



THE UNIVERSITY  
*of* EDINBURGH

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Postgraduate Opportunities 2020

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# Physics & Astronomy

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Influencing the world since 1583

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“Edinburgh isn’t so much a city, more a way of life . . . I doubt I’ll ever tire of exploring Edinburgh, on foot or in print.”

**Ian Rankin**  
Best-selling author and alumnus

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# Influencing the world since 1583

**13 Nov 2019**  
**Postgraduate Open Day**

[www.ed.ac.uk/  
postgraduate open day](http://www.ed.ac.uk/postgraduate-open-day)

For more than 400 years the University of Edinburgh has been changing the world. Our staff and students have explored space, won Nobel Prizes and revolutionised surgery. They've published era defining books, run the country, made life saving breakthroughs and laid the foundations to solve the mysteries of the universe.

Our distinguished alumni include NASA astronaut Piers Sellers, former MI5 Director General Dame Stella Rimington, Olympians Sir Chris Hoy and Dame Katherine Grainger and historical greats such as philosopher David Hume, suffragist Chrystal Macmillan, who founded the Women's International League for Peace and Freedom, and physicist and mathematician James Clerk Maxwell.

#### International collaboration

An internationally renowned centre for academic excellence, we forge world class collaborations with partners such as the California Institute of Technology (Caltech), Stanford University, the University of Melbourne, Peking University, the University of Delhi and the University of KwaZulu Natal. As a member of the League of European Research Universities and the Coimbra Group, we link up with leading institutions across Europe.

#### Linking research and commerce

We were one of the first UK universities to develop commercial links with industry, government and the professions. Edinburgh Innovations promotes and commercialises our research excellence and can assist you in taking the first step to market, through collaborative research, licensing technology or consultancy.

#### Enhancing your career

We are committed to embedding employability in your University experience and have an impressive track record for graduate employment. From volunteering schemes to our sector leading careers service, we provide you with opportunities to develop your skills, knowledge and experience, giving you an edge in the competitive job market.

## TOP 50

We're consistently ranked one of the top 50 universities in the world. We're 20<sup>th</sup> in the 2020 QS World University Rankings.

## 4<sup>TH</sup>

We're ranked fourth in the UK for research power, based on the 2014 Research Excellence Framework.\*

## 83%

The majority of our research – 83 per cent – is considered world leading or internationally excellent.\*

## TOP 100

We are ranked in the top 10 in the UK and in the top 100 in the world for the employability of our graduates.†

## £403m

In 2017/18 we won £403 million in competitive research grants.

## 19

There are 19 Nobel Prize winners who are alumni of the University or have been members of academic staff here.

## 22<sup>ND</sup>

We're ranked 22<sup>nd</sup> in the world's most international universities.‡ Since 2010, we have taught students from more than 160 countries.

 [twitter.com/appliedinburgh](https://twitter.com/appliedinburgh)

 [facebook.com/appliedinburgh](https://facebook.com/appliedinburgh)

 [youtube.com/edinburghuniversity](https://youtube.com/edinburghuniversity)

 [instagram.com/appliedinburgh](https://instagram.com/appliedinburgh)

\* Times Higher Education, Overall Ranking of Institutions

† Times Higher Education, Global Employability University Ranking 2018

‡ Times Higher Education: The World's Most International Universities 2019

## Taught masters programmes

The School of Physics & Astronomy offers taught master of science (MSc) programmes in particle and nuclear physics, mathematical physics, and theoretical physics.

[www.ed.ac.uk/pg/817](http://www.ed.ac.uk/pg/817) (Mathematical Physics)

[www.ed.ac.uk/pg/818](http://www.ed.ac.uk/pg/818) (Theoretical Physics)

### Mathematical Physics/Theoretical Physics

MSc 1 yr FT

#### Programme description

These programmes, run by the Higgs Centre for Theoretical Physics, are designed to prepare you for a research career in academia or industry by introducing advanced ideas and techniques that are applicable in a wide range of research areas, while emphasising the underlying physics concepts.

The programmes are a core part of the Higgs Centre for Theoretical Physics, which has been created to mark the start of a new era in theoretical physics research, following the discovery of the Higgs boson at CERN. You will have the opportunity to take part in the centre's activities, including weekly seminars, colloquia and workshops involving physicists from around the world, and you will be involved in research-level projects as part of your dissertation.

The partnership between mathematics and physics is an essential one. In theoretical physics we attempt to build abstract constructs that rationalise, explain and predict physical phenomena. To do this we need mathematics: the language of physics. The underlying structure of the physical world can be understood in great detail using mathematics; this is a never-ending source of fascination to theoretical physicists.

#### Programme structure

You will take two compulsory courses plus a selection of courses that will bring you to an advanced level in subjects such as general relativity, cosmology, statistical physics, condensed matter physics, quantum field theory and the standard model of particle physics. You may also take courses drawn from a wider pool including specialist courses in mathematics, computing and climate science. For Mathematical Physics, mathematics courses can account for up to half of the taught course element.

Following the taught component of the programme, you will undertake a three-month research project leading to a dissertation.

*“I’m very pleased to support the two MSc programmes in theoretical and mathematical physics. This initiative will greatly help the University of Edinburgh to play a major role in training the next generation of theoretical physicists.”*

**Peter Higgs**, Emeritus Professor of Theoretical Physics,  
University of Edinburgh

#### Career opportunities

These programmes are designed to prepare you for a research career in academia or industry by introducing advanced ideas and techniques that are applicable to a wide range of research areas and sectors, including academia, industry, education and finance.

#### Entry requirements

A UK 2:1 honours degree, or its international equivalent ([www.ed.ac.uk/international/graduate-entry](http://www.ed.ac.uk/international/graduate-entry)), in physics or mathematics with sufficient theoretical physics content.

#### English language requirements

See page 16.

#### Fees and funding

For fees see page 16 and for funding information see page 18.

The Higgs Centre for Theoretical Physics awards a number of scholarships, open to all nationalities, on the basis of academic merit.

