UNIVERSITY OF EXETER

PHYSICS AND ASTRONOMY

UNDERGRADUATE SUBJECT BROCHURE 2019
EXETER CAMPUS

CONTENTS

"A Physics degree will get you anywhere. Employers love problem solving, analytical skills and people that are good with numbers and computers. During the degree you'll develop strong time management, report writing, presentation making and organisational skills, and you'll get plenty of team work experience. You'll learn how to do your own programming, and labs allow you to think freely and apply what you've learnt in lectures. These skills will give you a huge range of opportunities; a good Physics degree from a good university is a fantastic investment for your future and your career."

Alexandra, studying Physics

THIRD YEAR LABORATORY, PHYSICS BUILDING, STREATHAM CAMPUS

PHYSICS AND ASTRONOMY

12th in the UK for Physics and Astronomy in *The Times and The Sunday Times Good University Guide 2018*

82% of Physics students in graduate-level employment or further study within six months of graduating[1]

Combine your degree with a salaried research placement at companies such as Renishaw, the Home Office and the Rutherford Appleton Laboratories

Study abroad at one of our partner universities in North America, New Zealand or Australia

Supportive community characterised by genuine student-staff relationships and small tutorial groups, typically made up of five students

Studying Physics is a stimulating, thought-provoking, challenging and ultimately rewarding experience.

At Exeter you will be encouraged to think as a researcher, solving complex problems throughout your degree. You will have access to advanced research facilities that include clean-rooms for photo and nanolithography, a helium liquefier for low temperature experiments, a water tank for acoustic experiments, amplified ultra-fast laser systems for the study of ultra-high speed phenomena and a suite of instruments for imaging biological materials.

Alongside completing a three or four year degree, you can combine your studies with a salaried research placement or year abroad, in North America, New Zealand or Australia. By choosing to undertake a research placement you will gain first hand experience in a research group, contributing to a relevant and important project, with the potential to be published.

We are globally-renowned for our expertise in Astrophysics, specifically star formation and exoplanets. We therefore offer a specialist degree in this area, led by those responsible for our reputation.

From your first day you will be treated as a practitioner of physics, developing yourself as a capable and adaptable problem solver, ready to pursue a career in variety of sectors, or life in academic research.

ACCREDITATION

IOP | Institute of Physics
Juno Champion

All our MPhys and Single Honours BSc degrees are accredited by the Institute of Physics. Accredited MPhys degrees fully satisfy the educational requirements of the Chartered Physicist (CPhys) professional qualification.

"The Physics programme at the University of Exeter gave me an opportunity to study and research a large range of different physics areas. Spending a year working in industrial research helped show me that applying physics to real-world industrial challenges was something that particularly interested me."

Allan, Physics with Professional Experience graduate

www.exeter.ac.uk/ug/physics

[1] *Destination of Leavers from Higher Education Survey (DLHE) of 2015/16 undergraduates.*

DEGREE PROGRAMMES

SINGLE HONOURS

BSc/MPhys Physics (EXETER)

BSc F300 3 yrs

MPhys F303 4 yrs

A*AA-AAB | IB: 38-34 | BTEC: D*DD-DDD

Required subjects: At least one grade A and a grade B in GCE AL Maths+ and Physics or at least one HL6 and one HL5 in IB Maths and Physics.

- ☐ Equips you with the fundamental tools and an understanding of the concepts and phenomena which together form the underlying principles of the subject
- ☐ Both three- and four-year options lead to independent PhD-style research in your final year(s)
- ☐ Option to transfer between programmes during your first year
- ☐ Content covers both theoretical and experimental physics, which you will investigate in our teaching laboratories
- ☐ Join our physics society, Physoc; an engaged and active community with an exciting calendar of events

Year 1 Study the fundamentals of physics, covering areas such as astrophysics, properties of matter and vector mechanics, while learning a variety of mathematical skills and subjects. You will also use waves and optics to understand related systems, and study IT and electronics as well as practical physics.

Year 2 Your second year will focus on four key areas: condensed matter, electromagnetism, quantum mechanics and thermal physics. Your understanding of these areas will enhance your knowledge of other related modules, leading to a sounder understanding of the evolution of our universe and the living systems within it.

Year 3 This year, you will study a variety of topics at a much more detailed level, such as Electromagnetism, Quantum Mechanics▲, Particle Physics and Soft Matter. Choose from the many different core modules to broaden your understanding of our galaxies, ultrafast and high energy physics, and much more.

Year 4 (MPhys only) You will study two core modules in Year 4, however completion of your final project will be the main focal point. Optional modules will vary, but include topics such as computational physics and modelling, solar and extra-solar planets and their atmospheres, and nanostructures and graphene physics.

BSc/MPhys Physics with Astrophysics (EXETER)

BSc F3F5 3 yrs

MPhys F3FM 4 yrs

A*AA-AAB | IB: 38-34 | BTEC: D*DD-DDD

Required subjects: At least one grade A and a grade B in GCE AL Maths+ and Physics or at least one HL6 and one HL5 in IB Maths and Physics.

- ☐ Apply the fundamental laws of physics to some of the most remarkable environments in the universe
- ☐ Work with data obtained from earth and space-based observational facilities, including the hubble space telescope
- ☐ Our building is home to our observatory dome, housing a 14" Celestron Edge HD telescope
- ☐ Study topics include relativity and cosmology, star birth and extrasolar planets under tuition of world-leading researchers

Year 1 Your first year consists of the same structure as BSc/MPhys, except you will study IT and astrophysics instead of IT and electronics – giving you a broader understanding of astrophysics in order to carry out the rest of your degree modules.

Year 2 You will learn the same core modules as BSc/MPhys, except you will study two extra core modules: Scientific Programming and Observing the Universe. This will prepare you for much more in-depth study in your third year.

Year 3 Exploring astrophysics in greater detail, your key modules will focus entirely around the evolution of our universe. Key areas of focus will be in electromagnetism, galaxies and high energy astrophysics, nuclear and high energy physics, stars from birth to death and quantum mechanics▲. You will also undertake project work to either complete your degree (BSc) or prepare you for your final year (MPhys).

