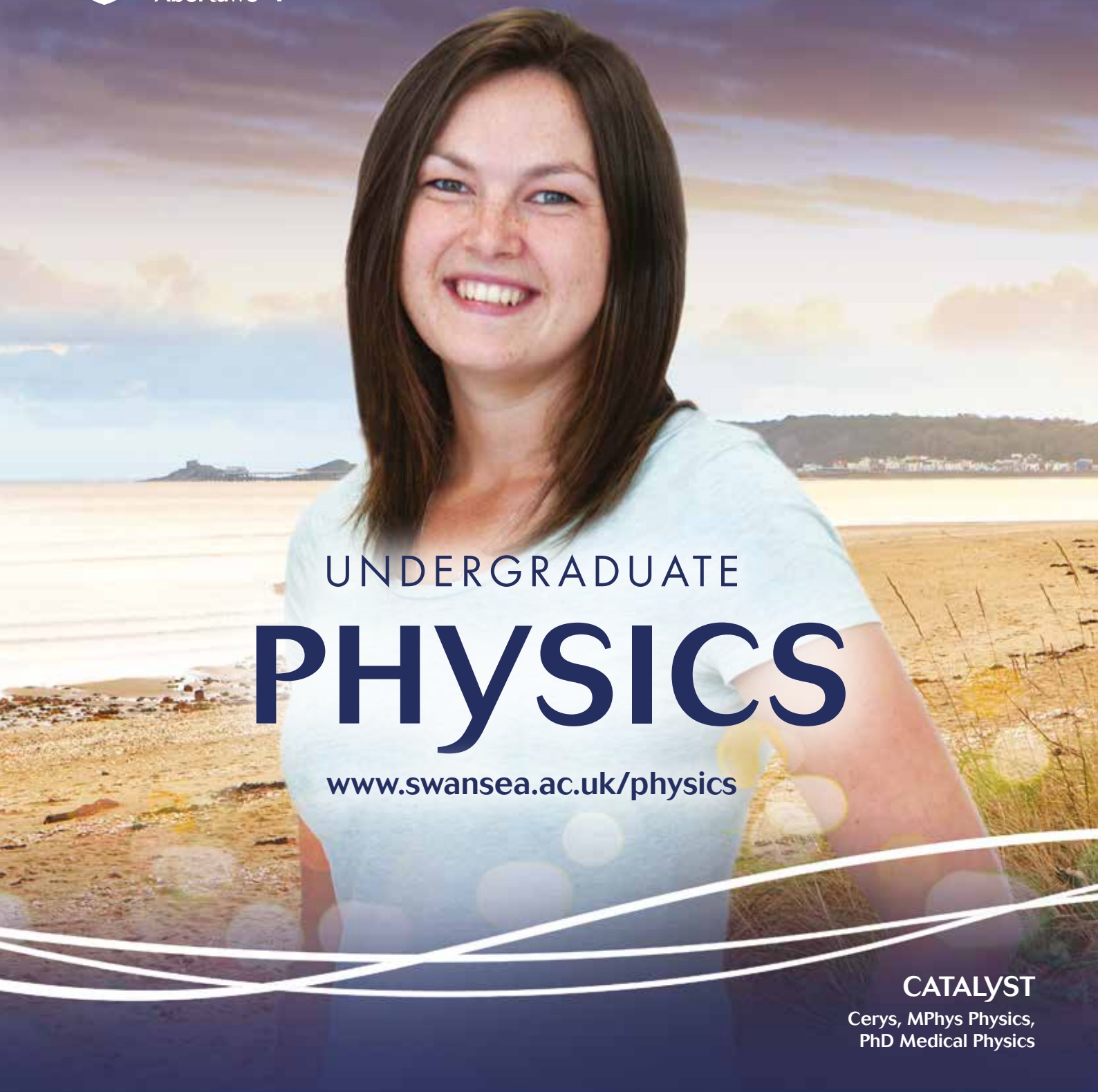
Swansea University
Prifysgol Abertawe

College of Science
Coleg Gwyddoniaeth



UNDERGRADUATE

PHYSICS

www.swansea.ac.uk/physics

CATALYST

Cerys, MPhys Physics,
PhD Medical Physics

WELCOME

The Department of Physics at Swansea offers excellent and stimulating degree schemes, within a friendly and welcoming environment. Staff are proud of our open door policy, which means we make ourselves available to help students - when they need it. Our teaching is informed by research undertaken at the highest international levels, spanning aspects of particle physics theory and antimatter science via studies of antihydrogen, through to the physics and applications of lasers, cold atoms and quantum control theory. Swansea Physics is growing: we have modernised our undergraduate laboratory facilities and we have recently welcomed new academic staff to the Department. We have exciting times ahead. We hope you will be able to visit us to see for yourselves.

