
work effectively with a variety of types of Information Technology;	All modules
formulate a problem and solve it using computational methods;	All modules
plan, manage, execute and report an investigation;	All modules
learn and gain understanding and to pass on that understanding to others;	All modules
work effectively both as an individual and as part of a team;	All modules
sustain motivation for an extended period of time;	All modules
recognise their responsibilities as an individual and as part of a team or an organisation.	All modules

9. Final and intermediate awards

Credits required for each level of academic award are as follows:

Honours Degree	360 credits	You will require at least 120 credits at levels 4, 5 and 6 You must accumulate a minimum of 135 credits in each Principal Subject (270 credits in total), with at least 45 credits at each level of study (Levels 4, 5 and 6) in each of two Principal Subjects (90 credits per year). Your degree title will be 'subject X and subject Y'. If you choose to study one Principal subject in your final year of study a minimum of 90 credits in that subject is required. Your degree title will be 'subject X with subject Y'.
Diploma in Higher Education	240 credits	You will require at least 120 credits at level 4 or higher and at least 120 credits at level 5 or higher
Certificate in Higher Education	120 credits	You will require at least 120 credits at level 4 or higher

International Year option: in addition to the above students must pass a module covering the international year in order to graduate with a named degree including the 'international year' wording. Students who do not complete, or fail the international year, will be transferred to the three-year version of

the programme.

10. How is the Programme Assessed?

The wide variety of assessment methods used on this programme at Keele reflects the broad range of knowledge and skills that are developed as you progress through the degree programme. Teaching staff pay particular attention to specifying clear assessment criteria and providing timely, regular and constructive feedback that helps to clarify things you did not understand and helps you to improve your performance. The following list is representative of the variety of assessment methods used on your programme:

- **End of module examinations** test the ability of the student to describe, explain, and critically discuss the principles of the subject and to demonstrate competence in applying these principles to applications and to solve problems from appropriate areas of the discipline.
- **Assessed Problem Sheets** assess the student's skills in solving numerical and other problems within the discipline by drawing on their scientific understanding and knowledge, and experience of experimental techniques
- **Laboratory and Project Reports** - structured proformas and full lab reports are formal summaries of work carried out in the laboratory and test students' understanding of the practical aspects of the programme and develop the skills necessary to enable students to present and analyse their results.
- **Observation of laboratory skills and laboratory notebooks**: Throughout the extensive laboratory and other practical work in this programme, many types of assessment are utilised to achieve the learning outcomes. Notebooks are used to communicate the results of work accurately and reliably and to encourage good working practice, including managing risk assessments and following safe working practices.
- **Oral and/or Poster presentations** on project work demonstrate the ability of the student to present complex concepts and information in a clear and concise manner, to interact and communicate effectively to a wide range of professional environments, including to both scientific and non-scientific audiences.
- **In-class exercises and tests** taken either conventionally or online via the Keele Learning Environment (KLE) assess students' subject knowledge and their ability to apply it in a more structured and focused way.
- **Individual or group oral presentations** assess individual student's subject knowledge and understanding. They also test their ability to work effectively as members of a team, to communicate what they know orally and visually, and to reflect on these processes as part of their own personal development.

Marks are awarded for summative assessments designed to assess your achievement of learning outcomes. You will also be assessed formatively to enable you to monitor your own progress and to assist staff in identifying and addressing any specific learning needs. Feedback, including guidance on how you can improve the quality of your work, is also provided on all summative assessments within three working weeks of submission, unless there are compelling circumstances that make this impossible, and more informally in the course of tutorial and seminar discussions.

Year 1 (Level 4) lecture modules are assessed by a mixture of continuous assessment (mostly in the form of problem classes and problem sheets) and examination. The skills component of these modules is assessed on your work at the bench, your understanding of the experiment as displayed in discussion with the staff in the laboratory and in the laboratory reports you are required to write. Problem classes and tests that occur periodically throughout the year assess the mathematics component. The computational strand is assessed by demonstration of use of computer code.

Year 2 (Level 5) lecture modules are assessed by a mixture of continuous assessment (mostly in the form of problem classes and problem sheets), laboratory work and examination. Laboratory work is assessed on your work at the bench, your understanding of the experiment as displayed in discussion with the staff in the laboratory and in the laboratory reports you are required to write. The laboratory work is connected to the content of the lecture modules and the marks for the laboratory are therefore convolved with the examination and continuous assessment marks to give a final mark for each module.

