Life, the universe and everything...
Physics at the University of York

2020 Entry
World-leading research advancing the frontiers of technology

Inspiring the next generation of physicists

‘Life, the Universe and everything’ is a tribute to the late, great Douglas Adams author of the *The Hitchhiker’s Guide to the Galaxy*. If you aren’t familiar with his work you can find out more at www.douglasadams.com

With thanks to John Houlihan, Ian Martindale, Shaun Bloodworth, Thomas Shutt, Adam Shore, William Brzozowski, James Lees, Samuel Thompson, and Hannah Willett for photographs and images used in the brochure.
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+44 (0)1904 322 241
physics-admissions@york.ac.uk
york.ac.uk/physics
Undergraduate Admissions, Department of Physics, University of York, York, YO10 5DD
Facebook: UoYPhysics
Twitter: @PhysicsatYork

This brochure is for students applying to join us in 2020 and was correct at the time of going to press. We hope to provide the programmes, opportunities and facilities described but for the most up-to-date information please visit our website at york.ac.uk/physics
Welcome to the Department of Physics, a department at the forefront of pioneering global research and technological advancement in areas such as plasma physics and fusion energy, nuclear physics and condensed matter physics. Our renowned research groups play a leading role on the national and international stage, collaborating with major institutions and industries.

I, like my academic colleagues, started my journey in physics with a desire to understand the nature of “life, the universe, and everything”. It is this curiosity which underpins not only our personal interests and exploration of physics, but is what motivates physics research in the world today. Topics vary from biophysics, studies of planets and stars to quantum materials. Our enthusiasm for exploration in these and other areas is embedded throughout our teaching and research.

As a student, your teaching will be directly influenced by cutting edge research and evolving technologies, further expanding and tailoring your studies to encompass a broad ranging physics curriculum or by aligning your studies to specialist areas of interest. Our newly reviewed undergraduate programmes offer a balanced, structured learning experience designed not only to train you in the fundamental workings of the universe, but to prepare you for life beyond university. Through our close links with industry and professional skills training built into our curriculum, we aim to equip you with both the knowledge and skills needed to excel in your chosen career and tackle the challenges of the future.

Our department prides itself on our friendly community, which is supported by our active and engaged student body. As a department, we have been enjoying a period of major expansion over the past five years, welcoming new members of staff and developing our research areas. Our new colleagues are expanding the horizons in quantum technologies, nuclear physics, biophysics, laser-plasma physics, fusion energy and space propulsion. Now, more than ever, is an incredibly exciting time to join us as an undergraduate student, with teaching led by specialists at the forefront of new discoveries and technologies.

I hope that you will join us on this incredible, exciting and rewarding journey into the world of physics and I wish you every success.

Professor Kieran Gibson
Head of Department of Physics, University of York
Physics is the most fundamental of the sciences. Its discoveries are hugely influential and have wide-ranging impact across many interdisciplinary areas, from technology and medicine to computers and power stations. Physics has designed the world we live in today and, as a subject, is at the forefront of shaping future world technologies and pushing boundaries in areas such as quantum computers and nuclear fusion.

It is vital to our understanding of how the universe works in both the everyday and the extraordinary, from understanding why the sky is blue and the grass is green to quantum entanglement and black holes. At its core, physics is a journey of discovery in which topics are explored through teamwork, debate and collaboration across the globe. The efforts of physicists can be found in everyday technologies as well as at the forefront of discovery, driving both business and innovation.

Our programmes are delivered in a world-leading research environment, taught by academics at the cutting edge of their research fields. The Department’s research and teaching excellence is shown in exciting new areas including state-of-the-art facilities. Our academics have established strong links with industry leaders, allowing students further opportunities to enhance their studies through work placements and studying abroad.

We promote excellent staff-student rapport within the Department, which ensures an extremely friendly and supportive atmosphere for our students. Regular supervision meetings, small group tutorials and our ‘open door’ policy for approaching academic staff are distinctive in our teaching approach and enable students to share their insights and develop a deeper understanding of their subject.

**A Russell Group University**
Committed to maintaining the very best research and links with local and national business and the public sector

**Research Led Teaching**
Study and learn with academics who are active researchers and experts in their field

**Research Excellence**
95% of our research activity is ‘internationally recognised’ ([REF 2014](#))

**Quality in Teaching**
86% Student Satisfaction in the National Student Survey (NSS) ([NSS 2018](#))

**Placement Opportunities**
Study abroad with our partner universities or in industry through our placement years

**Supportive Environment**
Friendly and supportive environment through small group teaching and our open door policy

**Developing Employability Skills**
Our White Rose Industrial Physics Academy is dedicated to linking students with industrial employers

**Degree Accreditation**
All of our physics degrees are accredited by the Institute of Physics

**IOP Juno Champion**
Promoting equality and diversity for a fully inclusive working environment

**Athena SWAN Silver Award**
Providing a positive and diverse environment for students and staff
Degree Courses

Our programmes are built around a solid core of knowledge and training in Physics. As a student you will complete a thorough grounding in physics knowledge, scientific principles and methods, through a common core set of modules to gain a comprehensive understanding of fundamental physics. This ensures that our degrees are accredited by the Institute of Physics, the professional body of physicists, and provides the tools and knowledge for you to specialise and tailor your degree as you progress through your studies. Flexibility within our programme structures enables options to study a broad ranging physics curriculum or align your studies to specific areas of interest such as nuclear or plasma physics, directly influenced and taught by our leading research groups. This allows students to understand how physics interrelates with other subjects and industry.

Our Physics programmes are offered as a four-year integrated Masters (MPhys) or a three-year Bachelors (BSc) degree. The MPhys provides the opportunity to develop specific advanced physics skills and is suited for those looking to enter an academic or industry-led research career. The BSc covers a broad-ranging curriculum and provides an excellent pathway into graduate-level careers or postgraduate study.

Our range of courses offer you the opportunity to pursue specific interests such as theoretical physics or astrophysics, or subject combinations with Philosophy or Mathematics. For students who do not possess the required Physics and Mathematics background, we offer a Foundation Year for entry onto our main pathways. To enhance your studies, you may also add a placement year, either studying abroad with one of our European partners or through an industrial placement.

The Department of Physics has links with many departments and also contributes to the undergraduate Natural Science programme. To find out more visit york.ac.uk/natural-sciences

Department Scholarships and Master Class Research Placements

The Physics Academic Excellence Scholarships are designed to recognise and reward academic achievement. The scholarship offers £1000 for newly enrolled students who achieve an A* or equivalent in mathematics or physics at A level standard and select York as their firm institution when applying through UCAS. This scholarship is renewable annually and is subject to attaining full credits and an overall year mark of 70% or higher in the first attempt.

In addition, any student who joins the Department of Physics having achieved an A* or equivalent in Mathematics or Physics and maintains an overall Year Mark of 70% or higher in the first attempt is guaranteed a Master Class Research Placement. This unique research master class is a paid placement with one of our research groups in the Department of Physics.

For further details on the departments scholarship and master class please visit: york.ac.uk/physics/undergraduate/scholarships
Choosing your Physics Pathway

Trying to decide which physics pathway is right for you?
Try our decision diagram to help select the courses most aligned with your study interests.

Which do you find more interesting:
Developing a deep physical understanding or studying a broad and interdisciplinary application of knowledge?

Deep physical understanding

Do you want the flexibility to explore your choice of advanced physics topics or to specialise in particular streams of physics?

Flexible learning every time

Are you looking to explore our physical world through computational knowledge or go beyond in exploring the greater universe and cosmology?

I’m a specialised specialist

Creating simulations of complex systems with computational laboratories to explore the world around us

Pick from the largest selection of topics from atomic physics and lasers, nanophysics and magnetism, biophysics and plasmas combined with our largest choice in experimental labs

The universe, galaxies and everything

You’ve got me stargazing

Creating simulations of complex systems with computational laboratories to explore the world around us

You read my mind

Experimental, I was looking for something a little more computational

Stargaze to your heart’s content on our Astrocampus taking our Physics with Astrophysics programmes. Find out more on page 14

Now you’re talking

Our Theoretical Physics programme may be for you. Take a look at page 16 to read more

Our widest ranging programmes are our MPhys and BSc Physics programmes. Take a look at page 12 to find out more

You admire the work of Newton, Einstein, Plato and Kant?
“The friendliness of Physics at York attracted me. The Department is endlessly supportive in helping us develop our career aspirations. Being at a research-intensive university is great – it’s clear that the staff love their work and what better education could you have than being taught by experts in their fields of study.”

Helena
MPHys Physics with Astrophysics
Our Physics programmes contain a balance of core fundamental physics and mathematics studies combined with a range of advanced specialist modules. Delivered in our world leading research environment and taught by academics at the forefront of their research fields, your studies are enhanced and informed by cutting edge research and evolving technologies.

Overview
Physics studies the fundamental forces of the Universe and the nature of waves, particles, and the structure of matter. You will study systems that are near absolute zero or as hot as the core of a supernova, systems with energies ranging from those important to chemical reactions to the energy scale of nuclear reactions, systems with densities as low as the vacuum of space to as high as nuclear matter and neutron stars. Options to investigate subjects like nanosystems, semiconductors, fusion plasmas, aspects of biophysics, quantum computing, and quantum states in nature will allow you to develop a deep understanding of complex physics. With access to state of the art equipment, you will be able to perform research activities, analyse complex situations and principles, and assess a variety of problems and real-world situations.