Professor Ken Meissner
Head of Department

DISCLAIMER

The following message contains some very important information. Please read it before you use this brochure. This brochure was printed in the Spring of 2017. It contains information on the undergraduate programmes in Physics that Swansea University intends to run for students who are planning to start university in the Autumn of 2018. We have made every reasonable effort to ensure that the information provided is both helpful and accurate as at the date of publication. However, some changes, for example to programmes, study location, placement opportunity, facilities or fees may become necessary due to legitimate staffing, financial, regulatory and academic reasons. We will endeavour at all times to keep any changes to a minimum and to keep prospective students informed appropriately. Any changes to the information contained in this brochure will be updated quarterly at **www.swansea.ac.uk/undergraduate-programme-changes** and on the online course pages at:
www.swansea.ac.uk/physics/undergraduate

> I was placed in the McLaren Technology Centre in Barcelona in the powertrain (hybrid) department, working on helping to develop a new dual clutch system for future platforms, utilising skills I had learned through the university of programmes such as Matlab and Simulink, and machine learning. Further to this, I was lucky enough to help undergo some testing in cars such as the infamous P1 GTR (which included a lot of wheel spin and some sideways action on a wet track!). Living and working in Barcelona was also an incredible experience - and most certainly one that I will never forget. The opportunity to be able to live as a local and experience the culture so deeply is one I will forever be grateful for.
>
> Without all this experience and self-development which I have gained through being at Swansea University, I would not have been able to secure the graduate job that I have. In September, I will be starting a 2 year graduate scheme with QinetiQ as part of their Radar and Electronic Warfare department. Not only will it take a firm hold of all of the Physics knowledge I have gleaned over the last four years by working on engineering and problem solving projects, but it will also help to develop even further the strong grounding of personal skills the university has helped to create.
>
> *Georgina Jackson*
> *Swansea University Graduate*

100% OF OUR STUDENTS SAY THE COURSE IS **INTELLECTUALLY STIMULATING**

(National Student Survey 2015)

Exceptional
project supervision

students can experience working in a research group as part of their final year project

TOP IN UK
for research intensity

(Complete University Guide 2017)

PORTFOLIO OF DEGREE SCHEMES DESIGNED TO REFLECT
CUTTING-EDGE RESEARCH DEVELOPMENTS

Summer studentship and project opportunities at
CERN Particle Physics Laboratory

£4.2M INVESTMENT
in state-of-the art Science laboratories

BEST UNDERGRADUATE PHYSICS SOCIETY IN THE UK
as judged by the Institute of Physics - 2017

YEAR IN INDUSTRY PROGRAMMES
available for 2017 entry



SWANSEA A CITY THAT HAS IT ALL

Studying at Swansea University you'll become part of a world-class research institution with grand ambitions. You'll receive an outstanding learning and teaching experience with a distinct emphasis on employability. But you'll also fall in love with the city.

Wherever you go in Swansea, you're by the sea. It's a fantastic location and an upcoming city; warm and friendly, it's compact, yet offers it all.

The latest National Student Survey (NSS) placed us 8th in the UK for student satisfaction, and the highest-ranking university in Wales. Swansea is as rich an environment for living as well as learning. From its breathtaking sweep of beaches and coves to its dazzling nightlife, eclectic dining to unique shopping experiences it's 378km^2 of everything you need to make your student experience amazing.



PHYSICS AT SWANSEA

Physics continues to tackle problems on the frontiers of knowledge, to which today's answers will affect the way we live tomorrow. From great discoveries such as the observation of fundamental particles like quarks and leptons, through the generation and understanding of antimatter, harnessing the quantum world with lasers and nanotechnology, to the shape of the universe as a whole, Physics covers it all.

Physics is crucial to understanding the world around us, the world inside us, and the world beyond us. It is the most basic and fundamental science.

Physics encompasses the study of the universe, it's the basis of many other sciences, including chemistry, seismology and astronomy, and has major applications in engineering, medical science and biology. All of these areas are easily accessible with a degree in Physics.

Physicists are creative problem solvers. Their analytical skills make them versatile and adaptable so they can work in fascinating places.

Employers know that a physicist brings additional skills with expertise and pay accordingly. A recent survey by the Institute of Physics found Physicists earn £3,000 more than the average graduate after one year.