In Year 3 (Level 6) modules stand alone. Lecture modules are assessed using a mixture of continuous assessment (mostly in the form of problem sheets) and examination. The project modules are assessed in terms of the originality and ingenuity you display, the quality and methods of research employed and on the final report. You are given the opportunity to display these qualities in a project plan, an interim report, a one-to-one interview and in your final report. The Dissertation and Communication Skills module is assessed on the scientific content and presentation of the dissertation and also on an oral presentation and a poster presentation that you are required to produce.

11. Contact Time and Expected Workload

This contact time measure is intended to provide you with an indication of the type of activity you are likely to undertake during this programme. The data is compiled based on module choices and learning patterns of

students on similar programmes in previous years. Every effort is made to ensure this data is a realistic representation of what you are likely to experience, but changes to programmes, teaching methods and assessment methods mean this data is representative and not specific.

Undergraduate courses at Keele contain an element of module choice; therefore, individual students will experience a different mix of contact time and assessment types dependent upon their own individual choice of modules. The figures below are an example of activities that a student may expect on your chosen course by year stage of study. Contact time includes scheduled activities such as: lecture, seminar, tutorial, project supervision, demonstration, practical classes and labs, supervised time in labs/workshop, fieldwork and external visits. The figures are based on 1,200 hours of student effort each year for full-time students.

Activity

	Scheduled learning and teaching activities	**Guided independent Study**	**Placements**
Year 1 (Level 4)	39%	61%	0%
Year 2 (Level 5)	40%	60%	0%
Year 3 (Level 6)	28%	72%	0%

12. Accreditation

This subject/programme is accredited by The Institute of Physics (IoP). Please note the following:

- Graduates with accredited BSc degrees are eligible for Associate Membership of the IoP. After a period of relevant post-degree experience and professional development they may apply for full membership of the IoP and for Chartered Physicist status.

13. University Regulations

The University Regulations form the framework for learning, teaching and assessment and other aspects of the student experience. Further information about the University Regulations can be found at: http://www.keele.ac.uk/student-agreement/

If this programme has any exemptions, variations or additions to the University Regulations these will be detailed in an Annex at the end of this document titled 'Programme-specific regulations'.

A student who has completed a semester abroad will not normally be eligible to transfer onto the International Year option.

14. What are the typical admission requirements for the Programme?

See the relevant course page on the website for the admission requirements relevant to this programme: https://www.keele.ac.uk/study/

Applicants who are not currently undertaking any formal study or who have been out of formal education for more than 3 years and are not qualified to A-level or BTEC standard may be offered entry to the University's Foundation Year Programme.

Applicants for whom English is not a first language must provide evidence of a recognised qualification in English language. The minimum score for entry to the Programme is Academic IELTS 6.0 or equivalent.

Please note: All non-native English speaking students are required to undertake a diagnostic English language assessment on arrival at Keele, to determine whether English language support may help them succeed with their studies. An English language module may be compulsory for some students during their first year at Keele.

Recognition of Prior Learning (RPL) is considered on a case-by-case basis and those interested should contact the Programme Director. The University's guidelines on this can be found here: http://www.keele.ac.uk/qa/accreditationofpriorlearning/

15. How are students supported on the programme?

Keele Learning Environment (KLE)

All the Physics modules are supported by learning materials that are accessible to students via the KLE at https://students.keele.ac.uk/webapps/login/.

Personal Tutor

All the students are assigned a Personal Tutor as a part of University's Personal Tutor system for their duration of studies at Keele. There is a formal requirement for the Personal Tutors to meet with their first year tutees during the first week of the semester one. Subsequently, Personal Tutors should meet at least four times per year to discuss progress and offer support and advice. During the subsequent undergraduate years Personal Tutors should meet at least three times per year. Students can make arrangement to seek help or advice on any matter that affects their life and work as a student at Keele. More details available at: http://www.keele.ac.uk/personaltutoring/

Year Tutor

Each year of study has an associated Year Tutor who monitors the students and the modules to ensure the course is running smoothly and that you are making progress as you should. They will note any problems and bring them to the attention of the Course Management Committee who will decide on an appropriate course of action. You should regard the year tutor as your first point of contact to discuss any topic related to the courses or your own academic performance.

Student with disabilities

If you have long-term disabilities, you will have the assistance of the Disability Coordinator and the Examinations Office and from academic and support staff who liaise with these services.

Health and Safety

All the students are briefed on the health and safety as part of their induction and repeated again at the beginning of the first laboratory session. Students are required to sign an agreement that they have read the Safety Handbook, and that they will abide by the rules and regulations governing the safety and welfare of all members within the University. The Safety handbook can be accessed on the KLE (https://students.keele.ac.uk/webapps/login/) under the section "Physics and Astrophysics Information"

Further information

It is essential that students check the KLE (http://students.keele.ac.uk/) for up to date information on course and teaching materials related to their Physics modules.