Course Outline
Our degree programmes are built around a solid core of knowledge and training in physics. All students complete a thorough grounding in subject knowledge, scientific principles and methods through a common core set of modules to gain a comprehensive understanding of fundamental physics.

Through your studies you will be taught the key skills required to assess and evaluate real life problems, execute industry standard scientific reports and present sophisticated concepts communicating the interrelation of core physics ideas. Progressing through the course you will advance your laboratory skills designing and performing state of the art experiments, utilising sophisticated equipment and professional software. This will allow you to deepen your understanding of how physics interrelates with other academic subjects and industry.

In your final year you will plan and execute a major research project under the guidance of an academic project supervisor. The project undertaken either collaboratively (BSc) or individually (MPhys) is an exciting opportunity to take part and actively contribute to original research as part of our innovative research groups. These include study areas such advanced plasma, nuclear and computational physics, material physics, biophysics and further quantum mechanics.

As a Physics student you will enjoy:
• Understanding and exploring how the world around you works
• Observing and investigating physical phenomena to further your personal understanding
• Discovering how physical principles are applied to real world problems

91% MPhys in Physics students satisfied with their course
(NSS 2018)

95% of MPhys students in work after 6 months are in professional or managerial roles
(Unistats, DLHE 2016/17)
# Physics Modules

## First Year
Our degree courses consist of core and optional modules. The first year emphasis is on core material which covers the essential physics and maths needed to consolidate your pre-university studies and build upon concepts and understanding for the second year.

### Core Modules
- Electromagnetism, Waves and Optics
- Introduction to Thermal and Quantum Physics
- Mathematics I
- Newtonian and Relativistic Mechanics
- Experimental Laboratory I

### Optional Modules
- Human Uses of Energy with Professional Skills
- Mapping the Universe with Professional Skills
- Mathematical Modelling with Professional skills

### Year Abroad
Language Studies

## Second Year
The second year emphasis is to build upon concepts and ideas introduced in stage one, which are further expanded and explored in stage two modules. Advancing laboratories will enable you to plan and execute experiments over extended periods of time, critically analysing both laboratory techniques and results.

### Core Modules
- Electromagnetism and Optics
- Experimental Laboratory II
- Experimental Techniques with Professional Skills
- Mathematics II
- Quantum Physics II
- Thermodynamics and Solid State I

## Third Year
During the third year you will have the opportunity to study a range of specialist modules, in addition to the advanced core modules exploring specialist fields.

### Core Modules
- Statistical Mechanics and Solid State II

### Core Modules: BSc
- BSc Project incorporating Professional Skills, Industrial Project in York or BSc Industrial Placement Project

### Core Modules: MPhys
- Advanced Experimental Laboratory
- Quantum Physics III

## Fourth Year
In your final year of study, you will have the opportunity to select a range of advanced modules incorporating learning in advanced fields. This allows you to apply the core knowledge you have gained through previous years of study in topics aligned with our internationally recognised research groups.

### Core Modules
- MPhys Project Incorporating Professional Skills, Industrial Project in York or MPhys Industrial Placement Project

### Optional Modules
- Advanced and Further Quantum Mechanics
- Advanced Computational Physics
- Advanced Plasma Physics
- Biophysics
- From Subatomic Physics to Astrophysics
- Light and Matter
- Nanomaterials: from Graphene to Spintronics

Please note, modules may change to reflect the latest academic thinking and expertise of our staff. To view full details of our taught module content please visit our website at: [www.york.ac.uk/physics/undergraduate](http://www.york.ac.uk/physics/undergraduate)
Our Physics with Astrophysics programmes explore and investigate the application of physics to the greater Universe. You will analyse our solar system, the edge of the universe, formation of galaxies and black holes through specialist modules developing advanced theoretical and observational techniques.

Overview
Studying Physics and Astrophysics gives you an understanding of the scale and physical processes at work in the Universe. From nuclear reactions that power the Sun to the great challenges of cosmology, you gain an appreciation of the greater cosmos in topics aligned with the department’s active research fields. Specialist modules allow you to pursue a broad understanding of modern astrophysics across the electromagnetic spectrum, including stars, dark matter and the exotic concept of dark energy. Our teaching is enhanced by our programme’s flagship facilities on our dedicated AstroCampus, the department’s extensive observatory. As a student you are given autonomous access to telescopes from the first weeks of study and develop deep understanding in observation and detection methods using optical, solar and radio telescopes.

Course Outline
The Physics with Astrophysics programme includes the full development of core physics concepts, principles and mathematical techniques, but with a special focus in both theoretical and experimental astrophysics. Progressing through the course you will advance your laboratory skills designing and performing state of the art experiments, specialising in sophisticated techniques and professional software for observation and measurement. Alongside this, advanced modules will allow you to focus your studies on the contemporary research areas of the department including plasmas and particle astrophysics.

In your final year, you will be given the opportunity to explore the Universe for yourself, developing key research skills and interpreting outcomes through a major research project. Supervised by an academic member of staff, you will establish a line of scientific enquiry and investigate this either collaboratively (BSc) or individually (MPhys) professionally presenting your findings to conclude your studies. Final year projects are an exciting opportunity to take part and actively contribute to original research, and can help to orientate your final career aspirations.

As a Physics with Astrophysics student you will enjoy:
- Exploring the underlying structure and evolution of the universe
- Applying core physics principles from quantum theory to general relativity in order to understand our universe
- Observing the cosmos and applying physical models and analysis techniques

100% MPhys in Physics students satisfied with their course  
(NSS 2018)

90% of MPhys students in work after 6 months are in professional or managerial roles  
(Unistats, DLHE 2016/17)
**Physics with Astrophysics Modules**

### First Year
Our degree courses consist of core and optional modules. The first year emphasis is on core material, which contains the essential physics and maths needed to consolidate your pre-university studies and build upon concepts and understanding for the second year.

<table>
<thead>
<tr>
<th>Core Modules</th>
<th>Year Abroad</th>
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<tbody>
<tr>
<td>Electromagnetism, Waves and Optics</td>
<td>Language Studies</td>
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<tr>
<td>Experimental Laboratory for Astrophysics I</td>
<td></td>
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<tr>
<td>Introduction to Thermal and Quantum Physics</td>
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<tr>
<td>Mapping the Universe with Professional Skills</td>
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<tr>
<td>Mathematics I</td>
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<tr>
<td>Newtonian and Relativistic Mechanics</td>
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<tr>
<th>Year Abroad</th>
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<tr>
<td>Language Studies</td>
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</table>

### Second Year
The second year emphasis is to build upon concepts and ideas introduced in stage one, which are further expanded and explored in stage two modules. Advancing laboratories will enable you to plan and execute experiments over extended periods of time, critically analysing both laboratory techniques and results.

<table>
<thead>
<tr>
<th>Core Modules</th>
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<tbody>
<tr>
<td>Astrophysical Technologies, Planetary Science with Professional Skills</td>
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<tr>
<td>Electromagnetism and Optics</td>
</tr>
<tr>
<td>Experimental Laboratory for Astrophysics II</td>
</tr>
<tr>
<td>Mathematics II</td>
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<tr>
<td>Quantum Physics II</td>
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<tr>
<td>Thermodynamics and Solid State I</td>
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</table>

### Third Year
During the third year you will have the opportunity to study a range of specialist modules in addition to the advanced core modules exploring specialist fields.

<table>
<thead>
<tr>
<th>Core Modules</th>
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<tbody>
<tr>
<td>Galaxies and the Interstellar Medium and Cosmology</td>
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<tr>
<td>Statistical Mechanics and Solid State II</td>
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<tr>
<th>Core Modules: BSc</th>
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<tbody>
<tr>
<td>BSc Project Incorporating Professional Skills, Industrial Project in York or BSc Industrial Placement Project</td>
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<tr>
<th>Core Modules: MPhys</th>
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<tbody>
<tr>
<td>Advanced Astrophysics Laboratory</td>
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<tr>
<td>Quantum Physics III</td>
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</table>

### Optional Modules
- Atomic Physics, Lasers and Modern Optics
- Introduction to Plasma Science and Technology and Stellar Physics
- Introduction to Quantum Computing and Advanced Theoretical Techniques
- Nanoscale and Magnetism
- Relativity and Particle Physics
- Quantum Physics III (BSc Only)

### Fourth Year
In your final year of study, you will have the opportunity to select a range of specialist modules incorporating learning in advanced fields. This allows you to apply the core knowledge you have gained through previous years of study, in topics aligned with our internationally recognised research groups.

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<tr>
<th>Core Modules</th>
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<tbody>
<tr>
<td>MPhys Project Incorporating Professional Skills, Industrial Project in York or MPhys Industrial Placement Project</td>
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<tr>
<th>Optional Modules</th>
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<tbody>
<tr>
<td>Advanced and Further Quantum Mechanics</td>
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<tr>
<th>Core Modules: MPhys</th>
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<tbody>
<tr>
<td>Advanced Computational Physics</td>
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<tr>
<td>Advanced Plasma Physics</td>
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<tr>
<td>Biophysics</td>
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<tr>
<td>From Subatomic Physics to Astrophysics</td>
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<tr>
<td>Light and Matter</td>
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<tr>
<td>Nanomaterials: from Graphene to Spintronics</td>
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</table>

Please note, modules may change to reflect the latest academic thinking and expertise of our staff.