We currently offer the following degree programmes

F303	4 years	Full Time	**MPhys Physics**
F340	4 years	Full Time	**MPhys Theoretical Physics**
F304	3 years	Full Time	**MPhys Physics with a year abroad**
F300	3 years	Full Time	**BSc Physics**
F390	3 years	Full Time	**BSc Physics with Nanotechnology**
F3F5	3 years	Full Time	**BS. Physics with Particle Physics and Cosmology**
F341	3 years	Full Time	**BSc Theoretical Physics**
F302	4 years	Full Time	**BSc Physics with a year abroad**
F301	4 years	Full Time	**BSc Physics with integrated foundation**
F478	4 years	Full Time	**BSc Physics with a Year in Industry**
F636	4 years	Full Time	**BSc Theoretical Physics with a Year in Industry**
F857	5 years	Full Time	**MPhys Theoretical Physics with a Year in Industry**
F30Y	5 Years	Full Time	**MPhys Physics with a Year in Industry**

WHAT ARE THE DIFFERENCES BETWEEN THE PROGRAMMES?

Our BSc programmes are recommended for those who are interested in developing their physics knowledge, improving their numeracy, communication and problem solving skills. The BSc programme gives a thorough grounding in many aspects of modern physics and introduces a student to the current research interests in the field. Schemes such as 'Physics with Nanotechnology', 'Physics with Particle Physics and Cosmology', and 'Theoretical Physics' contain around 40 credits in these specialist areas that generally reflect particular research expertise and enthusiasm in the Department. Earning a first or upper second-class B.Sc. in Physics demonstrates that you are a skilled, knowledgeable and numerate graduate, ready for the demands of highly technical employment.

Our M.Phys. programme is a four-year advanced initial degree which gives exceptionally talented students the opportunity to specialise, is aimed at aspiring professional physicists and prepares you for postgraduate research or 'physics' jobs in industry. The noteworthy aspects of the Swansea M.Phys. start with specialisms available in year 3, whilst in the final year the first semester concentrates on modern applications of physics taught by research experts in those areas. The second semester is a full-time research project, during which students become an active part of a research group (see pages 14 - 15 for an overview). Our students, employers and external examiners have been greatly impressed by the achievements of our students during these projects. More than 70% of our M.Phys. students go on to take PhDs after gaining substantial research skills in their M.Phys. degrees, and the M.Phys. has an overall student satisfaction of 100% in the NSS 2014.

HOW MUCH CHOICE WILL I HAVE DURING MY DEGREE?

As shown in the detailed information on page 6, students on all degree programmes follow a common first year. This equips all our students with the core physics knowledge and mathematical tools required for their ongoing study as they either follow the Physics syllabus or specialise according to their interests and abilities. As students progress through their degrees, they are given more options, choosing modules that reflect their interest and possible future career pathway. All six lecture modules in the first semester of the final year of the M.Phys. are selected by the student. This is illustrated on page 6.

It is possible to change from a three year to a four year degree programme when a student shows strong academic performance evidence in first/second year examination results.

BUILDING A SOLID FOUNDATION

We offer a four year BSc Physics with Integrated Foundation degree (F301) which is appropriate for students not possessing the necessary qualifications to enter the three year BSc schemes. Students who have not achieved their potential either due to bad results or inappropriate choice of A-levels can apply. It is also the acknowledged route to a physics degree for returning mature students. Foundation year physics modules include introductions to: optics & wave motion, electricity & magnetism & waves, atoms & nuclei and bulk & thermal physics. In addition there are modules on the fundamentals of calculus, algebra and mathematics, plus computing and environmental science modules. Although students enter this degree scheme for a variety of reasons, we take particular pleasure that many graduate with a first or second class honours degree having produced a sustained performance throughout their time at Swansea.

OPPORTUNITIES FOR TRAVEL

Swansea lecturers maintain close links with researchers from many institutions around the world. The MPhys and BSc programmes with a Year Abroad allows students to spend the year between their second and third year at an overseas university. The Physics department has existing exchange programmes with Berlin, Vienna, Brest, Parma, Sydney and North American Institutions and the list of University wide links around the world are constantly expanding. In addition, Swansea students continue to participate in summer studentship schemes at CERN in Geneva.

SPENDING A YEAR IN INDUSTRY

Our Year in Industry (YoI) programmes allow students to experience working as a professional scientist during their degree course. This additional year is added between the penultimate and final years, and gives a valuable insight into how their Physics degree will give them direct access to cutting edge industrial applications. Each YoI student is assigned an academic mentor who manages the assessment of their placement, and will visit the industrial partner. We offer YoI courses across our portfolio, including Physics at BSc and MPhys, and we make good use of our alumni, who are employed across the UK and the rest of the world, and are building a network of new industrial partners that expands every year. Theoretical Physics YoI is also offered as a BSc and MPhys, where our experience producing high calibre graduates in this area, some of whom work in e.g. high performance computing, informs our Industrial year placement options.

DEGREE SCHEME STRUCTURE

Swansea Physics courses are modular and are a mixture of lecture and laboratory based courses together with project modules and tutorials. Below is an indicative overview of our modules where the BSc programmes are formed of Years 1 to 3, whereas the MPhys programmes include Years 1 to M. For foundation year details, see pg 5, Building a Solid Foundation section.