16. Learning Resources

The Physics and Astrophysics section of the School is housed in Lennard Jones Building, which contains well-equipped undergraduate Physics teaching laboratories and a dedicated PC laboratory supporting both Windows and Linux. There are rooms available in the building for the students to work and socialise with their peers. There are dedicated boxes located in the building for submission of the problem sheets and laboratory reports. In addition, the School Office is open continuously during the week from 9am to 5pm to answer student queries.

17. Other Learning Opportunities

Study abroad (semester)

Students on the programme have the potential opportunity to spend a semester abroad in their second year studying at one of Keele's international partner universities.

Exactly which countries are available depends on the student's choice of degree subjects. An indicative list of countries is on the website (http://www.keele.ac.uk/studyabroad/partneruniversities/); however this does not guarantee the availability of study in a specific country as this is subject to the University's application process for studying abroad.

No additional tuition fees are payable for a single semester studying abroad but students do have to bear the costs of travelling to and from their destination university, accommodation, food and personal costs. Depending on the destination they are studying at additional costs may include visas, study permits, residence permits, and compulsory health checks. Students should expect the total costs of studying abroad to be greater than if they study in the UK, information is made available from the Global Education Team throughout the process, as costs will vary depending on destination.

Whilst students are studying abroad any Student Finance eligibility will continue, where applicable students may be eligible for specific travel or disability grants. Students who meet external eligibility criteria may be eligible for grants as part of this programme. Students studying outside of this programme may be eligible for income dependent bursaries at Keele. Students travel on a comprehensive Keele University insurance plan, for which there are currently no additional charges. Some governments and/or universities require additional compulsory health coverage plans; costs for this will be advised during the application process.

Study Abroad (International Year)

A summary of the International Year, which is a potential option for students after completion of year 2 (Level 5), is provided in the Annex for the International Year.

Other opportunities

Also there are other opportunities such as *Physics Ambassador Scheme* and *e-mentoring scheme* for students to enhance their employability skills.

18. Additional Costs

As to be expected there will be additional costs for inter-library loans and potential overdue library fines, print and graduation. We do not anticipate any further costs for this programme.

19. Quality management and enhancement

The quality and standards of learning in this programme are subject to a continuous process of monitoring, review and enhancement.

- The School Education Committee is responsible for reviewing and monitoring quality management and enhancement procedures and activities across the School.
- Individual modules and the programme as a whole are reviewed and enhanced every year in the annual programme review which takes place at the end of the academic year.
- The programmes are run in accordance with the University's Quality Assurance procedures and are subject to periodic reviews under the Internal Quality Audit (IQA) process.

Student evaluation of, and feedback on, the quality of learning on every module takes place every year using a variety of different methods:

- The results of student evaluations of all modules are reported to module leaders and reviewed by the Programme Committee as part of annual programme review.
- Findings related to the programme from the annual National Student Survey (NSS), and from regular surveys of the student experience conducted by the University, are subjected to careful analysis and a planned response at programme and School level.
- Feedback received from representatives of students in all three years of the programme is considered and acted on at regular meetings of the Student Staff Voice Committee.

The University appoints senior members of academic staff from other universities to act as external examiners on all programmes. They are responsible for:

- Approving examination questions
- Confirming all marks which contribute to a student's degree
- Reviewing and giving advice on the structure and content of the programme and assessment procedures

Information about current external examiner(s) can be found here:
http://www.keele.ac.uk/qa/externalexaminers/currentexternalexaminers/

20. The principles of programme design

The programme described in this document has been drawn up with reference to, and in accordance with the guidance set out in, the following documents:

a. UK Quality Code for Higher Education, Quality Assurance Agency for Higher Education:
http://www.qaa.ac.uk/quality-code
b. QAA Subject Benchmark Statement: Physics, Astronomy and Astrophysics (2019)
https://www.qaa.ac.uk/docs/qaa/subject-benchmark-statements/subject-benchmark-statement-physics-astronomy-and-astrophysics.pdf?sfvrsn=eff3c881_4
c. Keele University Regulations and Guidance for Students and Staff: http://www.keele.ac.uk/regulations

d. The Institute of Physics Accreditation Scheme for First Degree Courses in Physics
https://www.iop.org/education/higher_education/accred-and-recog/page_73752.html?gclid=EAIaIQobChMIuqrjwNHk5QIVBrDtCh12AwijEAAYASAAEgJU-_D_BwE

21. Annex - International Year

Physics with International Year

Please note: in order to be eligible to take the International Year option your other subject must also offer this option. Please refer to the information published in the course document for your other subject.