To view full details of our taught module content please visit our website at: [www.york.ac.uk/physics/undergraduate](http://www.york.ac.uk/physics/undergraduate)
Theoretical physics allows complex phenomena and technologies to be understood and modelled in terms of underlying fundamental physical principles, using a combination of advanced mathematical and computational techniques. As a student on our Theoretical Physics degree programme you will learn these theories and techniques, and gain expertise in putting them into practice, taught by academics at the forefront of their research fields.

Overview
Theoretical physics explores the physics of the world around us, focusing on how mathematical and computational knowledge describes the framework and structure of the field. Traditionally, theoretical physicists have made key contributions to physics by using mathematical techniques. Today, these mathematical tools are joined by an array of powerful computational methods which permit theoreticians to address complex systems and problems that are inaccessible to a purely mathematical physics methods by using computer simulation.

A flagship of the programme is the access to a range of powerful supercomputers which may be used by students in areas of project work and for parts of specialist computational modules. Hence, in addition to the traditional theoretical physics topics, you will also develop substantial practical computational skills, including the opportunity to learn parallel programming.

Course Outline
This degree programme recognises the modern skills required by theoretical physicists, it provides a balanced programme ranging from traditional mathematical physics to modern computational simulation techniques. The fundamental and core physics is covered in the initial years while more specialist modules, informed by the active research conducted by our academic staff, are available in the later years of study. Progressing through your studies you will investigate a range of mathematical and computational methods to construct and analyse a wide range of different physical phenomena. This may be in any of the different research areas of our staff, including biophysics, condensed matter physics, nuclear physics and plasma physics.

In your final year you will plan and execute a major research project under the guidance of an academic project supervisor. The project undertaken either collaboratively (BSc) or individually (MPhys) is an exciting opportunity to take part and actively contribute to original research as part of our innovative research groups.

As a Theoretical Physics student you will enjoy:
• Understanding the fundamental laws that govern the world around us
• Exploring the mathematical structure of physics
• Building mathematical and computational tools to explore physical phenomena

85% of MPhys students in work after 6 months are in professional or managerial roles
(Unistats, DLHE 2016/17)
Theoretical Physics Modules

First Year
Our degree courses consist of core and optional modules. The first year emphasis is on core material, which contains the essential physics and maths needed to consolidate your pre-university studies and build upon concepts and understanding for the second year.

Core Modules
- Laboratory for Theoretical Physics
- Electromagnetism, Waves and Optics
- Introduction to Thermal and Quantum Physics
- Mathematical Modelling with Professional skills
- Mathematics I
- Newtonian and Relativistic Mechanics

Year Abroad
Language Studies

Second Year
The second year emphasis is to build upon concepts and ideas introduced in stage one, which are further expanded and explored in stage two modules. The computational laboratory will enable you to plan and execute experiments over extended periods of time, critically analysing techniques and results.

Core Modules
- Computational and Mathematical Techniques for Theoretical Physics
- Computational Laboratory
- Electromagnetism and Optics
- Mathematics II
- Quantum Physics II
- Thermodynamics and Solid State I

Third Year
During the third year, you will have the opportunity to study a range of specialist modules, in addition to the advanced core modules exploring specialist fields.

Core Modules
- Computational and Mathematical Techniques II
- Statistical Mechanics and Solid State II

Core Modules: BSc
- BSc Project Incorporating Professional Skills, Industrial Project in York or BSc Industrial Placement Project

Core Modules: MPhys
- Advanced Computational Laboratory
- Quantum Physics III

Optional Modules
- Atomic Physics, Lasers and Modern Optics
- Introduction to Plasma Science and Technology and Stellar Physics
- Introduction to Quantum Computing and Advanced Theoretical Techniques
- Nanoscale and Magnetism
- Relativity and Particle Physics
- Quantum Physics III (BSc Only)

Fourth Year
In your final year of study you will have the opportunity to select a range of specialist modules incorporating learning in advanced fields. This allows you to apply the core knowledge you have gained through previous years of study, in topics aligned with our internationally recognised research groups.

Core Modules
- MPhys Project Incorporating Professional Skills, Industrial Project in York or MPhys Industrial Placement Project

Optional Modules
- Advanced and Further Quantum Mechanics
- Advanced Computational Physics
- Advanced Plasma Physics
- Biophysics
- From Subatomic Physics to Astrophysics
- Light and Matter
- Nanomaterials: from Graphene to Spintronics

Please note, modules may change to reflect the latest academic thinking and expertise of our staff. To view full details of our taught module content please visit our website at: www.york.ac.uk/physics/undergraduate
Physics with Philosophy studies focus on the most fundamental aspects of physics, setting them in the wider context of natural philosophy. Through the course, you will explore the valuable interaction between the two disciplines, broadening your knowledge of the philosophical problems raised by science.

Overview
The Physics with Philosophy programme gives students a broad perspective of the insights of great thinkers, where the works of Newton and Einstein stand alongside those of Plato and Kant. In the Physics department, you will study core physics modules to provide a complete and thorough grounding in physics knowledge and scientific principles gaining a comprehensive understanding of fundamental physics. In the philosophy department, the entire history of thought is studied, not just the philosophy of science. You will emerge with knowledge of the great thinkers of antiquity, of different strands of world philosophy and the modern perspective.

One of the more exciting aspects of the joint honours course is that you will become able to critically evaluate scientific methods from a philosophical viewpoint.

Course Outline
The Physics with Philosophy programme provides a good all-round study of physics, set in the wider context of its place in human knowledge. Tackling fundamental questions about the nature of space, time and matter provides one of the most challenging and rewarding courses at the university. In addition to the core physics modules students will take a variety of modules provided by the Department of Philosophy. Progressing through the course, you will deepen and broaden your knowledge into contemporary research areas focused by the specialities of our leading research staff.

In your final year you will plan and execute a major research project under the guidance of an academic project supervisor. The project undertaken is either collaborative (BSc) or individual (MPhys) and is an exciting opportunity to take part and actively contribute to original research.

The combination of core modules in physics, a core module on the philosophy of science, and a wide-angle view of philosophy, puts you in a great place in your final year. You can choose either a project in the spirit of the joint honours programme, dedicated to critically evaluating the merits and demerits of competing scientific and philosophical theories, or can choose to join one of our internationally-renowned research groups on a physics research project.

As a Physics with Philosophy student you will enjoy:
• Engaging and exploring the crossover between fundamental physics and the theory of knowledge
• Learning the theories of the great thinkers of history in each discipline
• Critically evaluating both scientific methods and theories from a philosophical viewpoint, and philosophical perspectives and theories in the light of modern physics
• Engaging with a range of physical and philosophical theories, and appreciating the intellectual beauty and societal applications of physics and philosophy

Our programme is embedded with a rich history in teaching and was the first Physics with Philosophy degree to be established in the UK.
Physics with Philosophy Modules

**First Year**
Our degree courses consist of core and optional modules. The first year emphasis is on core material, which contains the essential physics and maths needed to consolidate your pre-university studies and build upon concepts and understanding for the second year. You will gain a firm grounding in philosophy, developing your skills in reasoning and argument to challenge and form your opinions on the bigger philosophical questions.

<table>
<thead>
<tr>
<th>Core Modules</th>
<th>Optional Modules</th>
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<tbody>
<tr>
<td>• Beginning Philosophy</td>
<td>• Ancient Philosophy</td>
</tr>
<tr>
<td>• Classical Mechanics and Relativity with Professional Skills</td>
<td>• Metaphysics</td>
</tr>
<tr>
<td>• Electromagnetism, Waves and Optics</td>
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<tr>
<td>• Introduction to Thermal and Quantum Physics</td>
<td></td>
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<tr>
<td>• Mathematics I</td>
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<tr>
<td>• Reason and Argument A</td>
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</table>

Year Abroad
Language Studies

**Second Year**
The second year emphasis is to build upon concepts and ideas introduced in stage one, which are further expanded and explored in stage two modules. You will explore in-depth issues in central areas of philosophy to deepen your skills and understanding.

<table>
<thead>
<tr>
<th>Core Modules</th>
<th>Selected Optional Modules*</th>
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<tbody>
<tr>
<td>• Electromagnetism and Optics</td>
<td>• Ethical Theory</td>
</tr>
<tr>
<td>• Mathematics II</td>
<td>• Philosophy of Language</td>
</tr>
<tr>
<td>• Philosophy of Science</td>
<td>• Intermediate Logic</td>
</tr>
<tr>
<td>• Quantum Physics II</td>
<td>• Hume’s Empiricism</td>
</tr>
<tr>
<td>• Thermodynamics and Solid State I</td>
<td>• Rationalism: Spinoza and Leibniz</td>
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</tbody>
</table>

**Third Year**
During the third year, you will have the opportunity to study a range of specialist modules, in addition to the advanced core modules exploring specialist fields.