YEAR 1

- Dynamics
- Dynamics II
- Introduction to Astronomy and Cosmology
- Matter and Fields I
- Matter and Fields II
- Wave and Optics
- The Quantum World
- Calculus for Physicists
- Algebra for Physicists
- Mathematics for Scientists
- Quantitative Methods in Physics
- Laboratory Physics I

YEAR 2

Compulsory

- Statistical Physics
- Introduction To Physics Simulation
- Quantum Mechanics I
- Mathematical Methods in Physics I
- Condensed Matter Physics I
- Electromagnetism & Special Relativity I
- Electromagnetism II
- Mathematical Methods in Physics II
- Particle Physics I
- Laboratory Physics II and group projects (10 or 20 credits)

Optional

Typically a choice of one ne optional module from the following:

- Foundations of Astrophysics
- Introduction to Nanotechnology

In addition, students who are on a theoretical based degree can choose some Mathematics based modules in place of 10 credits of laboratory physics II

YEAR 3

Compulsory

- Electromagnetism
- Quantum Mechanics II
- Advanced Techniques of Theoretical Physics
- Atomic Physics I
- Condensed Matter Physics
- Experiments Atomic Physics and Quantum Optics II
- Particle Physics II
- Research Project

Optional

Optional modules may depend upon the BSc course you are on, or may be compulsory on the MPhys programme.

- Foundations of Astrophysics
- Particle Physics and Cosmology
- Probing The Nanoscale
- Modern Laser Systems
- Large Molecules and Life
- Teaching Physics via a school placement
- General Relativity
- Option Experiments
- Mathematics methods in Physics III

YEAR M

Semester 1, six modules are selected from the following:

- Quantum Field Theory
- Relativistic Quantum Mechanics
- Modern Laser Systems
- Phase Transitions and Critical Phenomena
- Particle Physics and Cosmology
- Physics Simulation using High Performance Computing
- Magnetism, Superconductivity and their Applications
- Large Molecules and Life
- Quantum Information Processing

Semester 2, either:

- Experimental Physics Research Project

OR

- Theoretical Physics Research Project

**Note some of the diversity at Year M is generated and delivered by a collaborative programme with Cardiff University.*

I chose Swansea for the openness of the Physics Department and how approachable the lecturers are; happy to answer questions, discuss and help students progress and achieve to their highest potential. Having already studied my Master in Physics here, it was a natural step into postgraduate study. The interdisciplinary PhD in Physics and Immunology pushes my knowledge and skills even further than before and has allowed me to do what I've always wanted - branch into the realms of applied medical physics. Swansea city's location is ideal for my love of water sports, the Gower coast is some of the most beautiful in Wales and being only an hour's drive from the Brecon Beacons means I can go hiking whenever I like.

Kathryn Welsby
M.Phys. Physics, PhD Physics

HOW WILL I LEARN?

Our physics programmes combine teaching delivered through lectures, with practical laboratory skills and research-based projects. These well-established methods are augmented with problem classes, tutorials and mathematics drop-in sessions.

LECTURE MODULES

This is the most fundamental method for teaching new physics knowledge and demonstrating the application of mathematical skills. Lectures involve verbal and written discourse by a member of academic staff, often augmented with PC-based data visualisation and modern presentation methods. The material covered in lectures is supported by Blackboard, a web-based Learning Portal.

LABORATORY AND COMPUTING SKILLS

Rather than just watching demonstrations, students carry out a series of practical and computational experiments during Laboratory sessions which are closely linked to the topics covered in the lecture modules. Our recent investment of £4.2M in Physics teaching facilities underlines how important this part of the degree is. Many of the experiments are performed via a computer interface, allowing seamless data acquisition, analysis and presentation of results, ensuring a distinct advantage over other graduates.

GROUP PROJECT

One of the most popular and challenging features of Year 2 is the Group Project element of the laboratory physics module, where you will work in a team of five or six to design and test an experiment, then analyse the results. Strong team-working skills are developed and a high level of organisation, planning and delegation is required. The Group Project culminates with two days of presentations, giving the students a flavour of a scientific conference.

RESEARCH PROJECT

A crucial component of any Physics degree course is an extensive, large-scale project, which can be either theoretical or experimental. B.Sc. students will encounter this in their final (3rd) year. Past projects have been as diverse as 'Measuring Superconductivity', 'Ion Propulsion Systems for Spacecraft' and 'Quark Bound States in the Quark-Gluon Plasma'. The M.Phys. project is very important and a major strength of the degree scheme. The final year of the M.Phys. schemes involves specialised courses and a full semester working on a cutting edge research project, with the possibility of performing the project at CERN. Students choose from experimental or theoretical projects and work as part of the Department's research groups. Valuable experience of real research is gained and many students are motivated to continue their research with a PhD.