Year 4 (MPhys only) You will spend the majority of this year focusing on your final project, however you will study four core modules alongside this. There is also an option to study a number of additional modules, such as Quantum Optics and Photonics or Ultrafast Physics, should you wish to.

MPhys Physics with Professional Experience (EXETER)

F304 4 yrs

A*AA-AAB | IB: 38-34 | BTEC: D*DD-DDD

Required subjects: At least one grade A and a grade B in GCE AL Maths+ and Physics or at least one HL6 and one HL5 in IB Maths and Physics.

- ☐ Spend your third year in relevant paid employment (eg, QinetiQ, DSTL, EDF Energy, Renishaw, the Home Office and the Rutherford Appleton Laboratories)
- ☐ Dedicated academic tutor who will offer guidance throughout your placement year through visits, telephone calls and emails
- ☐ Professional experience year contributes to final-year mark
- ☐ Experience professional employment, prior to applying to graduate market
- ☐ During your professional experience year your will pay a reduced tuition fee

Year 1 You will study the same core modules as those in MPhys Physics, except you do not have to study IT and electronics – this is an optional extra.

Year 2 All modules and learning are the same as MPhys Physics.

Year 3 In your third year you will undertake a summer of work experience, then complete background report project once back in the autumn term. The other key area of study throughout this year will be in quantum mechanics.

Year 4 There are four fundamental areas of study in the fourth and final year. These are a final project, condensed matter, nuclear high energy physics and statistical physics. You will also be able to choose from a number of different optional modules to increase and broaden your knowledge base.

▲ *MPhys only.*

MPhys Physics with Study Abroad in North America, New Zealand or Australia (EXETER)

with North American Study F3T7 4 yrs
with Study in New Zealand F308 4 yrs
with Australian Study F3TV 4 yrs
A*AA-AAB | IB: 38-34 | BTEC: D*DD-DDD
Required subjects: At least one grade A and a grade B in GCE AL Maths+ and Physics or at least one HL6 and one HL5 in IB Maths and Physics.

North America:

Iowa State University
University of Kansas
University of New Mexico

New Zealand:

Massey University
University of Auckland

Australia:

University of Sydney
University of Wollongong

- ☐ Broaden your university experience and study in a new cultural environment
- ☐ Opportunity to study topics not available at Exeter, including practical astronomy, space physics and the physics of weather

Year 1 In your first year you will develop your understanding of physics and become familiar with a variety of basic mathematical tools. The concepts and phenomena you will meet are many and varied, but are united by the underlying principles of physics.

Year 2 This year provides a firm foundation of physics, and the principles that constitute the framework of the subject. This year focuses on four main cornerstones of physics: condensed matter, quantum mechanics, electromagnetism and thermodynamics. The other modules in your second and subsequent years draw in part on your knowledge of this core.

Year 3 During your third year, you will broaden your experience by studying physics abroad. Throughout this time, you will study a variety of topics, such as nuclear physics and particle physics, nanostructures and graphene, biophysics, electromagnetism, and methods for theoretical physics.

Year 4 Completion of your project is the focal point of this year. You will study three core modules and optional modules which will vary depending on your course.

COMBINED HONOURS

BSc Mathematics and Physics (EXETER)

FG31 3 yrs
A*AA-AAB | IB: 38-34 | BTEC: D*DD-DDD
Required subjects: At least one grade A and a grade B in GCE AL Maths+ and Physics or at least one HL6 and one HL5 in IB Maths and Physics.

Please see www.exeter.ac.uk/ug/maths

- ☐ Explore the interplay between the two disciplines, understanding the ways they co-exist and complement each other
- ☐ Evenly divided workload designed to allow you to study both Physics and Mathematics, without compromise
- ☐ Flexibility to choose from wide range of optional topics such as chaotic dynamics, cryptography and stars from birth to death
- ☐ Recognised by the Institute of Physics
- ☐ See website or subject brochure for full module information

Year 1 In Year 1, the concepts and phenomena you'll meet are many and varied! You will develop your understanding of physics and will be introduced you to all of the main areas of university-level mathematics, consolidating and building on the material you will have learned at school or college.

Year 2 This year provides a firm foundation in mathematics and physics, and the principles that constitute the framework of the two subjects. In physics, you will take core modules in electromagnetism and quantum mechanics, while you will explore the use of mathematics to give these principles a precise form. The Linear Algebra module is also core, and will cover concepts and techniques that are widely used in many areas of mathematics. Optional modules give you the opportunity to learn about more specialised topics, and will inform your third year of study.