#### Contact MSc Administrator

**Tel** +44 (0)131 651 7067

**Email** [msc.tpmp@ph.ed.ac.uk](mailto:msc.tpmp@ph.ed.ac.uk)

More information: [www.ph.ed.ac.uk/msctpmp](http://www.ph.ed.ac.uk/msctpmp)

[www.ed.ac.uk/pg/946](http://www.ed.ac.uk/pg/946)

## Particle & Nuclear Physics

MSc 1 yr FT

#### Programme description

Particle and nuclear physics are two of the most important research areas in modern physics. Their study brings together advanced experimental and computational techniques, and theoretical understanding. The experiments are typically large collaborations working at international laboratories using highly sophisticated detectors. These detector technologies also find applications in medical physics and other forms of position sensing. The computational aspects deal with large data sets and use machine learning and other advanced techniques in data science. Theoretical nuclear and particle physics aims to interpret the experimental results in terms of mathematical models of the structure and evolution of the physical world.

This programme is run by the Institute for Particle and Nuclear Physics: [www.ph.ed.ac.uk/research/institute-for-particle-and-nuclear-physics](http://www.ph.ed.ac.uk/research/institute-for-particle-and-nuclear-physics)

You will take part in the Institute's activities, including regular seminars, colloquia and workshops involving physicists from around the world. You will also be involved in a research-level project as part of your dissertation.

The Institute is a member of the ATLAS, LHCb, CLICdp and FCC collaborations at CERN, the LZ dark matter at the Sanford Underground Research Facility in South Dakota, and the DUNE and Hyper-K neutrino experiments at Fermilab (USA) and J-PARC (Japan). In addition, we perform experiments at other leading international accelerator facilities at CERN, LUNA (Italy), RIKEN (Japan), and NSCL-MSU.

#### Programme structure

You will take compulsory courses in data analysis and research skills together with a choice of courses offered in nuclear physics, particle physics and detectors. You will also have a wide choice of courses in theoretical physics in areas of general relativity, cosmology, quantum field theory, quantum chromodynamics, statistical physics and other areas, including astronomy, condensed matter physics, high performance computing and big data.

Following the taught components, you will undertake a three-month research project leading to a dissertation. You will be based on one of the Institute's projects, as part of an international collaboration, and may have the opportunity to visit a leading research laboratory. We have strong links with industry and also offer you the opportunity to undertake your dissertation project with a local company.

#### Career opportunities

This programme will expose you to frontier activities in experimental nuclear and particle physics and develop your general transferable skills related to data analysis, research and communication. This provides a platform for employment in research, science-based industry, medical physics, education and a wide spectrum of professions that call for numeracy and data analysis skills.

#### Entry requirements

A UK 2:1 honours degree, or its international equivalent ([www.ed.ac.uk/international/graduate-entry](http://www.ed.ac.uk/international/graduate-entry)), in physics or a related subject with sufficient physics content. We may also consider your application if you have relevant experience; please contact us to check before you apply.

#### English language requirements

See page 16.

#### Fees and funding

For fees see page 16 and for funding information see page 18.

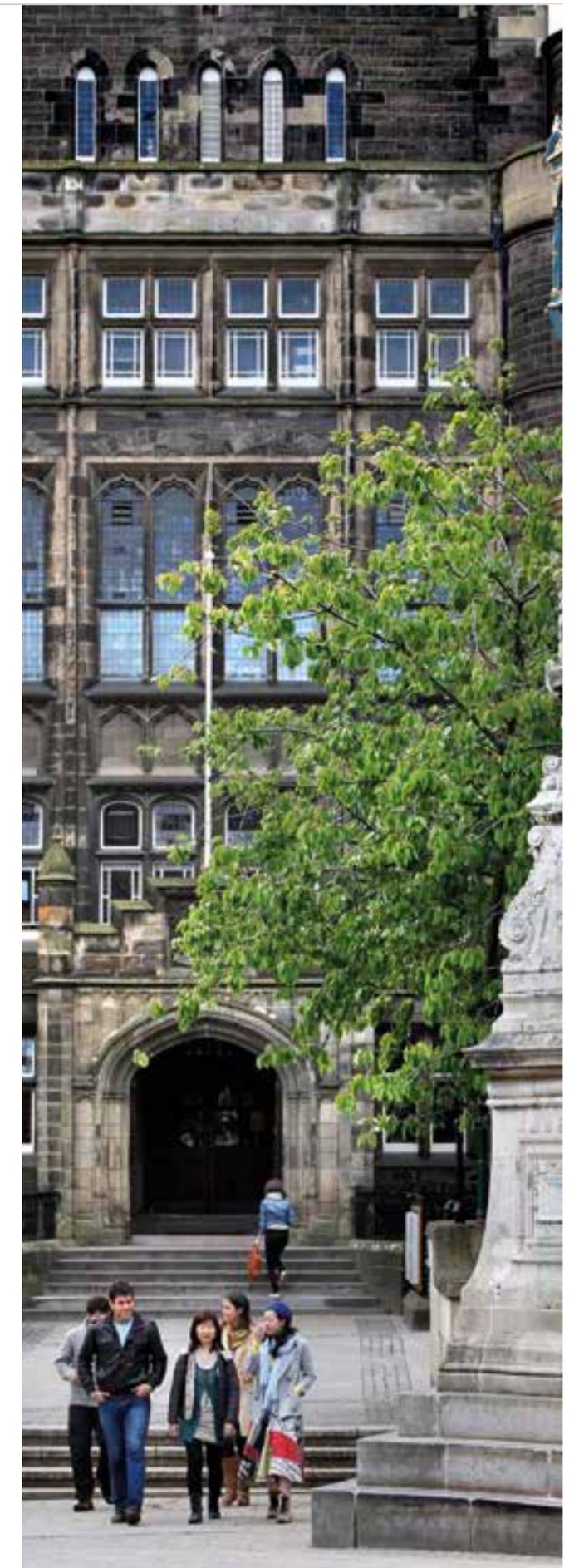
The Institute for Particle and Nuclear Physics awards a number of scholarships, open to all nationalities, on the basis of academic merit.

#### Contact MSc Administrator

**Tel** +44 (0)131 651 7067

**Email** [msc.pnp@ph.ed.ac.uk](mailto:msc.pnp@ph.ed.ac.uk)

More information: [www.ph.ed.ac.uk/mscpnp](http://www.ph.ed.ac.uk/mscpnp)



# Research opportunities and support

We offer a diverse range of doctor of philosophy (PhD) programmes across all of our areas of research. You will be supported by courses designed for PhD students, in addition to those offered by the Scottish Universities Physics Alliance (SUPA) Graduate School and the Institute for Academic Development (see page 15).