ACADEMIC TUTORIALS

Communication skills are essential for any physicist no matter how they use their degree; these skills are encouraged by tutorials which involve five or six students and a lecturer, the academic tutor throughout the year. These small groups are very well suited to student-led discussions and problem solving. It is also the natural environment to identify and address areas that are causing difficulties.

PERSONAL TUTORIALS

Your Personal Tutor monitors the pastoral aspect of your progress throughout your degree, and is your first point of contact with the University. He/she is always there to offer guidance with any non-academic problems which may occur during your time in Swansea, and can put you in contact with university agencies such as Student Wellbeing Services. Personal Tutors can also offer advice on additional resources within the University, such as the Swansea Academy of Learning and Teaching, and Summer placements.

COURSEWORK AND EXAMINATIONS

We monitor your development throughout your degree by continuous assessment, which offers us a week-by-week insight into how well you have understood the material in the lecture modules. In lecture-based modules such assessment usually contributes 20% towards the final module mark, the other 80% comes from an end-of-semester examination.

FEEDBACK

Examinations, continuous assessments and tutorials form the main elements of our Feedback route, allowing you to track your progress, whilst allowing us to offer guidance on how to improve and exceed your expectations. Timetabled feedback sessions are a mechanism by which model solutions for problems and assessments are developed within the class environment to ensure greater understanding of module material. We value student opinions and actively encourages student feedback on our teaching. Elected year group representatives provide on-going feedback via regular meetings of the student-staff experience forum. In addition, we issue module questionnaires in which students can evaluate the module against specific criteria. We encourage students to ask questions during their course and they can meet with staff to discuss academic difficulties in person.

FACILITIES

The Department is well-resourced to support teaching and research. Swansea physics graduates are more fortunate than most, gaining unique insights into exciting cutting-edge areas of physics due to the specialised research interests of all the teaching staff. This combined with a great staff-student ratio enables individual supervision in final year research projects. Projects range from superconductivity and nanotechnology to superstring theory and antimatter. The success of our Advanced MPhys programme is apparent in the large proportion of our MPhys students who seek to continue with postgraduate programmes in research.

LEARNING IN THE MEDIUM OF WELSH

The department currently offers 5 optional modules that support learning in the medium of Welsh and is aimed at those students who wish to maintain their learning in Welsh as part of their personal development. The department has several Welsh speaking staff and strong links to the Coleg Cymraeg Cenedlaethol.

WHAT WILL I LEARN?

During the course of your degree, you will learn a number of indispensable skills for life, which will make you well prepared for what comes after graduation. Our students excel in:

Problem solving - studying physics gives you a pragmatic and analytical approach to problem solving. You break down tasks to basic elements and use imagination and creativity to solve challenging problems.

Reasoning - you are trained in constructing logical arguments, applying analytical skills and grasping complex problems.

Numeracy - you will be highly skilled in employing mathematics to solve scientific problems, create mathematical models and interpret and present information graphically.

Practical skills - during lab sessions and in project work you plan, execute and report on experiments, using advanced technical equipment. Attention to detail is crucial.

Communication - tutorials, joint practical work and final-year presentations will teach you to communicate complex ideas and use technical language correctly and efficiently.

Information and communication technology - the use of computers and digital tools, with highly specialised software packages, is fully integrated, and access to high-performance computing resources is provided.

CERYS JENKINS, 23

MEDICAL PHYSICIST STUDYING FOR A PHD IN COLORECTAL CANCER DIAGNOSTICS

I love to be in the lab playing with equipment – playing with new ideas is what leads to discovery. Even if something hasn't worked the way I wanted, it still teaches me something.

Scientific research may be tough at times but it is never boring. It's so rewarding to do work that is different every day.

I am trying to create a diagnostic tool for colorectal cancer. It's amazing to think we are bringing techniques together for the first time and they might end up making a real difference to people.

Theoretical physics and medical research are not normally seen together but the university gave me the freedom to move between disciplines and work in an area I am passionate about.

I didn't choose physics, it chose me. I was the child who, rather than worrying how cold the sea was, asked why the tides went in and out and why I sank into the sand.

Now being curious is my life and I can keep asking questions until I get to the root of a problem and maybe even solve it.

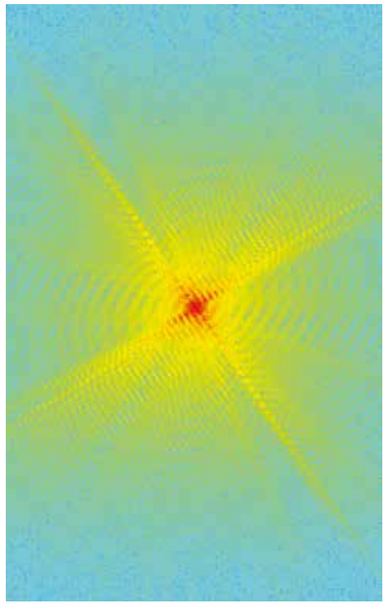
I am also an adventurer. I love travelling to new places, but also venturing into different areas of knowledge. I started off taking physics but am now learning about cancer biology and chemistry.