<table>
<thead>
<tr>
<th>Core Modules</th>
<th>Selected Optional Modules*</th>
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</thead>
<tbody>
<tr>
<td>• Quantum Physics III</td>
<td>• Physics modules as listed on page 13</td>
</tr>
<tr>
<td>• Statistical Mechanics and Solid State II</td>
<td>• Contemporary Issues in Bioethics</td>
</tr>
<tr>
<td><strong>Core Modules: BSc</strong></td>
<td>• Foundations of Maths</td>
</tr>
<tr>
<td>• BSc Project Incorporating Professional Skills</td>
<td>• Language &amp; Mind</td>
</tr>
<tr>
<td><strong>Core Modules: MPhys</strong></td>
<td>• Philosophy of Art: Hume to Tolstoy</td>
</tr>
<tr>
<td>• Philosophy of Physics</td>
<td>• The Value and Meaning of Life</td>
</tr>
</tbody>
</table>

**Fourth Year**
In your final years of study, you will have the opportunity to select a range of specialist modules incorporating learning in advanced fields. This allows you to apply the core knowledge you have gained through previous years of study, in topics aligned with our internationally recognised research groups.

<table>
<thead>
<tr>
<th>Core Modules</th>
<th>Selected Optional Modules*</th>
</tr>
</thead>
<tbody>
<tr>
<td>• MPhys Project and Research skills</td>
<td>• Physics modules as listed on page 13</td>
</tr>
<tr>
<td>• Topics in Theoretical Philosophy</td>
<td>• Contemporary Issues in Bioethics</td>
</tr>
<tr>
<td>• Foundations of Maths</td>
<td>• German Idealism: Moral, Legal and</td>
</tr>
<tr>
<td>• German Idealism: Moral, Legal and Political Philosophy</td>
<td>• Political Philosophy</td>
</tr>
<tr>
<td>• Value and the Meaning of Life</td>
<td>• Wittgenstein and Philosophy</td>
</tr>
</tbody>
</table>

Please note, modules may change to reflect the latest academic thinking and expertise of our staff.
*To view full details of our taught module content please visit our website at: [www.york.ac.uk/physics/undergraduate](http://www.york.ac.uk/physics/undergraduate)
Our Mathematics and Physics programmes combine specialist teaching from both the Mathematics and Physics Departments. Your studies are strengthened by the wide variety of research areas explored by our academics in both subjects, allowing you to study each discipline to a high level.

Overview
You will study all the key areas of fundamental physics with an even greater emphasis on the study of fundamental mathematics than in the theoretical physics degree programme. Teaching will emphasise the mathematical structure of physical theory, providing a thorough grounding in mathematical theory and physical models used today.

Course Outline
Studying Mathematics and Physics you will be taught for approximately half of your modules in the Department of Mathematics. Specialist teaching in mathematics will explore areas such as dynamical systems, fluid mechanics and nonlinear dynamics. These modules, taught by mathematical physicists will provide you with rigorous training in underlying mathematical theory, allowing for greater concentration on fundamental mathematics. As your studies progress, you will complete a thorough grounding in physical knowledge, scientific principles and methods, undertaking a common core of modules to gain a comprehensive understanding of fundamental physics.

In your final year you will deepen and broaden your knowledge into contemporary research areas focused by the specialities of our research staff with the final-year research project taken in either department. You will plan and execute a major research project under the guidance of an academic project supervisor. The project undertaken either collaboratively (BSc) or individually (MPhys/MMath) is an exciting opportunity to take part and actively contribute to original research as part of our innovative research groups.

As a Mathematics and Physics student you will enjoy:
- Studying the rich structure of both physics and mathematics
- The challenge of proving the laws of nature from first principles
- Gaining a deep appreciation of both Physics and Mathematics, working with experts in each field

Institute of Mathematics and its Applications

Accredited by the both the Institute of Mathematics and its Applications (IMA) and the Institute of Physics (IoP) and can lead to professional awards such as chartered status.
# Mathematics and Physics Modules

## First Year
Our degree courses consist of core and optional modules. The first year emphasis is on core material, which contains the essential physics and maths needed to consolidate your pre-university studies and build upon concepts and understanding for the second year.

<table>
<thead>
<tr>
<th>Core Modules</th>
<th>Year Abroad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algebra</td>
<td><a href="#">Language Studies</a></td>
</tr>
<tr>
<td>Calculus</td>
<td></td>
</tr>
<tr>
<td>Classical Mechanics and Relativity with Professional Skills</td>
<td></td>
</tr>
<tr>
<td>Electromagnetism, Waves and Optics</td>
<td></td>
</tr>
<tr>
<td>Introduction to Thermal and Quantum Physics</td>
<td></td>
</tr>
<tr>
<td>Mathematical Skills I: Reasoning and Communication</td>
<td></td>
</tr>
</tbody>
</table>

## Second Year
The second year emphasis is to build upon concepts and ideas introduced in stage one which are further expanded and explored stage two modules.

<table>
<thead>
<tr>
<th>Core Modules</th>
<th>Optional Modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied Mathematics for Mathematics and Physics</td>
<td>Physics modules as listed on page 13</td>
</tr>
<tr>
<td>Electromagnetism and Optics</td>
<td>Classical and Biological Fluid Dynamics</td>
</tr>
<tr>
<td>Functions of a Complex Variable</td>
<td>Complex and Asymptotic Methods</td>
</tr>
<tr>
<td>Linear Algebra</td>
<td>Differential Geometry</td>
</tr>
<tr>
<td>Mathematical Skills II</td>
<td>Dynamical Systems</td>
</tr>
<tr>
<td>Quantum Physics II</td>
<td>Fundamentals of Fluid Dynamics</td>
</tr>
<tr>
<td>Thermodynamics and Solid State I</td>
<td>Mathematical Ecology and Epidemiology</td>
</tr>
<tr>
<td>Vector Calculus</td>
<td>Modelling with MATLAB</td>
</tr>
</tbody>
</table>

## Third Year
During the third year, you will have the opportunity to study a range of specialist modules, in addition to advanced core modules exploring specialist fields.

<table>
<thead>
<tr>
<th>Core Modules</th>
<th>Optional Modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statistical Mechanics and Solid State II</td>
<td>Physics modules as listed on page 13</td>
</tr>
<tr>
<td><strong>Core Modules: BSc</strong></td>
<td>Classical and Biological Fluid Dynamics</td>
</tr>
<tr>
<td>Physics or Maths Project Incorporating Professional Skills</td>
<td>Complex and Asymptotic Methods</td>
</tr>
</tbody>
</table>

## Fourth Year
In your final year of study, you will have the opportunity to select a range of specialist modules incorporating learning in advanced fields. This allows you to apply the core knowledge gained through your previous years of study in topics aligned with our internationally recognised research groups.

<table>
<thead>
<tr>
<th>Core Modules</th>
<th>Optional Modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMath or MPhys Project and Research skills</td>
<td>Physics modules as listed on page 13</td>
</tr>
</tbody>
</table>

Please note, modules may change to reflect the latest academic thinking and expertise of our staff.
To view full details of our taught module content please visit our website at: [www.york.ac.uk/physics/undergraduate](http://www.york.ac.uk/physics/undergraduate)
The Foundation Year course offers an opportunity for those who have potential, but who do not possess appropriate qualifications, to develop the skills needed to progress to completing one of our degree programmes.

The course is aimed at two main groups of people:
- Mature students (Over the age of 21) seeking a change in career
- Students obtaining A levels qualifications who have not studied Physics and/or Mathematics to A level standard. (However, this course is not designed as a refresher for those with poor marks in Physics and Maths)

Due to the very individual backgrounds in education and work experience, applications are considered on an individual basis. Typically, applicants are required to demonstrate they have achieved the equivalent of A level standard of study and have demonstrated the ability to complete the course workload equivalent to simultaneously taking three A levels.

Overview
The course syllabus is based on modified versions of A Level material in Mathematics and Physics. The course also includes a practical physics element in which students learn in well-equipped laboratories. Covering University entry level content in three terms is a demanding task. The course numbers are therefore very restricted, which permits teaching in small groups with considerable personal support. Following successful completion, you will transfer to the first year of any of our Physics degrees such as:
  - Physics
  - Physics with Astrophysics
  - Theoretical Physics
  - Mathematics and Physics
  - Physics with Philosophy

Including the foundation year, the programmes are offered as a five year Integrated Masters course (MPhys) or four year Bachelors course (BSc) and it is often possible to add an extra year in industry or at an academic institution abroad.

Course Outline
The Foundation Year course is taught through a combination of lectures, example classes and tutorials, laboratory work, workshops and private study. The course will guide you through the required A level curriculum knowledge, assuming no prior knowledge but this does create a busy and demanding schedule. There is a great deal of support available via small teaching groups, sessions with teaching staff and academic supervision meetings.

Physics with a Foundation Year Modules
Modules and content summaries are included below for the core material in this programme.