A Graduate School Forum provides an interface between students and the Graduate School where issues concerning students can be discussed and resolved.

We have an active student group that organises student-led seminars and workshops in specific and general areas. They also organise social activities, typically a welcome BBQ, a residential trip to the Firth of Forth Field Centre on the shores of Loch Tay in the Scottish Highlands, Christmas Ceilidh with Scottish dancing, and day bicycle rides to the East Lothian beaches.

For further information on the PhD programme, see: [www.ph.ed.ac.uk/studying/postgraduate-research](http://www.ph.ed.ac.uk/studying/postgraduate-research)

You can 'meet' current students and find out what they think about their programmes at: [youtu.be/frQx7nsyEVs](https://youtu.be/frQx7nsyEVs)

## Entry requirements

You should typically have a UK 2:1 honours degree, or its international equivalent ([www.ed.ac.uk/international/graduate-entry](http://www.ed.ac.uk/international/graduate-entry)) in a related discipline. Please check the specific entry requirements for your programme online before applying.

## Career opportunities

Recent graduates have gone on to postdoctoral research posts at universities internationally or are now working for employers such as BAE, EY, HMRC and Moody's Analytics.

## See also...

You may be interested in postgraduate opportunities elsewhere within the University, in particular programmes offered by the schools of Biological Sciences, Chemistry, Informatics or Mathematics, or the CPD programmes offered by the Moray House School of Education.

[www.ed.ac.uk/studying/prospectus-request](http://www.ed.ac.uk/studying/prospectus-request)

[www.ed.ac.uk/pg/189](http://www.ed.ac.uk/pg/189)

## Astrophysics

PhD 3 yrs FT

Based at the historic Royal Observatory Edinburgh, the Institute for Astronomy (IfA) is one of the world's leading centres in astronomical research. We share our picturesque site on Blackford Hill with the UK Astronomy Technology Centre (ATC) – the UK's leading astronomical instrument maker – so as a postgraduate student you will be joining a vibrant community of specialists. There are around 30 PhD students based at the IfA at any given time.

### Research environment

The scope of our research is as wide as the cosmos we explore. Thanks to our affiliation with the UK ATC and our strong links with related research centres in the School of Physics & Astronomy, we are in a rare position to accommodate a diversity of research specialisms.

The particular areas of research that are currently being pursued are too numerous to list here, but they include: cosmology (large-scale structure in the universe, galaxy formation, dark matter and dark energy, particle cosmology); active galactic nuclei and related objects; nearby galaxies (large-scale star formation, structure, content and evolution of galaxies); stellar astronomy (parallax and proper motion studies, the stellar luminosity function, symbiotic stars); star formation (observation and theoretical studies, star formation in external galaxies); planet formation (disc and planet formation in protostars, discs around pre-main-sequence stars); exoplanets (through the Centre for Exoplanets); computational astrophysics (through the Edinburgh Centre for Computational Astrophysics); and applications of data science in astronomy (through the ScotDIST collaboration).

Observational PhDs use large telescopes in Chile, Hawaii, the Canary Islands and Australia, plus space missions and observatories, including the Hubble Space Telescope and Gaia.

### An inspiring setting

Not only will you be surrounded by a wealth of expertise at the Royal Observatory Edinburgh, but our historic setting also provides a constant reminder of the importance of astronomical advances throughout the centuries.

### Excellent prospects

Graduates from the IfA are among the most highly sought-after candidates for academic and commercial positions. Your qualification will see you well placed to take up a rewarding role that applies your knowledge to the advancement of astrophysics.

### English language requirements

See page 16.

### Fees and funding

For fees see page 16 and for funding information see page 18.

[www.ed.ac.uk/pg/190](http://www.ed.ac.uk/pg/190)

## Condensed Matter & Complex Systems

PhD 3 yrs FT

The Institute for Condensed Matter and Complex Systems encompasses myriad scientific worlds, from quantum ordering to astrobiology. Our interests overlap with computational materials science and biological and earth sciences. We lead new developments in statistical physics, novel simulation methodologies and cutting-edge experiments. The challenge is to understand out-of-equilibrium behaviour for which no general theory exists and for which experiments consistently reveal unexpected phenomena.

### Research environment

The Institute divides into two broad research groups:

#### SOFT MATTER, STATISTICAL AND BIOLOGICAL PHYSICS

Soft matter research concerns liquids, solids and viscoelastic materials (such as polymers and suspensions). We harness their properties to create novel materials in the laboratory and seek to understand the microscopic origins of their properties. Statistical physics describes the behaviour of large numbers of microscopic constituents and provides the theory of condensed matter and complex systems. Our challenge is to understand systems out of equilibrium through the analytical and numerical study of simple model systems as well as real world applications such as bacterial evolution. Our research in biological physics and in active matter spans aqueous solutions of small bioactive molecules via proteins and DNA to single cells, cell-cell interactions, and collections of organisms in ecosystems. We use state-of-the-art optical techniques and have dedicated wet labs.

#### QUANTUM ORDERING AND PHYSICS AT EXTREME CONDITIONS

Quantum ordering is manifested in the collective quantum states of electrons. We examine how and why particular states form and investigate their novel properties, including unusual forms of superconductivity. We investigate new materials in which completely unexpected types of quantum ordering may occur. In future this could allow materials with these novel properties to be engineered. Extreme conditions physics studies matter under very high pressures and temperatures. By changing the density, the properties of matter can be dramatically altered. We aim to understand these phenomena and characterise new behaviours. We use in-house light spectroscopy, and x-ray and neutron diffraction at facilities worldwide, including: the European Synchrotron Radiation Facility; the Spallation Neutron Source, Tennessee; and high-powered lasers like the national ignition facility in California.

### Leading centres

We have access to the resources of some of the top facilities in Europe and the UK. We host the UK Centre for Astrobiology, where the responses of molecules to life in extreme environments are studied. We examine the structure and properties of materials at extremes of pressure and temperature in internationally-leading facilities at the Centre for Science at Extreme Conditions. Our computer simulations have access to the world-class high performance computing resources hosted within the School, such as the University of Edinburgh Information System, and the Edinburgh Parallel Computing Centre (EPCC), and via national supercomputing services. Our condensed matter theorists are full participants in the Higgs Centre for Theoretical Physics.

### Careers success

Our graduates have pursued highly diverse and successful careers in academia and industry. Recent graduates have secured positions at the Diamond Light Source in the UK, and further afield at the European Spallation Source (Lund), ANSTO (Sydney) and HPSTAR (Shanghai).