The atmosphere at Swansea is so welcoming. I immediately felt at home and still love it five years later. On a sunny morning, walking beside the beach has to be the best journey to university in the world.

I have a broad range of interests, including scuba diving, beach sports and golf, and this laid-back city gave me the chance to pursue them all.

It's amazing to think we are bringing techniques together for the first time and they might end up making a real difference to people.

Cerys Jenkins
Medical Physicist



CAREER PROSPECTS

Graphic – 90% of our students go onto work and/or further study after finishing their course – Unistats 2014

Physics graduates have a wide range of job opportunities. Employers include academic institutions, government research organisations and industry, including aerospace and defence, education, energy, engineering, instrumentation, manufacturing, oil and gas, science, communication, space exploration and telecommunications.

Many physics graduates pursue a career outside of physics, e.g. in consultancy, IT, the environmental industry, financial services, the legal sector, transport and utilities.

First Career Destinations of our recent graduates:

- Patent Examiner, Intellectual Property Office
- Engineer, British Nuclear Fuels
- Full-time student, MSc in Physics at Imperial College London
- Aerospace Engineer, General Dynamics UK
- Full-time student, PhD in Semiconductor Lasers,
- University of Strathclyde
- Regional Sales Manager, Newport Corporation
- Research Fellow, National Physical Laboratory
- Software Engineer, Logica

Prifysgol Abertawe
Swansea University

SEA
SWANSEA EMPLOYABILITY ACADEMY
ACADEMI CYFLOGADWYDD ABERTAWE

WOW
WEEK OF WORK

SPIN
SWANSEA PAID INTERNSHIP NETWORK

www.swansea.ac.uk/sea

Alex undertook a CERN summer studentship, organised and paid by CERN. He worked on our ALPHA experiment, and followed a number of lectures at CERN from leading physicists from all over the world.

It was great to be doing actual research; you get to learn a lot of different problems and how to solve them. Unlike larger CERN experiments where physicists focus on a super-specialised project that doesn't let you see the greater picture, the experiment in ALPHA is small enough to get you involved with a lot of different aspects of physics that are complex enough for you to sharpen and develop new tools that you never thought they existed. ALPHA is undergoing an upgrading phase at the moment so no shiny results just yet, but I've been working with a simulation of cold positron-ion plasmas for a future plan to laser cool the particles even further, something that could potentially increase the efficiency tenfold. The results are a mixture of already acquired knowledge and a little bit of "why on earth did it just do that..?", so I can say that things seem great! Other than that, it was a fun environment and definitely a good research placement!

Alex Alampounti
Physics M.Phys and current Ph.D. student

AN INTERNATIONAL PERSPECTIVE

The Department of Physics and the College of Science have a rich international community with many international links. Students from 80 countries around the world have chosen to study our undergraduate, postgraduate and research degrees.

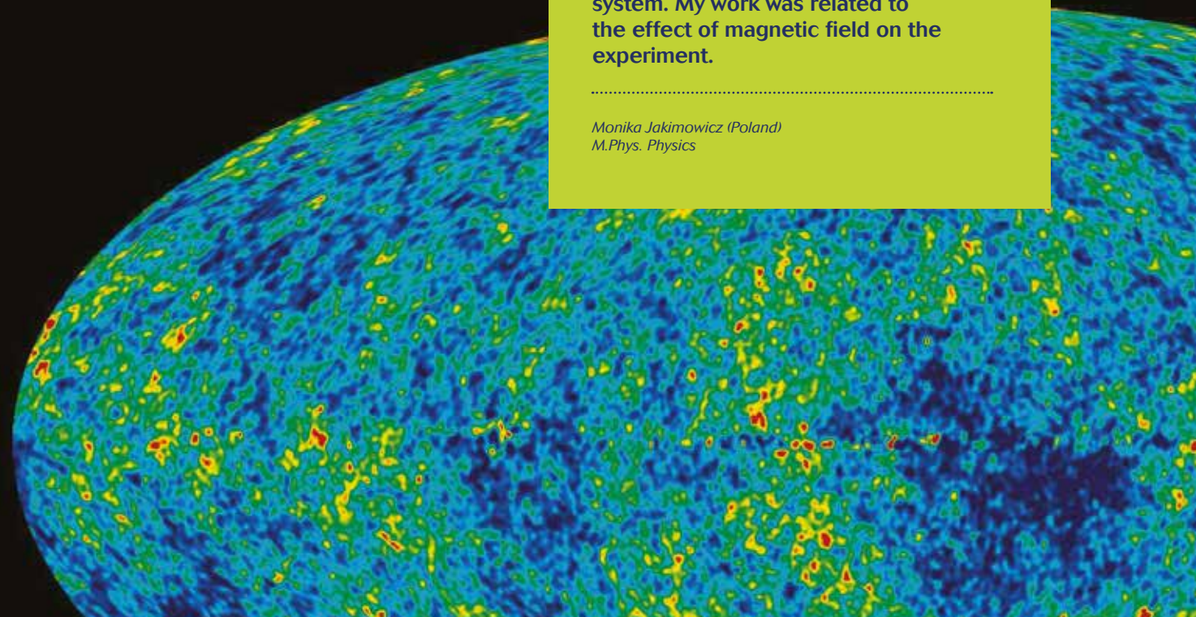
The department is thoroughly international with staff from Australia, Belarus, China, Germany, India, Italy, the Middle East, Poland, Russia, Spain, the USA, and Ukraine. This means we have a lot of experience of the challenges that students face when coming from another country.