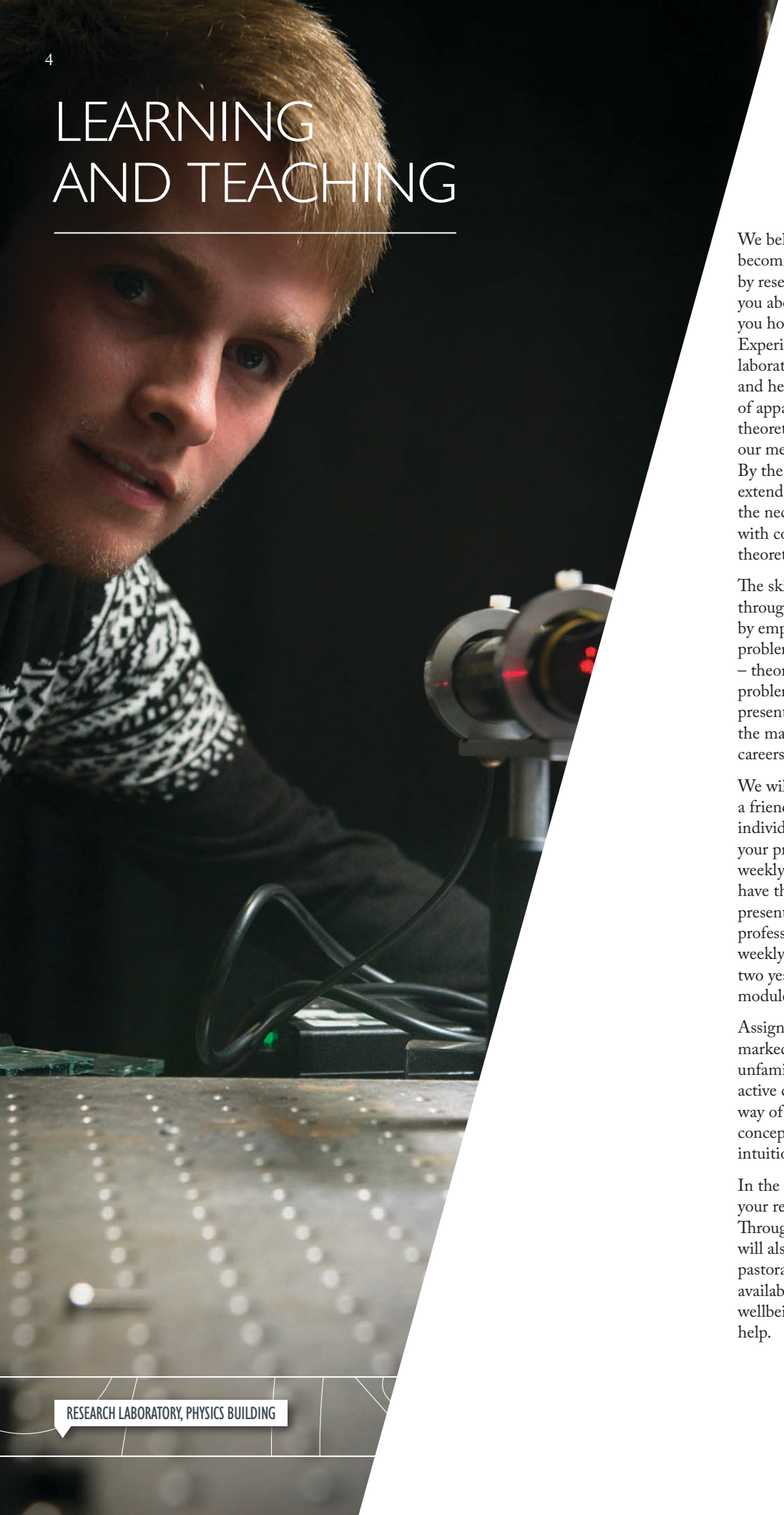
Year 3 The third and final year of this programme allows you to apply the core principles of maths and physics in a broad range of important areas. You will take a core module in Nuclear Physics and an advanced Electromagnetism course, as well as undertaking an extended (open-ended) project in our newly refurbished third year teaching lab. You also you have the opportunity to take a very wide range of modules, ranging from to Pure Maths (eg, Combinatorics) to Applied Maths (eg, Cryptography and the Mathematics of Climate Change), and including topics such as Fluid Dynamics, Theoretical Physics, Biophysics and Astrophysics.

ENTRY REQUIREMENTS: MORE INFO

+Candidates may offer GCE AL Maths, Pure Maths or Further Maths.

Applicants offering non-standard qualifications (for example the Access to Higher Education Diploma or Open University credits) may need to pass an A level-style mathematics test to demonstrate ability. This test will be undertaken as part of an interview.

LEARNING AND TEACHING



RESEARCH LABORATORY, PHYSICS BUILDING

We believe that every student benefits from becoming part of a culture that is inspired by research. Not only do our experts teach you about our pioneering research, we teach you how to undertake the research yourself. Experimental skills are acquired in the laboratories and astronomical observatory, and here you are introduced to a wide range of apparatus and techniques. Training in theoretical techniques are provided by our methods and computational modules. By the time you reach the start of your extended project work, you will have received the necessary preparation to undertake it with confidence in either experimental or theoretical topics.

The skills you will gather as you progress through your degree will also be highly valued by employers. The ability to solve complex problems (including designing experiments – theoretical or practical – to answer such problems), researching existing work and presenting your results, are all transferable to the management of a wide range of potential careers.

We will fully support you as a student in a friendly environment. You will receive individual attention and feedback throughout your programme, in the form of small group weekly tutorials with your tutor. You will also have the opportunity to practice your oral presentation skills, and gain support with your professional development. We also provide weekly problem solving classes in the first two years for both Mathematics and Physics modules.

Assignments will be set, discussed and marked – sometimes these will be on unfamiliar topics. We wish to encourage active discourse in physics as this is a good way of understanding the more subtle concepts and gaining confidence in your intuition.

In the final year of the MPhys programmes, your research project supervisor is your tutor. Throughout your time at Exeter, your tutor will also be your first point of contact for pastoral support and will advise about the availability of University services including wellbeing, disability support and financial help.

ASSESSMENT

Assessment in the first two years is a combination of continuous assessment and exams. About 65 per cent of the assessment in each of these years is by written examinations and short mid-term tests. The rest involves work for projects, laboratories, problems classes and more. You must obtain a pass mark for your first year in order to proceed, but your performance at this stage does not count towards your final degree classification. Progression on to the third year of any MPhys programme is subject to satisfactory academic performance.

PROJECTS

During your final year you can complete a one-term project, which may be theoretical or experimental, and is normally undertaken by pairs of students. Projects are normally inspired by research in the department, although you may propose your own topic for investigation.

Our BSc projects span from imaging atoms using quantum tunnelling to mapping the spiral structure of our galaxy using our radio telescope. Between these extremes, you may observe exoplanet transits or pulsars, image the nano-scale structure of butterfly wings, lotus leaves, or medical nanoparticles, levitate objects with sound, or determine the origin of meteorites in our solar system, amongst many other options.

Our MPhys projects cover the broad range of research that the Physics and Astronomy staff are engaged in. Past projects have ranged from modelling exoplanet formation and atmospheres, to using direct imaging to try to discover new planets around other stars. We have also had researchers studying the discs of young stars, and the effects of supernovae feedback on galactic evolution.