### English language requirements

See page 16.

### Fees and funding

For fees see page 16 and for funding information see page 18.



THE UNIVERSITY of EDINBURGH

## Case study: Edinburgh's research with impact

### Formulation physics

From the moment we awake each morning, we interact with complex fluids throughout the day – whenever we wash, eat, read on liquid crystal displays (LCDs) or touch a variety of coatings from topical creams to decorative paints. Other complex fluids may be less obvious to us, such as the dispersions used in pesticides and the pastes used to make catalytic exhausts, yet they are still vital to the quality of our lives. Given such ubiquity, what are complex fluids?

#### Complex fluids

Unlike simple liquids, made of molecules with equal freedom to move, complex fluids often contain nano- to micro-sized components in the form of dispersed polymers, particles, droplets or bubbles. Such materials can be highly concentrated dispersions such as toothpastes, polymeric and particulate composites such as the dough that forms bread, or emulsions such as decorative paints. To the general consumer these kinds of products are considered 'gooey' and have properties somewhere in between the classic models of liquids, which flow easily, and solids, which do not flow at all.

The Edinburgh Complex Fluids Partnership (ECFP) was set up in 2012 as a knowledge exchange unit to develop collaborations between industry and the Soft Matter and Biological Physics Group within the School of Physics and Astronomy.

#### Collaboration

During the first five years ECFP collaborated with more than 30 companies of all scales from start-ups to multinationals, working across numerous sectors including personal care, decorative paints, food and drink, agrochemicals and ceramics. The breadth of work illustrates the importance of developing generic physical principles through research, the results of which are relevant to a number of different systems with similar microstructure.

Through working with industry, ECFP has been able to help companies improve their formulations and processes and in doing so reduce wastage. Furthermore, exciting new research themes have arisen, inspired by fundamental challenges faced by industry.

[www.edinburghcomplexfluids.com](http://www.edinburghcomplexfluids.com)

**Working with industry, ECFP has been able to help companies improve their formulations and processes.**

See more online: [www.ed.ac.uk/research/impact](http://www.ed.ac.uk/research/impact)

“The quality of research in astronomy is excellent, and I have really enjoyed becoming part of the scientific community at the School.”

Rebecca Bowler, PhD Astronomy

[www.ed.ac.uk/pg/192](http://www.ed.ac.uk/pg/192)

## Nuclear Physics

PhD 3 yrs FT

### Research environment

We aim to understand the processes and nuclear reactions that create the chemical elements present in our cosmos. This requires performing experiments underground to study reactions at the very low energies occurring in stars such as the sun, and with beams of radioactive nuclei to study reactions involved in explosive events such as supernovae, which occur at higher temperatures and involve unstable isotopes. We perform computational simulations of nucleosynthesis in various stellar environments. We also perform experiments aimed at a deeper understanding of the structure of exotic nuclei, hadrons and nuclear matter, which for example, impact on the properties of neutron stars. These are relevant for interpreting new astronomical observations of neutron star mergers.

### Creating networks

The group works at world-leading international accelerator facilities in the USA, Canada, Europe and Japan. Experiments are undertaken in international collaborations of varying sizes. These partnerships will not only help you develop your research to an international standard, but will also give you the chance to establish valuable contacts in the world of nuclear physics.

### An asset for any career

Research degrees in nuclear physics from the University of Edinburgh have taken many of our graduates into appointments at international universities and labs. Many of our graduates now hold permanent academic positions in and outside the UK. Outside academia, our graduates work at high-tech companies, in the finance sector and at national laboratories. The quality of this programme is very well recognised and a significant asset to any academic or commercial employer.

### English language requirements

See page 16.

### Fees and funding

For fees see page 16 and for funding information see page 18.

“The attraction was the diversity of the courses available. I could tailor my programme and select courses that were mathematical, theoretical or experimental. Also, the staff were extremely approachable and caring.”

**Vasiliy Demchenko**, Physics graduate



[www.ed.ac.uk/pg/193](http://www.ed.ac.uk/pg/193)

## Particle Physics

PhD 3 yrs FT

Exploring nature at the tiniest scale, the particle physics group seeks to add to our understanding of the make-up of our universe. By joining our research group, you'll be following in the footsteps of our celebrated Emeritus Professor, Peter Higgs, whose groundbreaking Higgs mechanism has excited the world of physics for decades and has been the focus of operations at the Large Hadron Collider at CERN. You'll also have the opportunity to confer and work with some of the greatest minds in physics today, through our visitor programme, conferences and international facilities.

### Research environment

Our research group works in two areas – Experiment and Theory.

#### PARTICLE PHYSICS EXPERIMENT

We look to understand the fundamental particles of nature and the interactions that govern their behaviour. In particular, from understanding the symmetries present in the universe, we seek to explain the dominance of matter over anti-matter, and mechanisms of symmetry-breaking that lead to the creation of mass via the Higgs boson and non-Standard Model particles. Researchers from our group are working on two experiments at the Large Hadron Collider; the LHCb experiment and the ATLAS experiment. The group has a growing program related to the next generation of long baseline neutrino experiments DUNE and Hyper-K. In addition we are a leading member of the LZ Dark Matter experiment.

#### PARTICLE PHYSICS THEORY

Our research concerns fundamental physics at all energy scales, from hadronic binding energy to the massive forces at play in the first instants of the universe's existence. We collaborate with leading facilities, such as the Large Hadron Collider at CERN and the WMAP and Planck satellites. We are working on topics in both perturbative and non-perturbative field theory, with applications in predictions for the LHC, flavour physics, the structure of gauge theories, physics beyond the standard model, cosmology and turbulence. We have also developed a collaboration with Intel, hosting a prestigious Intel Parallel Computing Centre for the development of QCD simulation code for next generation systems.

### A universe of opportunities

The particle physics group offers prospective PhD students exciting opportunities to study at the very frontier of understanding. Fully funded studentships are available for a wide range of theoretical and experimental projects, plus opportunities to travel to CERN for long and short visits.