- Swansea is a safe and friendly multi-cultural city with lower living costs than most of the UK
- We are three hours from London by direct train
- We offer free academic English support classes for enrolled, full-time international students
- A free International Student Advisory Service is available for help and advice with healthcare, visas and more.

Visit the international pages on our website for country-specific information, student videos, and much more:
www.swansea.ac.uk/science/international

I really enjoy my studies as the lecturers give us a lot of support and they DO stimulate our interest in the subject. Thanks to the Physics department and the IOP, I received free training and along with other students became a STEM (Science, Technology, Engineering and Maths) Ambassador. This allows us to take part in local schools' experiments, help out in science fairs and do many other exciting activities to engage the public with science. I was also offered an internship in the University over the summer. During this placement I was working with an academic and a research student on a laser cooling system. My work was related to the effect of magnetic field on the experiment.

Monika Jakimowicz (Poland)
M.Phys. Physics



PHYSICS RESEARCH AT SWANSEA

The Department has a cutting-edge research programme carried out by our highly committed academic staff, all of whom are passionate about their subject. Our staff are all research active, publishing in high-impact peer-reviewed journals and writing specialist reviews of their fields. Academics are also regularly invited to international conferences all over the world, and organise international conferences, schools and workshops at Swansea University and elsewhere.

Students studying Physics at Swansea have the chance to experience all areas of our research: during the course of your degree you will be taught by internationally-recognised experts. Furthermore, your final year project will be directly linked to our ever-changing research programmes.

EXPERIMENTAL PHYSICS

A major focus of our research is low-energy positron and positronium physics, with particular application to the creation of ultra-low energy antihydrogen in the ALPHA experiment at CERN. ALPHA has created antihydrogen atoms almost at rest by mixing trapped antiprotons with positrons, and has now routinely traps what may be the first antimatter atoms in the universe for more than 1000 seconds. Antihydrogen trapping will permit spectroscopic comparison of the atomic properties of matter and antimatter, enabling precision tests of CPT symmetry.
The group is also involved in the KATRIN project based at Karlsruhe to bound the neutrino rest mass with unprecedented sensitivity by measuring the end-point of the beta-particle energy spectrum in tritium decay. We have successfully developed an extremely sensitive laser Raman system to continuously monitor the purity of the tritium gas as it is cycled around the apparatus. Members of the group also make regular use of the Central Laser Facility at the Rutherford Appleton Laboratory.

Femtosecond lasers are used to investigate the response of molecules to intense bursts of infrared, ultraviolet and XUV radiation. Expertise gained from atomic ionisation studies is now being used to generate ultrafast pulses of electrons with unprecedented coherence, with applications in time-resolved diffraction and microscopy of biomolecules with atomic resolution. Another major research area is the study of atomic and molecular quantum levels and the dynamics of photon-particle interactions. This includes the generation and laser probing of positronium using resonant multiple-photon ionisation spectroscopy (RIS) and using pulsed nanosecond lasers to make precise determinations of energy levels in atomic and molecular physics.

We collaborated with a group based at Imperial College London in confining and manipulating ultracold neutral atoms in microtraps, achieving the first ever Bose-Einstein Condensate (BEC) on a permanently magnetised atom chip. We have recently generated microwave sidebands through optical injection of a diode laser, and are investigating the use of nanofibres to couple light into ultracold atoms. Nanotechnology research is represented in the Department of Physics and in the University's Centre for NanoHealth, whereby modified scanning near-field optical microscopes have been used to study electric fields and spectral response from nanostructured materials and optoelectronic devices, and allow for studies on both crystalline materials and soft matter. Novel applications for nanotechnology are under development as ultrasensitive probes to the conditions inside cells.