<table>
<thead>
<tr>
<th>Autumn Term</th>
<th>Maths I</th>
<th>Physics and Electronics I</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Linear and Quadratic Equations</td>
<td>Properties of Matter</td>
</tr>
<tr>
<td></td>
<td>Basic Statistics</td>
<td>Heat and Temperature</td>
</tr>
<tr>
<td></td>
<td>Simple Trigonometry</td>
<td>Electricity and Magnetism</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Spring and Summer Terms</th>
<th>Maths II</th>
<th>Physics and Electronics II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Courses in the Spring and Summer terms build on the fundamentals established in the first term and seek to prepare students to apply the required entry level knowledge in Mathematics and Physics suitable for our Physics degree programmes.</td>
<td>Matrix Algebra</td>
<td>Mechanics</td>
</tr>
<tr>
<td></td>
<td>Differential Calculus</td>
<td>Electricity</td>
</tr>
<tr>
<td></td>
<td>Complex Numbers</td>
<td>Electromagnetism</td>
</tr>
<tr>
<td></td>
<td>Integral Calculus</td>
<td>Optics</td>
</tr>
<tr>
<td></td>
<td>Vectors</td>
<td>Gravitation</td>
</tr>
<tr>
<td></td>
<td>Trigonometric Identities</td>
<td>Waves</td>
</tr>
<tr>
<td></td>
<td>Series and Series Expansions</td>
<td>Electrostatics</td>
</tr>
<tr>
<td></td>
<td>Integral Calculus</td>
<td>AC Circuits</td>
</tr>
<tr>
<td></td>
<td>Differential Equations</td>
<td>Atomic Physics</td>
</tr>
<tr>
<td></td>
<td>Trigonometric Identities</td>
<td></td>
</tr>
</tbody>
</table>

In addition you will undertake laboratory work across all terms in the module “Fundamentals of Electronic Measurement”

Please note, modules may change to reflect the latest academic thinking and expertise of our staff. To view full details of our taught module content please visit our website at: www.york.ac.uk/physics/undergraduate
The University of York, in partnership with the Open University, offers a flexible route to a degree in Physics for students without standard entry qualifications. The OpenPlus pathway follows a prescribed set of modules with the Open University on a part-time basis, which may allow you to study alongside other commitments such as full-time employment or family responsibilities.

Overview

Studying the OpenPlus pathway will typically take three years of part-time study with the Open University. Upon successful completion of the OpenPlus modules you will transfer onto Year 2 of your chosen physics degree programme with the University of York.

Degree courses available to OpenPlus Students include:

- Physics
- Physics with Astrophysics
- Theoretical Physics

After two or three years of full-time study at the University of York, students will graduate with a Bachelors (BSc) or Masters (MPhys) degree from the University of York.

Course Outline

During your part-time studies with the Open University you will complete the prescribed set of modules as detailed in the table on this page. These modules will include studies of classical mechanics, waves, optics, electromagnetism, relativity and quantum physics. OpenPlus students will start with a mathematics module which will equip you with the fundamental building blocks for higher physics learning.

<table>
<thead>
<tr>
<th>Code</th>
<th>Module</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>MST124</td>
<td>Essential Mathematics</td>
<td>OU level 1</td>
</tr>
<tr>
<td>SS01</td>
<td>Laboratory Skills for Science</td>
<td>Residential</td>
</tr>
<tr>
<td>S217</td>
<td>Physics: from Classical to Quantum</td>
<td>OU level 2</td>
</tr>
<tr>
<td>MS224</td>
<td>Mathematical Methods</td>
<td>OU level 2</td>
</tr>
<tr>
<td>SXPS288</td>
<td>Remote Experiments in Physics and Space</td>
<td>OU level 2</td>
</tr>
</tbody>
</table>

These modules are delivered via distance learning and are accompanied by various supporting course materials.

In addition, as an OpenPlus student, you will be allocated a personal tutor at the start of each module and will have access to an OpenPlus study advisor. Their support will last for the duration of the module.

How to apply

For further information on applying to this programme please visit our OpenPlus web page which can be found by visiting: york.ac.uk/study/undergraduate/courses/physics-openplus/
Go Global: Opportunities to Study, Work or Volunteer Abroad

Studying, working or volunteering abroad during your degree is a life-changing experience that can boost your self-confidence, independence and ambition. It can also broaden your cultural and social perspectives, develop language skills and significantly increase your employability in the global jobs market.

Worldwide Exchange
The Centre for Global Programmes (CGP) offers a structured credit-replacing worldwide exchange programme, which means you can apply to study for an academic year at a partner university overseas. The University of York has links with top institutions in North and Latin America, Asia and Australia. Studying abroad through the worldwide exchange programme gives you the opportunity to experience different academic and social cultures without extending the length of your degree. The worldwide exchange programme is open to undergraduates across other University departments and there is an internal application process run by CGP. Find out more at york.ac.uk/globalyork

Year Abroad Programmes
On many of our degree programmes, you can apply to add on a year of studies at a partner university through our year abroad programme. We currently have exchange places with European partners in Germany, France and Italy.

Year abroad programmes include an additional year, taken immediately before your final year of study. This makes our BSc with year abroad programmes four years in duration and MPhys with a year abroad five years. To apply, please choose your the degree option with a year abroad when completing your UCAS application. UCAS Code details can be found on page 7. Alternatively, you can talk to us about transferring onto this programme once you start at York.

Your initial two years will be spent in York studying core fundamental physics concepts and attending language modules as part of the Languages for All (LFA) scheme. Details of our current year abroad partners and relevant language requirements can be found at york.ac.uk/students/study-abroad/opportunities/

In addition to LFA, the Centre for Global Programmes offers language and intercultural courses called Languages for International Mobility which can help you prepare for your year abroad and further language courses may also be provided by the host University during your studies abroad.

During your year abroad you will undertake a research led project at your host institution which is assessed on a pass/fail basis. This will give you the chance to immerse yourself in an internationally recognised research group and develop knowledge and skills you can then apply to your continuing studies at York. In addition, you will have the opportunity to take courses offered at your host institution, either in physics, or potentially another department. These courses can give you the opportunity to broaden your academic horizons and build your confidence in an international setting.
“The true joy of studying abroad was found in the people I met, many of whom I am still in contact with. To narrow the year down to a handful of highlights would be a criminal way to summarise the near constant experiences of something else novel, something exciting, something new and unexpected, something wholesome, something thought-provoking or even paradigm-shifting. The year had all the anticipated benefits, improvement in time management, self-reliance, self-discipline and of course subject knowledge, both breadth and depth. Moreover, the effect on me as a person was nothing short of transformative. It can scarcely be described how much I changed in that year. Sometimes I wonder whether I was even really living before!”

Joe
BSc in Physics with a Year Abroad
Universität Heidelberg, Germany
Undertaking an industrial placement will enable you to:

- Gain practical work experience in a professional context
- Enhance your transferable skills in applied settings
- Develop project management, team work and problem solving skills
- Gain salaried work, recruitment experience and opportunities of further employment

Led by the White Rose Industrial Physics Academy (WRIPA), who promote unique collaborations between leading industrial development partners, you will access support and guidance from our dedicated placement team to find the best opportunities to suit you. Our industrial placements can be accessed through a variety of routes including final year projects, summer placements and a year in industry.

Industrial Placements

Physicists play a vital role in many research and development based industries on a global scale. Due to their advanced analytical and transferable skills, the high demand for graduate physicists means that many students chose to enhance and build their CVs via scientific and technical work experience in an applied setting. Our industrial led placements allow you to gain practical, real world experience, enhancing your degree and enabling you to make informed choices on your career path and areas of expertise.

In recent years our students have undertaken placement opportunities in leading companies such as:

- Rolls-Royce
- AIRBUS
- kromek
- CERN
- BAE Systems
- Department for Environment, Food & Rural Affairs
- ILL
- JAGUAR
- Land Rover
- Selex ES
- Science & Technology Facilities Council
- cogent
- Finmeccanica Company
Placement Opportunities

Year in Industry
An industrial placement year takes place in the penultimate year of study. After completion of your additional year placement you will return to York to complete the final year of your chosen BSc or MPhys studies. During an industrial placement, you will be assigned an industrial supervisor, who is an employee of the company, and an academic supervisor from our Department. Both will support and monitor your progress through your placement year. To apply, please submit your application including the chosen Year in Industry UCAS code, which can be found on page 7.

As a year in industry student you will be responsible for applying and securing your chosen placement opportunity. Our dedicated placement team will help you find placement opportunities and support you during the application process, running a series of industrial visits and events to assist in your search. Placements however are not guaranteed and students who are not successful in obtaining a placement will be transferred to the standard physics pathways.

Summer Industrial Placements
We operate and facilitate a wide range of summer placements designed to enable students to gain valuable work experience during the vacation period. These projects provide an excellent opportunity to undertake a challenging assignment in active areas of research and evolving technologies. Summer placements are normally conducted between an eight to ten week period and in many cases provide paid opportunities for students. Past summer placements have included MBDA Systems, Spirent Communications, Documobi, Jaguar LandRover, Rolls Royce and EDF Energy.

Industrial Final Year Projects
Undertaking an industrial final year project will allow you to work collaboratively with one of our industrial partners. It will provide you with the opportunity to design, build and evaluate new methods and apply solutions in an industrial context. Past projects have included characterising the performance of a new type of radiation detector with Kromek; understanding the physical principles related to air flow and dust pickup with Dyson and examining the heat transfer to solids under different conditions including in air and liquids with Reckitt Benckiser (RB).

“In an increasingly competitive job environment our year in industry programmes are designed to give you an edge, and help you develop the tools you need in order to succeed. Not only will you form links with an industrial partner, but you will develop skills that are widely sought after by today’s employers.”