STUDY SPACE IN PHYSICS BUILDING

Computing space	Student meeting rooms	Facilities you can access
☐ 2 x Mac suites containing 40 and 20 machines respectively ☐ 40+ windows computers within our laboratories	2 x student common rooms – one of which is the highest point in Exeter and commands panoramic views of the city and beyond.	☐ Observatory containing a 14" Celestron Edge HD optical telescope ☐ Scanning Electron Microscope ☐ Scanning Tunnelling Microscope ☐ Slow motion camera capable of many thousand frames per second ☐ Acoustic chamber

PHYSOC

PhySoc is an established society and the majority of Physics students are members. It is a great opportunity to socialise with your fellow physicists, away from lectures and labs. PhySoc hold fortnightly events, ranging from pub crawls to bowling to beach trips and karaoke. For those with an interest in sport, you can represent PhySoc in football, badminton, netball, touch rugby and rounders in intramural leagues. Each year the society takes a trip abroad, with previous locations including Paris, Prague, Budapest and Amsterdam. Other calendar highlights include the Christmas meal and Summer Ball.

The Athena SWAN Charter recognises and celebrates good employment practice for women working in Science, Technology, Engineering, Mathematics and Medicine (STEMM) in higher education and research, and Project Juno is a scheme run by the Institute of Physics which recognises good practice in relation to gender equality. The University is proud to have held a Bronze institutional Athena SWAN award since 2011, and we were awarded a Bronze award at departmental level in 2015. Physics at Exeter has held Juno Practitioner status since 2013.

IOP Institute of Physics
Juno Champion

Project Juno is a scheme run by the Institute of Physics (IoP) which recognises good practice in relation to gender equality in Physics Departments. The aim is to promote an inclusive and equitable working culture within Physics, and to tackle any practical, structural or cultural barriers faced by women within the department. There are four levels to the Juno process – Supporter, Practitioner, Champion and the Juno Excellence Programme and Award. Physics at Exeter was awarded Juno Champion status in 2018 after previously being awarded and renewing Practitioner status in 2013 and 2015 respectively.

YOUR SUCCESSFUL CAREER

RECENT GRADUATES ARE NOW WORKING FOR▲:

- NHS
- Rolls Royce
- Renishaw
- QinetiQ
- EDF Energy
- Transport for London
- NASA
- Darktrace
- Civil Service
- Institute of Astrophysics (Paris)

CAREERS SERVICES

We have a dedicated, award-winning Careers Service, with offices at our Exeter and Penryn campuses, ensuring you have access to careers advisors, mentors and the tools you need to succeed in finding employment in your chosen field on graduation. We offer the Exeter Award and the Exeter Leaders Award which include employability-related workshops, skills events, volunteering and employment which will contribute to your career decision-making skills and success in the employment market. Our graduates compete very successfully in the employment market, with many employers targeting the University when recruiting new graduates. For further information about our Careers Service please visit: **www.exeter.ac.uk/careers**

MPHYS PHYSICS WITH PROFESSIONAL EXPERIENCE

This degree programme includes a Professional Experience year which allows you to gain work experience in a relevant business or commercial setting and contributes directly towards your degree classification◆. See page 2 for further details.

◆ *During your Professional Experience year you will pay reduced tuition fees.*

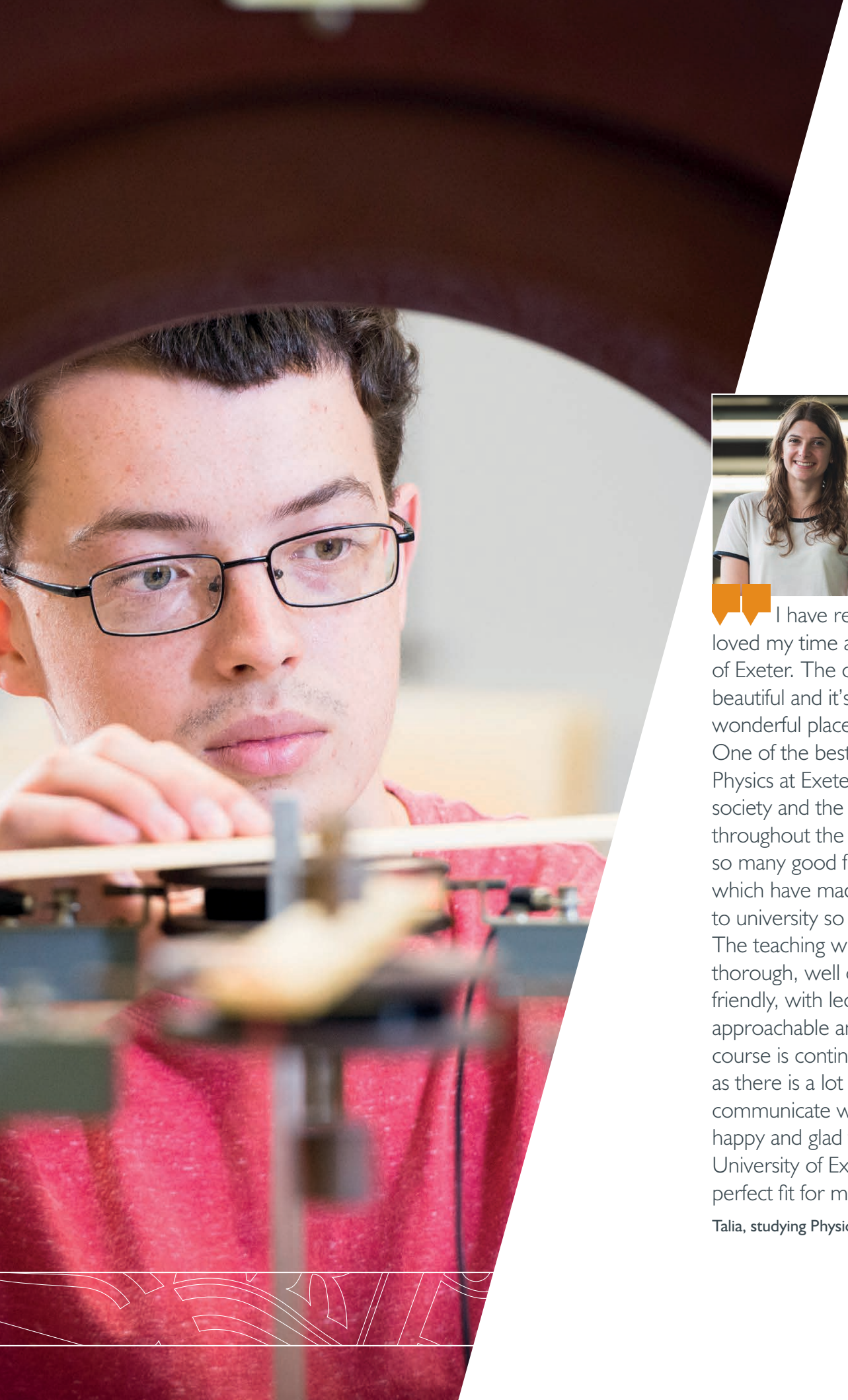
Physics at Exeter will shape you into a multitalented individual, who is able to succeed in a wide variety of professional roles.