THEORETICAL PHYSICS

A major thread of our research focuses on fundamental aspects of quantum field theory, string theory and quantum gravity, together with applications in QCD and LHC phenomenology. A further programme is centred on the computation of multi-particle scattering amplitudes in gauge theories such as QCD and quantum gravity using a novel toolkit inspired by the recently-conjectured duality between Yang-Mills and topological string theories.

Our Lattice Field researchers use direct estimation of the quantum path integral, principally by using high performance computers (HPC), to make systematically-improvable predictions in strongly-interacting quantum field theory, of which QCD, the gauge theory of quarks and gluons is the most important example. Our researchers have also been heavily involved the modelling the interactions which have recently resulted in the observation of the Higgs boson at the LHC. Another research area is cosmology, aimed to scientifically study the origin and future of our universe. Research topics include inflationary cosmology, dark energy, and dark matter.

We have recently welcomed new academics, including those with interests in multi-disciplinary research at the emerging mathematical biology interface, especially the role of quantum effects in biological systems and processes, and new applications of quantum control in medical imaging.

Our lecturers have been awarded many prestigious fellowships, senior fellowships and prizes; including the John Dawson Award for outstanding contributions to plasma physics.

HOW TO APPLY

Students from the UK and the European Union (EU) must apply via UCAS, which is the standard application system for UK universities. **www.ucas.com**

Applicants from outside the EU may apply directly at **www.swansea.ac.uk/international/students/apply**

For information specific to studying Physics at Swansea, see **www.swansea.ac.uk/physics/undergraduate** For up to date information on studying at Swansea, please visit **www.swansea.ac.uk/undergraduate**

Once you apply, if you have the potential to meet our entry requirements, you will be invited to a compulsory Applicant Visit Day, a great opportunity for you to explore Swansea University and all it has to offer. Guided tours of the campus, accommodation and sports facilities are normally available in the morning, hence parents and guardians are also encouraged to attend. The afternoon is devoted to the Physics programme, during which you will be able to attend talks, demonstrations and tours of the Department. Current students act as guides, giving you the opportunity to discuss the course informally. You will have the opportunity to discuss your academic direction and interests during an interview with a member of academic staff.

WHAT QUALIFICATIONS DO I NEED IF I AM A UK APPLICANT?

We welcome applicants with a wide range of qualifications, such as A-levels, International Baccalaureate, Welsh Baccalaureate, BTEC National Diploma and relevant equivalents.

BSc: A-levels/Welsh Baccalaureate: AAB-BBB or equivalent
Required subjects: Maths and Physics
IB: 32-34 to include at least 6 in HL Maths and 5 in HL Physics

MPhys: A-levels/Welsh Baccalaureate: AAA-AAB or equivalent
Required subjects: Maths and Physics
IB: 34-36 to include at least 6 in HL Maths and 6 in HL Physics

Please check the individual course pages on our website for more up to date, detailed and subject specific criteria, including recommended subjects: **www.swansea.ac.uk/undergraduate/courses**

WHAT QUALIFICATIONS DO I NEED IF I AM EUROPEAN UNION OR AN INTERNATIONAL APPLICANT?

We welcome EU and international applicants with a wide range of qualifications. We have included some of these on the table below. Please note that these are for guidance only. If your country is not listed, please get in contact with **study@swansea.ac.uk** or for International enquiries please contact **international-science@swansea.ac.uk**

English Language - we require IELTS 6.0 (with 6.0 in each component) or equivalent English test.

BURSARIES & SCHOLARSHIPS

Financial assistance from several sources is available to help students to study at Swansea. Swansea University award a number of Excellence Bursaries to all UK/EU students who achieve AAA at A-level (or equivalent) worth £3000 over three years; Merit Scholarships to all students who achieve AAB at A-level (or equivalent) worth £2000 over three years.

Depending on household income, students may be entitled to Income Related Bursaries.

Sporting Entrance Scholarships recognise students that have demonstrated outstanding ability in their chosen sport.

Details of all scholarships and bursaries can be found at **www.swansea.ac.uk/scholarships**

For the latest information on our entry requirements, including our BSc Physics with Foundation Year schemes, please visit our website.

LATEST INFORMATION

For up to date information on studying at Swansea, please visit **www.swansea.ac.uk/undergraduate** and for information about studying Physics at Swansea, please visit **www.swansea.ac.uk/physics/undergraduate**

CONTACT

For enquiries or further information about Physics at Swansea, please contact **study@swansea.ac.uk** or telephone **+44 (0)1792 295111**


“Theoretical physics and medical research are not normally seen together but the university gave me the freedom to move between disciplines and work in an area I am passionate about.”
#SwanseaScience