Andrew Hirst
Year in Industry Coordinator
“York is the place to build your future. Nowhere else have I found such an inclusive, active and friendly student body, made even better for being paired with an incredibly supportive staff and a working environment that will help bring you closer to your goals.”

Thomas
MPhys in Physics
Our Supportive Learning Environment

In Physics we pride ourselves on our supportive, friendly and active environment, which encourages students to grow and achieve their full potential. We use a range of methods to allow students to progress and interact with physics topics. We are committed to high-quality undergraduate teaching, utilising a range of approaches, blending modern Technology Enhanced learning and more traditional face-to-face teaching approaches.

Lectures
Much of our teaching is based on lecture series, which guide you through the development of the various branches of the subject. Lectures can contain video capture, online voting systems, interactive experiments and live data streams and are supported by lecture notes and resources to enhance your learning.

Small Group Teaching
A very important part of our teaching is the small group environment; it allows more practical sessions with academic staff to support your learning experience. This environment allows you to access tailored teaching in small groups to help build on practical applications of taught material.

Tutorials
Tutorials are your chance to explore physics and maths topics of interest with an expert academic staff member. Typically, tutorials take place with a group of five students, which gives you the opportunity to pose questions and set topics for discussion in particular areas of interest.

Supervision
You will be assigned an academic supervisor who will guide you through your studies and support your academic progress and general welfare. You will attend regular meetings with your supervisor, who will also help to advise you on options for further study and career paths towards the final years of your programme.

Practicals & Problem Classes
Practicals and problem classes allow students to work through chosen problems with the support of academic and teaching staff. This provides you with a great opportunity to tackle some problems and raise any issues you may have to help prepare you for examinations.

Seminars
Towards your final years small group seminars are conducted with students presenting short talks to reflect on contemporary areas of physics. This allows you to further develop your communication and analytical skills.

Laboratories
In recent years we have invested significantly in our undergraduate laboratories, including the AstroCampus and computational facilities, enabling you to work in modern research environments with new and industry-relevant equipment.

Research-Led Teaching
Our teaching is directly influenced by cutting edge research from distinctive and innovative fields such as condensed matter, theory, nuclear and plasma physics, Quantum computing, nanophysics, nuclear astrophysics, photonics and biophysics.

Open Door Policy
Our open door policy for approaching academic staff fosters an excellent staff-student rapport and ensures an extremely friendly and supportive environment.

Disabilities and Special Needs
The department has a dedicated disability support officer to help support and aid student’s transition into higher education teaching. The University has an explicit and committed policy of equal opportunities for students accessing the full range of academic, cultural and social activities.

Feedback and Assessment
Our modules are designed to provide comprehensive and timely feedback to you through a variety of media. Assessments take place in a variety of forms encompassing examination, continuous assessment, coursework, presentations, problem questions, formal reports, essays and open book assignments.

Students Representatives
Students Representatives are students who act as the voice of their cohort within the University. Voted by their year group they represent you within the Department, Faculty and the University as a whole.

Supporting Students
Our extended level of support has recently been recognised in the 2015 University of York Student Union Excellence in Teaching and Supervision Awards, winning the department award for its high quality supervision as voted by students.

Celebrating Teaching Excellence
Each year the university recognises and celebrates individual staff members whose teaching is particularly inspirational and innovative. In the Department of Physics we are proud to celebrate countless staff members who have been recognised through the Vice Chancellors Teaching Award and as Supervisor of the Year.
### First Year Example Timetable

<table>
<thead>
<tr>
<th>Time</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:00</td>
<td>Problem Class</td>
<td>Maths I</td>
<td>Introduction to Thermal and Quantum Physics</td>
<td></td>
<td>Introduction to Thermal and Quantum Physics</td>
</tr>
<tr>
<td>11:00</td>
<td>Maths I</td>
<td>Tutorial</td>
<td>Introduction to Thermal and Quantum Physics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12:00</td>
<td></td>
<td>Professional Skills Tutorial</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13:00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Newtonian and Relativistic Mechanics</td>
</tr>
<tr>
<td>14:00</td>
<td>Laboratory</td>
<td>Sports and Societies Activities</td>
<td>PUCS (Physics Undergraduate Consultancy Service)</td>
<td>Maths Practical</td>
<td>Maths Practical</td>
</tr>
<tr>
<td>15:00</td>
<td>Problem Class</td>
<td></td>
<td>Supervision</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16:00</td>
<td>Tutorial</td>
<td></td>
<td>Newtonian and Relativistic Mechanics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17:00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Core Subjects**
- Small Group Teaching
- Laboratory

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“I love labs – I really enjoy using all the equipment, having a go at applying what we’ve been learning and doing something hands on. An example of a lab I’ve really enjoyed this year is one that looked at the behaviour of electrical conductors, semi-conductors and superconductors. It involved cooling various materials using liquid nitrogen, putting currents through them and studying their properties. We also got to have a go at cooling superconductors and using them to levitate magnets which was pretty cool! For me a far cry from anything I did at school or college! It’s one of my favourite parts of the course, hopefully it will be for you too!”

Emma
BSc in Physics

For more information please visit york.ac.uk/physics
Exploring Physics Modules

Our modules are built around a solid core of knowledge and training in Physics. All students complete a thorough grounding in physics knowledge, scientific principles and methods through a common core of modules to gain a comprehensive understanding of fundamental physics. This ensures that our degrees are accredited by the Institute of Physics, the professional body of physicists, and provides the tools and knowledge for you to specialise and tailor your degree as you progress through your studies.

The flexibility within the programme structure enables you to choose to study a broad ranging physics curriculum or align your studies to specific areas of interest, such as nuclear or fusion and plasma physics, directly influenced and taught by our leading research groups. This gives you the opportunity to increase your understanding of how physics interrelates with other academic subjects, as well as with industry.

Year One Core Modules

Electromagnetism, Waves and Optics
This module will explore some of the core physics concepts you will need as you progress through your degree. The theory of electromagnetism will allow you to understand one of the four fundamental forces of nature, and you will study the behaviour and interaction and mathematical formalism of waves, which are ubiquitous throughout the universe. You will also combine these topics to expand your knowledge of optics (the behaviour of electromagnetic waves), a key component of many modern physics studies.

Introduction to Thermal and Quantum Physics
Exploring the macroscopic and microscopic contents of heat, temperature and work, you will investigate the study of heat transfer by radiation, convection and conduction; the zeroth and first Laws of thermodynamics including cyclic transformations and adiabatic systems. Using kinetic theory you will account for the bulk properties and behaviour of gases in terms of the motions of their constituent molecules.

Mathematics I
Mathematics is fundamental to the study of Physics. This module introduces the concepts of calculus, complex numbers, vectors, linear algebra and matrices, expanding upon knowledge acquired through previous study. Emphasis will be placed on problem solving with examples used from practical physics concepts.

Newtonian and Relativistic Mechanics
Classical mechanics is one of the cornerstones of physics. It provides methods for calculating the position, velocity, acceleration and other properties of the motion of point particles and extended bodies as function of time, if the forces acting are known. This module explores translational motion in systems containing one or few particles. It then progresses with rotational motion and some of the central concepts of physics, such as momentum, force, energy, work, angular momentum and key conservation laws.

Year Two Core Modules

Electromagnetism and Optics
This module investigates how Maxwell unified electricity, the understanding of the separate fields of magnetism and optics into one electromagnetic theory. Maxwell’s four equations describe all of electromagnetism, including the propagation of electromagnetic waves. You will encounter the electrical and magnetic properties of materials, and advanced optics including Fraunhofer and Fresnel diffraction and concluding with the physics of lasers.

Mathematics II
This module covers some of the most important areas of mathematical physics. Vector calculus provides the mathematics required to understand and use scalar and vector fields, providing the tools essential to allow interpretation of electric, magnetic and gravitational fields in subsequent courses. You will derive expressions for curl, divergence and gradients, giving you the mathematical tools needed to explore the laws of Gauss, Ampère and Faraday.

Quantum Physics II
Covering atomic and subatomic quantum physics you will explore quantum mechanics and its application to atomic physics, nuclear physics, and particle physics. Across these fields, concepts of quantization, quantum states, and quantum interactions will be explored.

Thermodynamics and Solid State Physics I
Thermodynamics is a branch of physics that can be applied to any system in which thermal processes are important, although we will concentrate on systems in thermal equilibrium. It is based on four laws (derived from experimental observation) and makes no assumptions about the microscopic character of the system. You will investigate these laws, consider their consequences and apply them to simple systems. Solid State Physics will introduce a key application of the concepts of thermodynamics in understanding the properties of crystalline solids.

A complete list of modules and course content for all our programmes can be found online via our modules catalogue. For further information please visit: york.ac.uk/physics/undergraduate
All of our physics degree courses are accredited by the Institute of Physics, giving a solid grounding in core physics and can lead to professional awards such as chartered physicist.
During your final year you will plan and execute a major research project under the guidance of an academic supervisor. The project undertaken either individually (MPhys) or collaboratively (BSc) is an exciting opportunity to take part and actively contribute to original research as part of our innovative research groups. These include areas such as advanced plasma, nuclear and computational physics, material physics, biophysics and further quantum mechanics.

Project work builds on the expertise that you have acquired through your initial years of study. It will develop your ability to design, carry out and report on an extended investigation, with the opportunity to explore creative and original concepts that you have developed.