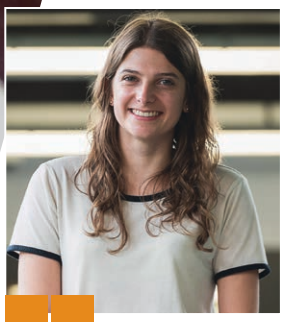
RECENT GRADUATES ARE NOW WORKING AS▲:

- Medical Physicist
- Engineer
- Transport Modeller
- Nuclear Physicist
- Technical Consultant
- Cyber Analyst
- Design and Development Engineer
- Software Engineer and Geophysicist

▲ *This information has been taken from the Destinations of Leavers from Higher Education (DLHE) Surveys 2014/15. Please note that, due to data protection, the job titles and organisations are listed independently and do not necessarily correspond.*

RESEARCH LABORATORY, PHYSICS BUILDING





I have really enjoyed and loved my time at the University of Exeter. The campus is beautiful and it's set in a really wonderful place in the country. One of the best things about Physics at Exeter is our close-knit society and the events put on throughout the term. I've made so many good friends here which have made the transition to university so smooth.
The teaching within Physics is thorough, well organised and friendly, with lecturers being approachable and helpful. The course is continuously improved as there is a lot of opportunity to communicate with staff. I am so happy and glad that I chose the University of Exeter; it was the perfect fit for me.

Talia, studying Physics

MODULES

KEY C = Core
● = Optional

For up-to-date details of all our programmes and modules, please check **www.exeter.ac.uk/ug/physics**

Year 1 Modules

Module Name	BSc/MPhys Physics	MPhys/BSc Physics with Astrophysics	MPhys Physics with Professional Experience	MPhys Physics with Study Abroad	BSc Mathematics and Physics†
Introduction to Astrophysics	C	C	C	C	
IT and Astrophysics Skills		C	●	●	
IT and Electronics Skills	C		●	●	
Mathematics Skills	C	C	C	C	C
Mathematics for Physics	C	C	C	C	C
Foundations					C
Practical Physics and IT Skills					C
Practical Physics I	C	C	C	C	
Properties of Matter	C	C	C	C	C
Structures					C
Vector Mechanics	C	C	C	C	C
Waves and Optics	C	C	C	C	C

Year 2 Modules

Module Name	BSc/MPhys Physics	MPhys/BSc Physics with Astrophysics	MPhys Physics with Professional Experience	MPhys Physics with Study Abroad	BSc Mathematics and Physics†
Analytical and Chaotic Mechanics	●		●	●	●
Condensed Matter I	C	C	C	C	●
Elective(s)*	●		●	●	
Electromagnetism I	C	C	C	C	C
Lasers, Materials and Nanoscale Probes for Quantum Applications	●		●	●	●
Mathematics with Physical Applications	C	C	C	C	●
Compulsory Options from Mathematics (please see our website)					C
Observing the Universe	●	C	●	●	●
Practical Physics II	C	C	C	C	●
Quantum Mechanics I	C	C	C	C	C
Scientific Programming in C	●	C	●	●	
The Physics of Living Systems	●		●	●	●
Thermal Physics	C	C	C	C	●

Year 3 Modules

Module Name	BSc/MPhys Physics	MPhys/BSc Physics with Astrophysics	MPhys Physics with Professional Experience	MPhys Physics with Study Abroad	BSc Mathematics and Physics†
Advanced Quantum Mechanics				●	
Advanced Solid State Physics				●	
Advanced Statistical Physics				●	
Applying Physics (BSc Group Project)	●	●			
Elective (MPhys Physics only)*	●				
Electromagnetism II	C	C	C	●	C
Energy and the Environment	●	●			●
Galaxies and High Energy Astrophysics	●	C			●
General Problems	C	C			
Mathematics					C
Methods of Theoretical Physics	●	●			●
Modules at Year Abroad Host				C	
Nanostructures and Graphene Science	●	●			●
Nuclear and High Energy Physics	C	C		●	C
Principles of Theoretical Physics	●	●			●
Professional Experience			C		
Project(s)	C	C	C	C	C
Quantum Mechanics II (MPhys only)	C	C	C		
Soft Matter	●	●▲			●
Stars from Birth to Death	●	C			●
The Biophysics of Cells and Tissues	●	●			●
Ultrafast Physics	●	●			●

Year 4 Modules

Module Name	MPhys/Physics	MPhys/Physics with Astrophysics	MPhys Physics with Professional Experience	MPhys Physics with Study Abroad
Condensed Matter II	C	C	C	C
Electromagnetism II				C
Independent Study	●	●	●	●
Nuclear and High Energy Particle Physics			C	C
Physical Methods in Biology and Medicine	●	●	●	●
Projects(s) and Dissertation	C	C	C	C
Quantum Many-Body Theory	●	●	●	●
Quantum Mechanics II				C
Quantum Optics and Photonics	●	●	●	●
Relativity and Cosmology	●	C	●	
Solar and Extra-Solar Planets and Their Atmospheres	●	C	●	●
Statistical Physics	C	C	C	C