International Year Programme

Students registered for this Combined Honours programme may either be admitted for or apply to transfer during their period of study at Level 5 to the Combined Honours programme in both their principal subjects, providing that they meet the progression criteria outlined in this document. Students accepted onto the International Year programme will have an extra year of study at an international partner institution after they have completed Year 2 (Level 5) at Keele.

Students who successfully complete both the second year (Level 5) and the International Year will be permitted to progress to Level 6. Students who fail to satisfy the examiners in respect of the International Year will normally revert to the Combined Honours programme without the International Year and progress to Level 6 on that basis. The failure will be recorded on the student's final transcript.

Study at Level 4, Level 5 and Level 6 will be as per the main body of this document. The additional detail contained in this annex will pertain solely to students registered for the International Year option.

International Year Programme Aims

In addition to the programme aims specified in the main body of this document, the international year programme of study aims to provide students with:

1. Personal development as a student and a researcher with an appreciation of the international dimension of their subject
2. Experience of a different culture, academically, professionally and socially

Entry Requirements for the International Year

Students may apply to the 4-year programme during Level 5. Admission to the International Year is subject to successful application, interview and references from appropriate staff.

The criteria to be applied are:

- Academic Performance (an average of 55% across all modules at Level 5 is required. Students with up to 15 credits of re-assessment who meet the 55% requirement may progress to the International Year. Where no Semester 1 marks have been awarded performance in 1st year marks and ongoing 2nd year assessments are taken into account)
- General Aptitude (to be demonstrated by application for study abroad, interview during the 2nd semester of year 2 (Level 5), and by recommendation of the student's personal tutor, 1st and 2nd year tutors and programme director)

Students may not register for both an International Year and a Placement Year.

Student Support

Students will be supported whilst on the International Year via the following methods:

- Phone or Skype conversations with Study Abroad tutors, in line with recommended Personal Tutoring meeting points.
- Support from the University's Global Education Team

Learning Outcomes

In addition to the learning outcomes specified in the main text of the Programme Specification, students who complete a Keele undergraduate programme with International Year will be able to:

1. Describe, discuss and reflect upon the cultural and international differences and similarities of different learning environments
2. Discuss the benefits and challenges of global citizenship and internationalisation
3. Explain how their perspective on their academic discipline has been influenced by locating it within an international setting.
4. Engage effectively in academic and scientific discourse in an international setting;
5. Integrate, apply and develop fundamental physical principles to describe and explain phenomena and solve problems within the context of specialised areas of Physics.

Please note that students on Combined Honours programmes with International Year must meet the subject-specific learning outcomes for BOTH their principal subjects.

These learning outcomes will all be assessed by the submission of a satisfactory individual learning agreement, the successful completion of assessments at the partner institution and the submission of the reflective portfolio element of the international year module.

Course Regulations

Students registered for the International Year are subject to the programme-specific regulations (if any) and the University regulations. In addition, during the International Year, the following regulations will apply:

Students undertaking the International Year must complete 120 credits, which must comprise *at least 40%* in the student's discipline area.

This may impact on your choice of modules to study, for example you will have to choose certain modules to ensure you have the discipline specific credits required.

Students are barred from studying any module with significant overlap to the Level 6 modules to be studied on their return. Significant overlap with Level 5 modules previously studied should also be avoided.

Additional costs for the International Year

Tuition fees for students on the International Year will be charged at 15% of the annual tuition fees for that year of study, as set out in Section 1. The International Year can be included in your Student Finance allocation, to find out more about your personal eligibility see: www.gov.uk

Students will have to bear the costs of travelling to and from their destination university, accommodation, food and personal costs. Depending on the destination they are studying at additional costs may include visas, study permits, residence permits, and compulsory health checks. Students should expect the total costs of studying abroad be greater than if they study in the UK, information is made available from the Global Education Team throughout the process, as costs will vary depending on destination.

Students who meet external eligibility criteria may be eligible for grants as part of this programme. Students studying outside of this programme may be eligible income dependent bursaries at Keele.

Students travel on a comprehensive Keele University insurance plan, for which there are currently no additional charges. Some Governments and/or universities require additional compulsory health coverage plans; costs for this will be advised during the application process.

Version History

This document

Date Approved: 09 June 2022

Previous documents

Version No	Year	Owner	Date Approved	Summary of and rationale for changes
1	2021/22	ARUMUGAM MAHENDRASINGAM	08 February 2021	
1	2020/21	ARUMUGAM MAHENDRASINGAM	13 December 2019	
1	2019/20	ARUMUGAM MAHENDRASINGAM	13 December 2019	