Presenting your project either individually, or as a team, you will deliver a conference presentation talk and poster on your findings at our annual end of year conference event. This helps to develop constructive communication skills in delivering physics concepts to a general audience.

Examples of student final year projects

– Masters Projects
– Bachelors Projects

Nuclear Physics
Nuclear Physics Group
Geant Monte-Carlo Simulations for the Electrons Detection System at ISOLDE (CERN)
Reaction Rate Studies for Type-1a Supernovae
Alpha-Capture Reactions for Nuclear Astrophysics
Next-Generation Radiation Detectors for Manipulation of PET Isotopes
Investigating Stellar Nucleosynthesis with an Astrophysical Reaction Network
Exotic Nuclei Studied with Knockout and Fragmentation Reactions
Nuclear Instrumentation Solutions for Industry
Studies of Exotic Nuclei around the $^{100}$Sn Region

Astrophysics
Astrocampus and International Research Partners
Practical Radio Astronomy
Classifying Stellar Pulsations From Space
Song of a Star
Development of a Control Moment Gyroscope System for Space Applications
Searching for Astrophysical Methanol Masers
Classifying Stellar Pulsations from Space
Investigating Stellar Nucleosynthesis with an Astrophysical Reaction Network

Condensed Matter Physics
Condensed Matter Physics Institute
Tight-Binding Studies of Graphene Nanoribbons for Mobile Device Applications
Shape Effects in Magnetic Nanoparticles for Hyperthermia Applications
Raman Spectroscopy Studies of Archaeological Bone
Nanophotonic Biosensors for Novel Diagnostics and Monitoring
Magnetic Evaluation of Thin Films
Organic Semiconductor Interfaces for Molecular Electronics
Plasma Physics and Fusion
York Plasma Institute

Simulation of Plasma Blobs
Low Temperature Plasma Induced CO2 Conversion for Green Chemistry
Optimisation of Single Photon X-ray Diffraction Signals
Hydrodynamic Instabilities in Laser-Driven Plasmas and Astrophysics
A New Way of Computing Certain Important Wave Modes in a Tokamak
The Physics of Inertial Confinement Fusion
Modelling the Chemical Kinetics of Reactive Species in Low-Temperature Plasmas
Plasma Characterisation in a Discharge Tube

Quantum Technologies
York Centre for Quantum Technologies

Quantum Information in Spin Chains
Light, Atoms and Losses: Recipe for Quantum State Engineering
Superconducting Charge Qubits
Detectors for Relativistic and Quantum Information Processing
Towards Relativistic and Quantum Thermal Machines

Biophysics
Physics of Life Group

Raman Investigations of Materials for Biological Applications
Origins of Life in Clay Minerals
Bespoke Computational Single-Molecule Biophysics
Vortex Beam Production by Nature Inspired Pattern
Predicting Effective Parameter Spaces for Biomedical Plasma Sources

Physics with Philosophy

Knowledge in Context - Exploring the Concept of Truth in Physics and Philosophy
The Meaning of the Time Variable in Post-Relativity Physics
Can Closed Time-like Curves Exist?
Dark Energy and the Cosmological Constant
The Many-Worlds Interpretation of Quantum Physics and How it Solves Problems for Relativity Theory
Life–Transforming Research in Biophysics
Physics of Life Group
York is becoming a leading research centre for medical physics and a significant focus of this work is related to the growing international crisis of antibiotic resistance. Our active research is developing new diagnostic sensing technology to ensure doctors reach treatment decisions more quickly and prescribe the antibiotic with the greatest chance of success. The Biological Physical Science Institute is a collaborative research at the cutting edge interface between the physical and life sciences.

"I believe scientists have a moral obligation to tackle problems that are related to major social issues, so I decided to change the focus of my work to biomedical research in order to develop diagnostic tests that provide clinically relevant information in a matter of minutes rather than days."

Thomas Krauss
Professor in Photonics and Research Champion

Exotic nuclei and the limits of stability
Nuclear Physics Group
Studying the structure and shape of nuclei under extreme conditions extends our knowledge of this strongly interacting quantum mechanical system. The nuclear physics group has expanded to become a national centre for experimental and theoretical nuclear physics and applications of nuclear technology. Here at York we house one of the largest groups for fundamental nuclear physics research in the UK, with an emphasis on key aspects of nuclear structure, nucleon interactions and the origins of elements in the cosmos.

Understanding the Constituents of the Universe
Astrophysics-themed Research
Astrophysics research cuts across a number of our research groups. Individual researchers explore our understanding and evolution of the chemical elements and the role of nuclear physics in extreme astrophysical environments, as well as trying to understand solar dynamics. Researchers also try to recreate astrophysical phenomena in the laboratory, including replicating planetary core conditions, stellar plasmas, nuclear reactions, and simulating the evolution of supernovae and astrophysical jets. We even have research efforts to design and explore next generation satellite propulsion technologies.

Developing the Atomic Scale
Condensed Matter Physics Institute
The Condensed Matter Physics Institute studies the fundamental nature of matter at the atomic scale and how we can manipulate this to develop new applications for future technologies. Our research areas cover a diverse range of contemporary topics which aim to uncover how complex processes and structures in matter arise from simple underlying laws so that we can predict and observe interesting new phenomena. Our research is strongly supported by several world-class research centres. One of which is the York – JEOl Nanocentre which has one of the highest resolution STEM and TEM microscopes in the world.

Leading the Quest for Limitless Clean Energy
York Plasma Institute
The York Plasma Institute forms an internationally-recognised centre of excellence in plasma science, delivering research and training across a diverse range of applications from cancer treatment to simulating supernovae explosions in the laboratory, from advanced manufacturing to engineering. The York Plasma Institute houses the remote tokamak control room enabling participation in tokamak experiments anywhere around the world.

Applying Quantum Strangeness to the Real World
York Centre for Quantum Technologies
The Centre aims to foster new collaborations across all areas of quantum theory, and in particular their applications to emerging quantum technologies. The research focus is wide-ranging, covering various application areas: quantum communications, sensing, imaging, computing technologies and quantum thermodynamics (with potential applications to satellite technology). Unusual effects are now moving into the world of technology, investigating the usage of quantum entanglement, some examples are quantum cryptography quantum networks, quantum information and processing and teleportation.
York JEOL Nanocentre has one of the highest resolution STEM and TEM microscopes in the world.

The York Plasma Institute is home to the largest nuclear fusion research group in the UK and houses the remote tokamak control room, enabling tokamak experiments anywhere around the world.

Our York Centre for Quantum Technologies is the leading partner in the UK’s Quantum Communications Hub.
“Going to York really helps you to set your CV apart from the others – it offers a fantastic academic reputation and develops your personal and professional skills.”
Anwen, Accountant, John Lewis

A degree in physics is one of the most sought after and valued qualifications available. As a physics graduate your career options are varied and span many interdisciplinary subjects such as biology, computing, electronics, chemistry and mathematics.

Many students go on to apply their physics knowledge in scientific and research based environments; here at York around forty per cent of our recent graduates entered into further academic study and specific research fields. Due to the key fundamental analytical and technical skills that a degree in physics equips you with, many other students enter into high profiles jobs in fields such as finance, management, accountancy, law and business. These valuable transferable skills, including computational and practical problem solving, logical thinking, teamwork and numeracy are highly valued by employers, allowing many students to excel at the forefront of their chosen held.

Here at York we help to prepare you for your career by extending your studies beyond the scientific, integrating these professional skills directly into your degree programme. In addition, talks and events organised via our White Rose Industrial Physics Academy (WRIPA) work to link you directly with potential employers.

Recent York Graduates
- Graduate Engineer, Cummins Turbo Technologies
- Data Analyst, Adobe
- Financial Coordinator, De Vere
- MAST in Mathematics, University of Cambridge
- IT Analyst and Consultant, Virgin Money
- Accelerator Physicist, Science and Technology Council
- Electrical Engineer, Jaguar Land Rover
- Environmental Modeller, E.ON
- Scientist, The Home Office
- Accountant, John Lewis
- Engineer, BAE Systems
- Physics Teacher
- CDT Fusion Energy, Durham University
- Technician, Kings College London
- Project Manager, Rolls Royce
- Associate Analyst, Ministry of Defence
- MSc Space Systems Engineering, University of Southampton
- Business Consultant, IBM
- Applications Developer, Lloyds Banking Group
- Associate Consultant, PricewaterhouseCoopers (PwC)
- Physicist, Cavendish Nuclear

Your Future: Careers and Employability

What do our graduates do?

Graduates who have not entered into further study pursue careers in a range of professional sectors:

[Graph showing career destinations]

Career destinations
- Information & communication 26%
- Education 19%
- Manufacturing & construction 19%
- Professional Services 9%
- Finance & legal 6%
- Health & social work 5%
- Scientific & technical 4%
- Media & advertising 3%
- Retail & wholesale 2%
- Creative arts, culture & recreation 2%
- Land & environmental 2%
- Other 3%
Physics Careers Support

We support our students in recognising their abilities, talents and extensive skills to make informed choices and prepare them for the next steps in their career path. Our dedicated department careers officer delivers a range of activities and workshops designed to help students enhance their employability options. These include sessions such as:

- Application writing
- Development of an employability plan and tutorial review sessions
- Preparing your next career steps workshops
- Careers fairs
- Enhancing your employability and careers options workshops
- Physics careers day
- Career development activities
- Interview training
- Leadership and teamwork activities

As a department we are committed to enhancing and supporting our students’ career development and employability. This is embedded within our core teaching throughout every year group to enhance and support your development.