* *An 'elective' is an unspecified module that allows you to broaden your education by taking a module from another discipline, eg, philosophy, or a foreign language.*

▲ *BSc Physics w/ Astrophysics (not MPhys).*

Please note that availability of all modules is subject to timetabling constraints and that not all modules may be available every year. For up-to-date details of all our programmes and modules, please check the undergraduate section of our website at **www.exeter.ac.uk/ug/physics**

YEAR 1

Introduction to Astrophysics	You will be introduced to the theories of quantum mechanics and special relativity, and explore how they are used to explain to a wide variety of astrophysical phenomena. You will develop a broad knowledge and understanding of the key ideas and language used by modern astronomers to describe and explain the observed universe.
IT and Electronics Skills	Every physicist must be able to analyse data, evaluate theoretical models, and present their work in the form of a technical report. They must also be able to perform investigations, such as experiments, and solve the problems they encounter in a systematic and logical manner.
Mathematics Skills	If you want to understand physics, you must have a sound grasp of mathematical methods and have a good level of 'fluency' in your application. This module covers areas such as differential calculus, complex numbers and matrices that have wide applicability throughout physics. It provides a firm foundation on which the follow-up module from Mathematics for Physicists will build, and emphasises problem solving with examples taken from physical sciences.
Mathematics for Physicists	You will consolidate your skills in foundation topics in mathematics and be introduced to some of the mathematical techniques that are most frequently used in physics. Emphasis is placed on the use of mathematical techniques rather than their rigorous proof.
Practical Physics I	From studying this module you will possess a broad foundation knowledge of experimental physics, upon which practical work in the Stage 2 and subsequent years builds. It starts with a short series of lectures, supplemented with online notes on error analysis and graph plotting. Laboratory work is normally undertaken in pairs, with support from demonstrators. Experiments are recorded in lab-books and presented as formal reports. One of the experiments involves working as a group and preparing and delivering oral presentation in a conference-like environment.
Practical Physics and IT	The practical laboratory work in this module provides a broad foundation in experimental physics, upon which experimental work for the Stage 2 year and project work in Stage 3 builds. You will also learn to produce high-quality typeset reports using LaTeX and a stylesheet. The module also introduces the student to the GNU Octave numerical mathematics package. The Octave language is essentially the same as the MATLAB language which is widely used in commercial and research environments for numerical modelling.
Properties of Matter	Understanding properties of matter is both a basic aspect of physics and very important in view of its increasing technological importance. The coverage of condensed matter within the degree programmes is spread over a number of modules, this being the first. The aim of this module is to develop a sound understanding of the basic concepts of properties of matter. This is done at two levels. Topics such as elastic properties and hydrostatic properties are explained using experimental observations and macroscopic theories. Surface tension in liquids is explained using a molecular-level theory. This is followed by a microscopic treatment of interatomic interactions, the ground-state electronic structure of atoms, and rotational and vibrational energy levels in molecules. The structure of liquid crystals is discussed in terms of different molecular arrangements. Finally, atomic structure and bonding in crystals with diamond structures and sodium chloride structures is described.
Vector Mechanics	Although some of the concepts will be familiar from A level, vector notation will be used throughout. Particular emphasis is placed on the precise and consistent application of the laws and methods.
Waves and Optics	The concepts of oscillation and wave propagation permeates the whole of physics. This module identifies and applies the underlying principles, enabling you to understand many apparently unrelated systems. A wide range of physical phenomena are used as examples. The module first considers the characteristic parameters of a forced, damped harmonic oscillator, and relates them to the characteristic parameters of wave propagation. Later stages discuss the propagation and reflection of waves, using waves on a stretched string as the model system. Longitudinal waves in solids, sound waves in gases, and waves in periodic structures (key to much of solid-state physics) are also discussed, followed by an introduction to geometrical optics and optical systems. The concepts introduced in this module underpin, and will be developed in later modules, eg, Electromagnetism I, Quantum Mechanics I and Condensed Matter I.
IT and Astrophysics Skills	You will first learn to produce high-quality typeset reports using LaTeX and a stylesheet. This is followed by an introduction to the GNU Octave numerical mathematics package. The final part introduces you to computer-aided manipulation and analysis of modern astrophysical data.