### English language requirements

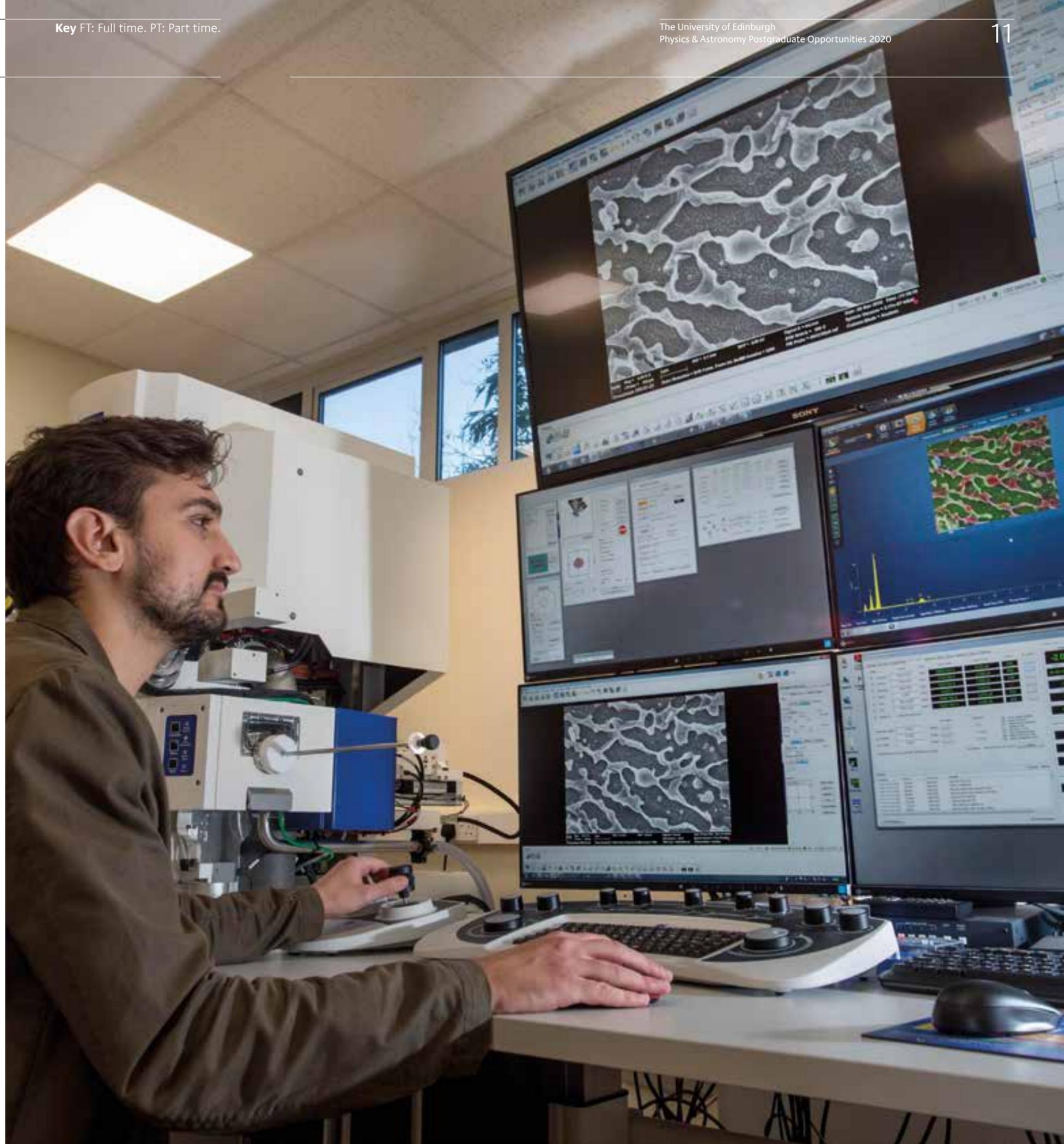
See page 16.

### Fees and funding

For fees see page 16 and for funding information see page 18.

“Aside from the opportunities to travel around the world, being part of the Institute of Condensed Matter & Complex Systems research group exposed me to a broad range of scientific fields and approaches to research.”

**Justin Whitehouse**, PhD Condensed Matter Physics



# About the School of Physics & Astronomy

As the birthplace of the Higgs mechanism and the prediction of the Higgs boson, the University of Edinburgh's School of Physics & Astronomy has a strong track record of innovation and research excellence.

Our research – 96 per cent of which was rated 4\* world leading or 3\* internationally excellent on the overall quality profile of the Research Excellence Framework (REF) 2014 – pushes the frontiers of scientific thinking.

From the smallest to largest scales, the School's pioneering work regularly attracts global attention. Not only have we played a vital role in the world's largest scientific experiment – to find the Higgs boson – but we have also carried out the biggest exercise yet to map dark matter, spanning billions of light years across the universe.

## New discoveries, and more to come

The discovery of the Higgs boson at CERN prompted the creation of a new centre at the School – where Peter Higgs remains an Emeritus Professor – to support research in theoretical physics. The Higgs Centre for Theoretical Physics brings together scientists from around the world to seek deeper understanding of the workings of the universe and its contents, through its extensive visitor and workshop programmes.

Our researchers work in three institutes:

### The Institute for Astronomy

The Institute for Astronomy is one of the UK's major centres of astronomical research, with particular strengths in survey astronomy, cosmology, active galaxies and the formation of stars and planets.

### The Institute for Condensed Matter and Complex Systems

At the Institute for Condensed Matter and Complex Systems we explore everything from the motion of microorganisms to the behaviour of matter under the extreme pressures found at the centres of stars.

### The Institute for Particle and Nuclear Physics

The work of the Institute for Particle and Nuclear Physics includes the giant experiments of the Large Hadron Collider at CERN, Switzerland, which are revealing the secrets of the building blocks of the universe.

The Institute of Physics awarded us Juno Champion status for our work to promote gender equality.



## Facilities and resources

Our School, home to around 100 academics devoted to research and teaching, offers the breadth of expertise and world-class facilities that will inspire you to produce groundbreaking work.

You'll be encouraged to explore the best the world can offer in your field of interest. Our connections with organisations such as CERN can widen your horizons, as can visits to international conferences and events. Thanks to our reputation as a centre for research excellence, we regularly play host to specialist conferences, and you can expect to have access to some of the most respected names in the field.