Developing Employability Skills

Self Management

- Deadline and project management
- Independent learning

Communication and Literacy

- Scientific report writing
- Individual and group presentations
- Report writing to specific audiences
- Research talk and conference analysis

Team Working

- Technical group exercises
- Paired lab work
- Physics practice question prompts and discussion
- 'Thinking like a Physicist' group discussion with academic supervisors

Problem Solving

- Physics practice questions
- Modules assignments and reports
- Laboratory based projects and analysis

Creativity and Innovation

- Observing and evaluating data trends to formulate strategies, generate ideas and increase social, cultural and global awareness
- Commercial, industrial and domestic application research and presentations
- Development of employability plan and assessment of skills

Application of IT and Numeracy

- Laboratory and project reports
- Use of specialist software
- Introduction to programming languages
- Use of Maths in Physics

Languages for All

- Start a new language or brush up on language skills with Languages for All
- Prepare for studying or working abroad

Enhancing Your CV

It is also possible to enhance your experience and skillset through a range of additional extra-curricular activities. These include internship and voluntary programmes through the University’s expansive Careers service, placements and research projects opportunities within the department as well as through our European and industrial partners, and a range of volunteering options from working in physics outreach to supporting students in schools.

“I felt that my degree gave me an advantage at interview because the skills you learn are so diverse and adaptable. The numerical skills and analysis skills are extremely useful to the work I do. The degree really helps to keep your options open, as you gain the skills to adapt yourself to wherever you wanted to be.”

Laura, Engineer, BAE Systems

For more information please visit york.ac.uk/physics
Life as a Physics Student

Events & Talks
The department hosts a range of public lectures, research group seminars and physics-related colloquia available to students throughout the academic year. In addition we also participate in a range of talks and events around the City of York such as Pint of Science, Festival of Ideas, British Science Week and YorNight.

Physics Undergraduate Consultancy Service
The Physics Undergraduate Consultancy Service (PUCS), is a weekly run student support session where final year students provide peer to peer support to our first and second year students. PUCS sessions are run on a weekly basis and are available on a drop in basis.

PhysFest Welcome Party
Each year we welcome our new physicists into the department through our welcome party, PhysFest. Held on our Astrocampus, PhysFest is an annual tradition where we celebrate our new starters with a pizza party and our famous apple pie, made from Newton’s Apple tree growing our courtyard. PhysFest has a host of games and activities for everyone and has in past years included live music and ceilidh dancing.

Annual Physics Awards Day
A variety of awards celebrate our most inspirational lecturers, students and staff of the year. This is a day that reflects and celebrates the diverse nature of the department.

Newton’s Apple Tree
Growing in a courtyard garden in the department we have a grafted cutting from an ancient apple tree which still survives in Newton’s garden at Woolsthorpe Manor, his birthplace in Lincolnshire. Each September the apples are picked ready to make into pies for our new student welcome party PhysFest.

Outreach Activities
We have a series of varied outreach programmes which engage young people of all ages and the general public. For students this provides exciting opportunities and experience in delivering fun-filled activities, as well as promoting your passion for physics.

Women in Science
Here at York we are committed to supporting women in science, which is recognised in a number of awards that we hold. We support a diverse environment for both students and staff as well as providing opportunities to access Women in Science networks and resources.
Physics Societies

PhysSoc
Hello from the PhysSoc committee!!

PhysSoc is the University of York Physics Society. Our job is to organise a huge range of events over the course of the academic year, ranging from our legendary socials, public lecture series and revision sessions!

Getting involved with PhysSoc is a great way to get to know people – not just in the Department of Physics but also in the wider university as well. Physics is definitely the most sociable department at York – not just students, but staff as well – we are a great community and PhysSoc is a huge part of that!

Our events range from groups socials, to more relaxed games and film nights, as well as huge annual events such as the Christmas Ball and inter-science competitions such as sports events and University Challenge! We also host a set of fantastic public lectures with speakers from our department as well as further afield undertaking one off talks on exciting areas of physics. During exams we hold regular revision sessions for everyone to get together and work out problems and discuss different subjects.

We look forward to meeting you and for more information please, like, follow and find us at:

Twitter: @YorkPhysSoc
Love, PhysSoc x

“We are a great community and PhysSoc is a huge part of that!”
Thom, PhysSoc President 2016/17

AstroSoc
The University of York’s Astronomy Society (AstroSoc) is one of the friendliest and most well-loved societies on campus. Thanks to the amazing ongoing developments on the AstroCampus and within the Department of Physics, we have access to some fantastic equipment and resources. AstroSoc gladly welcomes York students with an interest in Astronomy regardless of their level of knowledge.

We meet up regularly at the AstroCampus and provide a relaxing and friendly environment for the experience, education and ultimately enjoyment of astronomy. In addition we hold a host of activities including socials, sci-fi film and Astronomy trips – one of our main trips recently has been to the Jodrell Bank Observatory.

With every new discovery, more questions and conundrums are raised. Astronomy is a self-perpetuating circle of curiosity and delight, and there is no better place to give it a go than with York’s very own AstroSoc!

Twitter: @UoYAstroSoc
Email: astronomy@yusu.org

In recent years, AstroSoc attempted to send their mascot, Astroduck, into space, to boldly go where no duck has gone before! The project was the first to be funded by the University’s crowdfunding site, YuStart.
Next Steps

Find Out More
For full details on the courses offered and information about the department please visit our website at york.ac.uk/physics

Applying
All applications to undergraduate degree courses at York are made via UCAS (the Universities and Colleges Admissions Service). The application system opens mid-September, guides on how to apply through UCAS available online by visiting www.ucas.com. To see a full list of our available UCAS course codes please see page 7.

Typical offer
A Levels
MPhys: AAA, BSc: AAB
Including Physics and Maths at grade A and a pass in all practical components where offered

International Baccalaureate
Mphys: 36 Points, BSc: 35 Points
With Higher level Maths and Physics at grade 6

National Extended Diploma
DDD plus A at A level in Physics and Maths

Foundation Year
Due to the highly diverse experience of the foundation year applicants, the offer extended will vary depending on individual, although typically a BBB at A-level would be requested for students without additional work experience. Please contact the admissions team for more details.

Other Qualifications
For details of other acceptable qualifications please visit york.ac.uk/physics/undergraduate

Department Scholarships and Master Class Research Placements
The Physics Academic Excellence Scholarships and Master Class Research placement provides a £1000 scholarship and unique research master class in recognition of academic achievement. The scholarship is open to newly enrolled students who achieve A* or equivalent in Mathematics or Physics and select York as their firm institution when applying through UCAS. This scholarship is renewable annually and is subject to attaining full credits and an overall year mark of 70% or higher in the first attempt. To read more about our scholarship opportunities please visit our website: york.ac.uk/physics/undergraduate/scholarships

Interview Days
All UCAS applicants are required to complete an interview session with the department before an application is progressed to the offer stage. Our decision about whether to invite applicants to interview is based on information on the UCAS form, including your personal statement, reference, and academic grades or predictions. Upon completion of a successful academic interview an offer will be determined taking into account both feedback gathered at interview and information from your UCAS form.

Mature Students
We welcome applications from mature students, whose skills and experience are highly valued by staff and students. We are happy to consider applications with either A levels or non-standard qualifications.

International and EU Students
The University has a diverse international community with students from many different countries. Applications from international and EU students are very welcome, and we are happy to consider these applications on an individual basis. University staff make regular overseas visits, to find out when and where you can meet our representatives or to speak with a current York ambassador please visit york.ac.uk/international

English Language Requirements
Prospective students must show evidence of a good command of the English language, especially where previous education has not been studied in English. For details on applicable English language qualifications please see: york.ac.uk/apply/entry/undergraduate/applying/condition entry/undergraduate/applying/condition

Open Days
We would be delighted to see you join us at one of our Open Days. Open Days give you the opportunity to speak to staff and students, explore our departments and attend our talks and mini lectures. To book your place please visit: york.ac.uk/study/undergraduate/visits

If you are unable to visit one of our Open Days, you can also make an independent visit or book a campus tours. For more details visit: york.ac.uk/study/undergraduate/visits

Life in York
At York, we want you to have an unrivalled experience – you just have to take part in what’s on offer. You’ll make friends for life, discover new passions and learn invaluable skills that will set you up for a bright future. Discover why you’ll love York by visiting our student life pages: york.ac.uk/study/student-life

Contact Us
We welcome all enquiries from prospective undergraduates and are happy to answer any queries that you may have about our courses and life in the department.

Admissions Tutors:
Dr Andy Higginbotham
Dr Vlado Lazarov

Foundation Year Admissions Tutor:
Dr Chris Murphy
+44 (0)1904 322 241
physics-admissions@york.ac.uk
www.york.ac.uk/physics
Undergraduate Admissions
Department of Physics
University of York
York
YO10 5DD
Facebook: UoYPhysics
Twitter: @PhysicsatYork