YEAR 2

Analytical and Chaotic Mechanics	This module introduces some fundamental concepts in analytical dynamics, and illustrates their applications to relevant problems. The module covers the calculus of variations, Lagrangian and Hamiltonian formulations of dynamics, Poisson brackets, canonical transformations, and Hamilton-Jacobi equations.
Condensed Matter I	By taking this module, you will understand how electrons, and other waves, propagate within crystalline materials and affect their properties. The properties of periodic structures are discussed, particularly the relationship between real space and reciprocal space and the representation of elastic and inelastic scattering in both spaces. Both phonons and electrons are profoundly influenced by the crystal structure in which they propagate. The last section of this module considers the transport of electrons in the free-electron and nearly-free-electron approximations, which give a good description of the behaviour of electrons in metals and semiconductors. The vibrational excitations of the crystal lattice (phonons) are of particular importance to the properties of insulators.
Electromagnetism I	Survey the phenomena associated with electrostatics (charges at rest) and magnetostatics (the magnetic effects associated with steady currents). It introduces and develops the use of the electric and magnetic field vectors and relates them by considering electromagnetic induction at a classical level. The connection between these fields and conventional lumped-circuit parameters R, C and L is also developed.
Mathematics with Physical Applications	Achieve a deeper understanding of and greater competence in some central mathematical ideas and techniques used throughout physics. The emphasis is on practical skills rather than formal proofs. Students will acquire skills in some key techniques that relate directly to the advanced modules they will meet in the later stages of their degree programme, but also have wide applicability across the mathematical sciences.
Practical Physics II	Laboratory work is an important part of the process of learning physics where students apply their knowledge practically. It allows students to deepen their understanding and improve problem solving techniques, and enables them to take an active part in the enquiry into the natural world. You will then be introduced to more advanced techniques and equipment, with detailed and often open-ended experiments. The experiments complement lecture material of the Stage 2 and 3 modules. A number of the experimental topics are not directly covered in lectures and aim to extend your overall vision of physics and your ability to define and solve problems independently. In addition, you will develop a wide range of experimental skills such as experimental skills, careful record keeping, critical interpretation of data and presenting.
Quantum Mechanics I	Study the mathematical expression of the basic principles of quantum mechanics and methods for finding solutions of problems that permit straightforward mathematical analysis. These solutions demonstrate many of the general features of the subject and will be applied in subsequent modules in the Physics programme.
Thermal Physics	Building on the discussion of thermal properties in the Properties of Matter module, you will be introduced to classical thermodynamics and shown how its laws arise naturally from the statistical properties of an ensemble. Real-world examples of the key ideas are presented and their application in later modules such as Condensed Matter I and Stars is stressed. The concepts developed in this module are further extended in the Statistical Physics module.
The Physics of Living Systems	You will examine the basic physical concepts and principles required to understand and study living systems. A synthetic approach is adopted: molecules-cells-tissue, emphasising the contributions of physics and the outstanding challenges. It starts at the molecular level and works up the scale of size and complexity to cover several major systems found in complex organisms.
Lasers, Materials and Nanoscale Probes for Quantum Applications	We are living in the age of quantum optoelectronics: optical-signal processing, high-power laser sources, optical amplifiers, single-photon manipulation, quantum confined-electron devices, etc. This module will emphasise how our understanding of light and matter may be used to provide assorted optoelectronic devices, and also how they in turn may enhance our understanding of light and matter.
Scientific Programming in C	A knowledge of a computing language and how to write programmes to solve physics related problems is a valuable transferable skill. It is taught through a series of practical sessions where you will initially learn to understand the logic of the source code. This module teaches the C programming language, but the principles involved are applicable to almost every procedural programming language. This module provides a general introduction to programming in C and to the main elements of ANSI C. It is designed to give you the ability to write clearly structured, debuggable and maintainable computer programs in C and to be able to understand programs written by others.
Observing the Universe	The specific aims of the module are to gain an understanding of the hierarchy of objects in the universe, including their structural and evolutionary relationship to each other; an understanding of the underlying principles of key instrumentation used for observational astrophysics; an understanding of how we can obtain structural information and physical parameters from distant, often unresolved, objects.

YEAR 3

Background Report for Project	You will use the library facilities at the study-abroad host institution to plan and then produce a background report that will form the basis for your final year project module. Our Exeter-based project supervisor will monitor progress and provide guidance by email.
Professional Experience	Gain a direct experience of undertaking a research project in a non-university professional environment, normally an industrial or government laboratory. The project topic will usually be physics-based but in some cases may involve the application of physics-related skills (eg, mathematical modelling) to another field.
Electromagnetism II	This is the second electromagnetism module taken by Physics students. It builds on Electromagnetism I and covers fundamental physics that students are capable of directly observing. The Maxwell equations are stated and manipulated to obtain the wave equation, and the form of the solutions discussed. The dielectric and magnetic properties of solids are then introduced, with emphasis on the frequency dependence of their real and imaginary components, and the consequences for wave propagation. Wave propagation at interfaces between dissimilar materials is considered, leading to derivation of Fresnel reflection and transmission coefficients. The need to guide electromagnetic waves of different frequency is discussed, and guiding by transmission lines, waveguides and optical fibers is introduced. Finally the electromagnetic fields generated by charges moving with uniform or oscillatory velocity are discussed. A number of interesting physical phenomena are considered that are important in a wide variety of areas and in many key technologies.
General Problems	Problem-solving is the process of answering questions by using reasoning beyond the mere application of pre-learned procedures. This is a synoptic module that presents you with unfamiliar problems to solve. It will require you to draw on the skills and knowledge of core physics, providing you with the skills and confidence to develop your own solutions to problems.
Nuclear and High Energy Physics	Investigations of the atomic nucleus and of the fundamental forces that determine nuclear structure, offer fascinating insights into the nature of the physical world. The tools for probing these systems are high-energy particle accelerators and colliding-beam systems. This module aims to give you a broad overview of the subject matter and encouragement to seek further information.
Quantum Mechanics II	Cover a range of more advanced topics, leading to the discussion of quantum transitions and non-relativistic scattering. Much of physics concerns manifestations of the electromagnetic interaction which is susceptible to perturbation techniques. The methods outlined in the module are applicable to many situations in condensed matter and nuclear physics enabling useful and informative solutions to be obtained to non-exactly-soluble problems without resort to numerical methods.
Ultrafast Physics	This module covers areas of physics that emerged as a result of the application of the state-of-the-art ultrafast measurement techniques in the study of spintronics, magnonics, plasmonics and metamaterials. In particular, topics explored in this module include ultrafast sources, time resolved spectroscopy and imaging, ultrafast magnetisation reversal, excitation of non-Fermi electron distributions, coherent phonons, magnons, etc, ultrafast demagnetisation, nonlinear electro- and magneto-optical effects (including electromagnetic radiation).
Soft Matter	Discuss important approaches for describing and understanding the behaviour and interactions in soft matter systems. In particular, topics explored will include electrostatic and other interactions in solutions, random walks, conformation of (bio) polymers, diffusion processes, mechanics of soft membranes and hydrodynamic interactions in liquid films. In addition, it will introduce important experimental methods used to study soft matter systems and will discuss their theoretical bases.
Galaxies and High Energy Physics	Apply the two main techniques of astronomy – astronomical observations and theoretical modelling – in order to understand galaxies in the universe, including the Milky Way, and their physical processes.
Stars from Birth to Death	The study of stellar systems encompasses a wide range of physics, including gravitation, quantum mechanics, and thermodynamics. This module takes these fundamental physical concepts, learned in the core modules, and uses them to derive the properties of stars. The basic internal structure of stars is described in the first sections, while later sections deal with the ageing and death of both high and low-mass objects. The final sections describe how stars form.