### World-leading facilities

World-leading research requires exceptional facilities to help fulfil your academic ambitions. While we have established strong connections with many prestigious global research centres, a number of internationally-recognised facilities are based here at Edinburgh. They include:

#### The Higgs Centre for Theoretical Physics

The discovery in July 2012 of the Higgs boson at CERN, almost half a century after Peter Higgs' prediction in 1964, is a milestone in the history of theoretical physics. Rarely has a theoretical prediction been confirmed so spectacularly, so long after it was made. The theoretical ideas put forward by Peter Higgs, Francois Englert and Robert Brout, inspiring thousands of physicists and putting in motion the experimental searches for the Higgs boson, were celebrated with the Nobel Prize in Physics awarded in October 2013.

The discovery marks the start of a new era in theoretical physics. While the Standard Model of elementary particle physics is now complete, many fundamental questions remain unanswered. We still don't understand the intricate structure of charges and flavours in the Standard Model, or what determines the values of its parameters. We are still struggling to build a compelling theory of quantum gravity, and understand the role played by the vacuum in the formation of the early universe. We have no idea what dark matter and dark energy are, and we have difficulty understanding structure formation and complexity.

The Higgs Centre for Theoretical Physics has been established by the University to seek answers to some of these questions,

by creating opportunities to formulate new theoretical concepts to take us beyond the limitations of current paradigms.

#### The Higgs Centre of Innovation

The new Higgs Centre of Innovation, located on the Royal Observatory Edinburgh site, opened in July 2018. This new centre brings together the innovation and technology developed in astronomy, particle and nuclear physics with a start-up company incubator facility to exploit technologies such as in imaging, medical applications and satellite development. The Centre aims to form a link between research and industry to the benefit of all, and especially to PhD students working in these areas.

#### UK Centre for Astrobiology

We are affiliated with the NASA Astrobiology Institute and have a mission to advance our understanding of molecules and life in extreme environments on Earth and beyond. We do this with a combination of theoretical, laboratory, field and mission approaches. We apply this knowledge to improving the quality of life on Earth and developing space exploration as two mutually enhancing objectives. Our work is underpinned by broad and compelling questions: How did life originate? Is there life elsewhere in the Universe? What are the limits of the Earth's biosphere? Can we establish a permanent human presence beyond the Earth? We study the responses of molecules to extreme environments, including the space environment, simulate extra-terrestrial environments, and maintain a 1.5km-deep subsurface biology laboratory at the Boulby Mine in Yorkshire, England.

#### The Centre for Science at Extreme Conditions (CSEC)

At this highly specialised laboratory, the physical properties of materials can be measured at extremely high pressures. CSEC, which has risen to international prominence over the past 20 years, provides the infrastructure needed to explore the effects of pressure on structure at interatomic distances.

## Community

As you would expect from one of the largest physics research centres in the UK, our academic community spans a broad range of subject areas.

Our staff includes a number of Fellows of both the Royal Society and the Royal Society of Edinburgh, and you'll have access to experts from other institutions through our membership of the Scottish Universities Physics Alliance (SUPA).

This means you'll be undertaking your research in an environment that encourages discovery through collaboration. You'll be part of a vibrant and motivated group of researchers, and will be able to participate in events aimed at developing strong collaborative links.

### Social networking

You'll have plenty of opportunities to leave your office or lab to enjoy the company of your peers from across the University. Edinburgh University Students' Association has a host of societies, sporting activities and social events waiting for you. It is one of the oldest students' associations in the UK and is an excellent way of getting to know other students.

### SUPA connections

Our membership of SUPA helps ensure exposure to as broad a range of thinking as possible. SUPA features courses, guest lecturers and online events aimed at bringing together the expertise of Scotland's physicists and astronomers. You'll have the opportunity to connect with your peers from other Scottish universities and establish your place within the wider scientific community.



## Employability and graduate attributes

As well as the specific skills you will gain throughout your studies, you will also develop techniques and abilities that will give you a head start in any career. We offer outstanding services to enhance your employability and make the most of your time here.

### Institute for Academic Development

All postgraduate students can benefit from our Institute for Academic Development (IAD), which provides information, events and courses to develop the skills you will need throughout your studies and in the future. IAD events also offer the perfect opportunity to meet and network with other postgraduates from across the University.

Further information is available online:  
[www.ed.ac.uk/iad/postgraduates](http://www.ed.ac.uk/iad/postgraduates)

For taught postgraduates, IAD provides a popular study-related and transferable skills support programme. It is designed to help you settle into postgraduate life, succeed during your studies and move confidently to the next stage of your career. We offer on-campus and online workshops and one-to-one study skills consultations, plus online advice and learning materials. Workshops and learning resources cover key topics tailored to different academic stages, including: pre-arrival sessions; getting started with your studies; critical reading, writing and thinking; managing your exams; and planning for and writing up your dissertation.

IAD also provides a comprehensive programme of transferable-skills training, resources and support for researchers completing a doctorate. The workshop programme is designed to help you successfully prepare for the various milestones of your PhD, from getting started with your research, to writing up and preparing for the viva, as well as developing personal and professional skills that can be transferred to your future employment. Workshops cover topics such as writing skills, reference management tools, statistics, preparing for conferences, delivering presentations, time and project management, and personal development. IAD also offers online resources and planning tools to help get your research started, as well as support for tutoring and demonstrating, and public engagement and communication.

### Careers Service

Our Careers Service plays an essential part in your wider student experience at the University, offering a range of tailored careers and personal development guidance and support. We support you to recognise the wealth of possibilities ahead, while at university and after graduation, helping you explore new avenues, tap into your talents and build your employability with confidence and enthusiasm.

We provide high-quality, tailored support to all students. From exploring career options to making decisions, from CV writing to interview practice, from Employ.ed internships to graduate posts and from careers fairs to postgraduate alumni events, we will help you prepare for the future.

We sustain and continually develop links with employers from all industries and employment sectors, from the world's top recruiters to small enterprises based here in Edinburgh. Our employer team provides a programme of opportunities for you to meet employers on campus and virtually, and advertises a wide range of part-time and graduate jobs.

More information:  
[www.ed.ac.uk/careers/postgrad](http://www.ed.ac.uk/careers/postgrad)

### Platform One

Platform One is an online meeting place where members of the University community, past and present, can gather. It aims to provide a supportive environment where students, alumni, staff and volunteers can share knowledge and experiences. Together, we form a single community that meets on Platform One. Join us and find out more about the people and possibilities.