YEAR 4

Condensed Matter II	Develop your understanding of effects that played a key role in the development of contemporary solid state physics. The different topics covered will be linked by the idea that electrons in solids can be treated as quasi-particles interacting with other quasi-particles: electrons, phonons, photons. In addition to electrons, other excitations in solids are considered, eg, Cooper pairs, plasmons and polaritons.
Project (MPhys only)	A major distinguishing feature of the MPhys degree is its substantial project which requires students to apply the knowledge they have acquired to a real problem in a research environment. The aim of this module is to foster the open-ended problem solving skills that are characteristic of the practising physicist.
Statistical Physics	Building on the Thermal Physics module, you will study four aspects of statistical physics by applying them to a number of physical systems in equilibrium. Firstly, it is shown that a knowledge of the thermodynamic state depends upon an enumeration of the accessible quantum states of a physical system; secondly, that statistical quantities such as the partition function can be found directly from these states; thirdly, that thermodynamic observables can be related to the partition function, and finally, that the theoretical results relate to experimental observations.
Solar and Extra-Solar Planets and their Atmospheres	Study how theory and observations underpin our rapidly developing knowledge of planetary objects both inside and outside the solar system, an area of physics that has been developing rapidly since the first observation of an extra-solar planet in 1995 and a major research theme at Exeter. You will learn how to apply your knowledge of core physics in order to understand and interpret a wide range of phenomena associated with planetary objects both inside and outside the solar system.
Relativity and Cosmology	Be introduced to the special and general theories of relativity. Although the course avoids the use of advanced mathematical topics and emphasises the concepts behind the theory, students will require a good level of mathematical fluency and intuition in order to engage with the material.
Quantum Optics and Photonics	Explore how light may be controlled and guided, and how quantum physics may be harnessed in the future to offer new and exciting opportunities in manipulating light. This module will range over basic physics and topical applications. Topics include: waveguides and optical fibre; lasers; amplifiers; nonlinear optics; polarisation, optical activity and birefringence, orbital angular momentum; entangled states; cavity QED; novel light sources; photonic crystals, and negative index materials.

I chose Exeter primarily because the physics course looked great and it allowed me to study part of my degree in Australia. In my fourth year I've had a fascinating time studying exoplanet atmospheres for my Masters project. In addition to my studies in Physics I've also had a huge amount of support from the University in setting up my own company which I'll be launching when I graduate.

Duncan, studying MPhys Physics with Study in Australia

KEY INFORMATION AT A GLANCE

	UCAS CODE	TYPICAL OFFER
BSc Single Honours		
Physics	F300	A*AA-AAB; IB: 38-34; BTEC: D*DD-DDD
Physics with Astrophysics	F3F5	A*AA-AAB; IB: 38-34; BTEC: D*DD-DDD
BSc Combined Honours		
Mathematics and Physics	FG31	A*AA-AAB; IB: 38-34; BTEC: D*DD-DDD
MPhys Single Honours		
Physics	F303	A*AA-AAB; IB: 38-34; BTEC: D*DD-DDD
Physics with Astrophysics	F3FM	A*AA-AAB; IB: 38-34; BTEC: D*DD-DDD
Physics with Professional Experience	F304	A*AA-AAB; IB: 38-34; BTEC: D*DD-DDD
Physics with Australian Study	F3TV	A*AA-AAB; IB: 38-34; BTEC: D*DD-DDD
Physics with North American Study	F3T7	A*AA-AAB; IB: 38-34; BTEC: D*DD-DDD
Physics with Study in New Zealand	F308	A*AA-AAB; IB: 38-34; BTEC: D*DD-DDD

We make every effort to ensure that the entry requirements are as up-to-date as possible in our printed literature. However, since this is printed well in advance of the start of the admissions cycle, in some cases our entry requirements and offers will change.

Please note: Places are not normally offered to applicants who do not take part in an interview.

Normally students can transfer between any of the programmes above during the first year. However, when applying to transfer on to programmes with limited capacity (ie, Professional Experience and Study Abroad), your transfer may be made dependent on academic performance.

For further details on all our entry requirements, please see **www.exeter.ac.uk/ug/physics**

International students

If you are an international student you should consult our general and subject-specific entry requirements information for A levels and the International Baccalaureate, but the University also recognises a wide range of international qualifications. You can find further information about academic and English language entry requirements at **www.exeter.ac.uk/ug/international**

For full and up-to-date information on applying and entry requirements, including requirements for other types of qualifcation, please see **www.exeter.ac.uk/ug/applications**

Physics and Astronomy Interview Days

Those applicants who meet our minimum entry requirements will be invited to visit the department between November and March. The visit will include tours and presentations relating to our research activity and a short academic interview with a member of staff, during which details of programmes can be explained and any queries answered. All applications are considered on an individual basis and offers will be made shortly after an interview has taken place.

However, if visiting the campus is difficult for you, please contact us when you receive your invitation letter to discuss alternative arrangements.

STREATHAM CAMPUS, EXETER

Website: **www.exeter.ac.uk/ug/physics**
www.exeter.ac.uk/enquiry
Phone: +44 (0)1392 725349

THE UNIVERSITY OF EXETER

TEF Gold

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QS STARS RATED FOR EXCELLENCE 2018

5 star rated from QS

22,000 students from 178 countries

98%

98% of our research rated of international quality [1]

RUSSELL GROUP

A member of the Russell Group of universities

The UK's fastest growing and fastest rising research university[2]

FIND OUT MORE

Come to one of our open days. Visit us at our campuses in Exeter and Cornwall: **www.exeter.ac.uk/ug/visiting**

For further information please visit **www.exeter.ac.uk/ug/physics**

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[1] 98% of our research was rated as 2*,3* or 4* in the Research Assessment Exercise 2014.

[2] Between 2006/07 – 2015/16, the University of Exeter saw the greatest rise in research income, compared to all other Russell Group universities.

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