More information:  
[www.ed.ac.uk/platform-one](http://www.ed.ac.uk/platform-one)

### Backing bright ideas

Edinburgh Innovations, the University's commercialisation service, offers free support to student entrepreneurs including one-to-one business advice and a range of workshops, bootcamps, competitions and networking events. Successful recent clients include David Hunter, inventor of the performance-tracking golf watch Shot Scope; Orfeas Boteas, creator of the Dehumaniser sound effects software used by Hollywood movies and blockbuster video games; and Enactus Edinburgh, a team of student social entrepreneurs who represented the UK in the Enactus World Cup with their local and international projects.

### Equality recognition

The School has been awarded Athena SWAN Silver status and Juno Champion status in recognition of our ongoing commitment to advancing women's careers in education and research.

More information:  
[www.ecu.ac.uk/athena-swan](http://www.ecu.ac.uk/athena-swan)  
[www.iop.org/juno](http://www.iop.org/juno)

# Applications and fees

We have an online application process for all postgraduate programmes. It's a straightforward system with full instructions, including details of any supporting documentation you need to submit.

When applying, you will set up an account, which lets you save your application and continue at another time. Full guidance on our application system is available at: [www.ed.ac.uk/postgraduate/applying](http://www.ed.ac.uk/postgraduate/applying)

## General requirements

Our usual entrance requirement for postgraduate study is a UK 2:1 honours degree, or its international equivalent ([www.ed.ac.uk/international/graduate-entry](http://www.ed.ac.uk/international/graduate-entry)), in a relevant field, such as physics, astronomy, computer science, mathematics or engineering.

If your background is not directly related to physics or astronomy, you may still be considered. Please contact the programme administrator to discuss your suitability.

You will also need to meet the University's language requirements (see right).

Entry requirements for individual programmes can vary, so check the details for the specific programme you wish to apply for.

## References

Two references are required for applications to our postgraduate taught and postgraduate research programmes. You should check the entry online for exact requirements for your intended programme of study. For general guidance on references, visit: [www.ed.ac.uk/postgraduate/references](http://www.ed.ac.uk/postgraduate/references)

## Deadlines

### Taught programmes

Some programmes have application deadlines. Please check the programme entry online for details. For all other programmes, you are encouraged to apply no later than one month prior to entry to ensure there is sufficient time to process your application. However, earlier application is recommended, particularly where there is a high demand for places or when a visa will be required. Should you wish to submit a late application, please contact us for guidance. Most scholarships (including the Higgs Centre MSc Prize Scholarships) have application deadlines in early May, and in most cases you need to apply for your University place before you can be considered.

### Research programmes

You may apply for admission to PhD studies at any time but we encourage you to make your application by the end of January. This is so that you can be notified of scholarship application deadlines if you need to apply for these to support your studies.

### English language requirements

You must demonstrate a level of English language competency at a level that will enable you to succeed in your studies, regardless of your nationality or country of residence. We accept the following English language qualifications at the grades specified:

- IELTS Academic: total 6.5 (at least 6.0 in each module).
- TOEFL-iBT: total 92 (at least 20 in each module).
- PTE Academic: total 61 (at least 56 in each of the Communicative Skills sections).
- CAE and CPE: total 176 (at least 169 in each module).
- Trinity ISE: ISE II (with distinctions in all four components).

Please note:

- English language requirements can be affected by government policy so please ensure you visit our degree finder to check the latest requirements for your programme: [www.ed.ac.uk/postgraduate/degrees](http://www.ed.ac.uk/postgraduate/degrees)
- Your English language qualification must be no more than three and a half years old at the beginning of your programme, unless you are using IELTS, TOEFL, PTE Academic or Trinity ISE, in which case it must be no more than two years old.

- We also accept recent degree-level study that was taught and assessed in English in a majority English-speaking country (as defined by UK Visas & Immigration), or at a university in a non-majority English-speaking country which has specifically been approved by the University of Edinburgh's Admissions Qualifications Group. A list of approved universities is published on our website. If you are not a national of a majority English speaking country, then your degree must be no more than three and a half years old at the beginning of your programme of study.

- We do not require you to take an English language test before you apply.

Abbreviations: IELTS – International English Language Testing System; TOEFL-iBT – Test of English as a Foreign Language Internet-Based Test; PTE – Pearson Test of English; CPE – Certificate of Proficiency in English; CAE – Certificate in Advanced English; Trinity ISE – Integrated Skills in English.

[www.ed.ac.uk/english-requirements/pg](http://www.ed.ac.uk/english-requirements/pg)

### Tuition fees

The following table provides an overview of indicative fee levels for programmes commencing in 2020.

Please note:

- International students starting full-time taught programmes of study lasting more than one year will be charged a fixed annual fee.
- All other students on full-time and part-time programmes of study lasting more than one year should be aware that annual tuition fees are subject to revision and are typically increased by approximately five per cent per annum. This annual increase should be taken into account when you are applying for a programme.
- In addition to tuition fees, your programme may be subject to an application fee and additional costs/programme costs may apply. Please check the latest programme information online.

### Asylum seeker tuition fee status and scholarship

Information for applicants seeking asylum from within the United Kingdom, who wish to commence a programme of study at the University in 2020, is available online. This includes our tuition fee rates and scholarship opportunities: [www.ed.ac.uk/student-funding/asylum](http://www.ed.ac.uk/student-funding/asylum)

### Tuition fees for EU students

EU students enrolling in the 2020/21 academic year will be admitted as Scottish/EU fee status students. Taught masters students will be eligible for the same tuition support as Scottish domiciled students from the Student Awards Agency Scotland (SAAS).

#### For UK/EU students

	Annual fee
All taught programmes 1-year FT	£13,000
PhD 3-years FT	£4,327*
PhD 6-years PT	£2,164*

#### For international students

	Annual fee
MSc Mathematical Physics/Theoretical Physics 1-year FT	£22,850
MSc Particle & Nuclear Physics 1-year FT	£28,150
PhD 3-years FT	£23,500

\* Figure shown is the 2019/20 fee level

All other fees quoted are indicative of 2020/21 fee levels. Because these figures are indicative, it is important you check online before you apply and check the up-to-date fee level that will apply to your specific programme: [www.ed.ac.uk/student-funding/tuition-fees/postgraduate](http://www.ed.ac.uk/student-funding/tuition-fees/postgraduate)

*“My favourite part of the MSc was the thesis project over the summer. It was a great experience to see first-hand what doing research would be like. It was also a fantastic opportunity to meet people in the field and I even got to go on a trip to CERN to present my research. I am currently doing a PhD in experimental particle physics here in Edinburgh, which I would not have done without the summer project.”*

**Emmy Gabriel**, MSc Theoretical Physics graduate, currently studying for a PhD



# Funding

A large number of scholarships, loans and other funding schemes are available for your postgraduate studies. It is only possible to show a small selection in print. To see the full range, please visit: [www.ed.ac.uk/student-funding/postgraduate](http://www.ed.ac.uk/student-funding/postgraduate)

Awards are offered by the School of Physics & Astronomy, the College of Science & Engineering, the University of Edinburgh, the Scottish, UK and international governments and many funding bodies.

Here we list a selection of potential sources of financial support for postgraduate students applying to the School of Physics & Astronomy. This list was correct at the time of printing but please check the full and up-to-date range online (see above).

## University of Edinburgh Alumni Scholarships

We offer a 10 per cent scholarship towards postgraduate fees to all alumni who graduated from the University as an undergraduate, and to all students who spent at least one semester studying at the University on a visiting programme: [www.ed.ac.uk/student-funding/alumni-scholarships](http://www.ed.ac.uk/student-funding/alumni-scholarships)

### Key

- Taught masters programmes
- Masters by Research programmes
- Research programmes

## Scholarships at the University of Edinburgh

- **Centre for Doctoral Training in Mathematical Modelling, Analysis and Computation (MAC-MIGS)** ●  
This PhD programme is run jointly by the University of Edinburgh and Heriot Watt University. It typically offers 15 PhD studentships per year and is based in the new Bayes Centre. Entry to this CDT is via the School of Mathematics, with typically two studentships per year in physics: [www.mac-migs.org.uk](http://www.mac-migs.org.uk)
- **Centre for Doctoral Training in Soft Matter and Industrial Innovation (SOFI2)** ●  
This is a tri-institutional collaboration between the universities of Durham, Edinburgh and Leeds. Recently renewed for 2019-24 entry, it typically offers 12 studentships a year, with two placed in the School of Physics & Astronomy: [www.dur.ac.uk/soft.matter/soficdt](http://www.dur.ac.uk/soft.matter/soficdt)
- **Edinburgh Global Research Scholarships** ●  
These scholarships are designed to attract high-quality international research students to the University: [www.ed.ac.uk/student-funding/global-research](http://www.ed.ac.uk/student-funding/global-research)
- **Higgs Centre MSc Prize Scholarships** ●  
The Higgs Centre for Theoretical Physics offers two scholarships in Theoretical or Mathematical Physics. The scholarships will be awarded on the basis of academic merit to students of all nationalities who are accepted for admission to MSc Theoretical Physics or Mathematical Physics: [www.ph.ed.ac.uk/higgs-centre-scholarships](http://www.ph.ed.ac.uk/higgs-centre-scholarships)

## Principal's Career Development PhD Scholarships

These provide a valuable opportunity for PhD students to undertake training and skills development and offer opportunities in areas such as teaching, public engagement, entrepreneurship, data science, and research. Each award covers the UK tuition fee and a stipend: [www.ed.ac.uk/student-funding/development](http://www.ed.ac.uk/student-funding/development)

## School-funded places

We have School-funded PhD places and PhD places covering a stipend and the Home/EU tuition fee available across all our subjects: [www.ph.ed.ac.uk/postgraduate-research/funding-studentships](http://www.ph.ed.ac.uk/postgraduate-research/funding-studentships)

## Research council awards

Research councils offer awards to PhD students in most of the Schools within the University of Edinburgh. All studentship applications from the research councils must be made through the University, through your School or College office. Awards can be made for both taught and research programmes.

Normally only those UK/EU students who have been resident in the UK for the preceding three years are eligible for a full award. For some awards, candidates who are EU nationals and are resident in the UK may be eligible for a fees-only award. The UK Government has confirmed that EU postgraduate research students commencing their studies in 2020/21 will retain their fee status and eligibility for research council support for the duration of their programme: [www.ed.ac.uk/student-funding/research-councils](http://www.ed.ac.uk/student-funding/research-councils)

The University also offers a number of scholarships in partnership with the following overseas government agencies:

- **Mexico** ●  
Banco de Mexico and the Banco de Mexico's FIDERH trust (FIDERH): ●●● [www.fiderh.org.mx](http://www.fiderh.org.mx)  
  
Fundacion Mexicana para la Educacion, la Tecnologia y la Ciencia (FUNED): ●● [www.funedx.org](http://www.funedx.org)
- **Pakistan** ●  
Higher Education Commission, Pakistan (HEC): [www.hec.gov.pk](http://www.hec.gov.pk)

## Loans available for study at the University of Edinburgh

The University of Edinburgh is a participating institution in the following loans programmes, meaning we certify your student status and can help with the application process.

- **The Canada Student Loans Program** ●●●  
The University is eligible to certify Canadian student loan applications: [www.ed.ac.uk/student-funding/canadian-loans](http://www.ed.ac.uk/student-funding/canadian-loans)
- **Erasmus+** ●  
The Erasmus+ Master Loan helps masters students with their living and tuition costs when studying in an Erasmus+ country other than where they live or where they took their first degree. For more information: [erasmusplus.org.uk/master-loan](http://erasmusplus.org.uk/master-loan)

## Postgraduate Doctoral Loans England

Student Finance England offers postgraduate loans for doctoral study, payable to eligible students and divided equally across each year of the doctoral programme: [www.gov.uk/doctoral-loan](http://www.gov.uk/doctoral-loan)

## Postgraduate Doctoral Loans Wales

Student Finance Wales offers loans for postgraduate doctoral study, payable to eligible students, divided equally across each year of the doctoral programme: [www.studentfinancewales.co.uk/postgraduate-students/postgraduate-doctoral-loan](http://www.studentfinancewales.co.uk/postgraduate-students/postgraduate-doctoral-loan)

## Postgraduate Loans (PGL) England

Student Finance England offers postgraduate loans for taught and research masters programmes, payable to eligible students: [www.gov.uk/postgraduate-loan](http://www.gov.uk/postgraduate-loan)

## Postgraduate Loans (PGL) Northern Ireland

Student Finance Northern Ireland offers eligible students a tuition fee loan for taught and research programmes, at certificate-, diploma-, and masters-level, which will be paid directly to the University: [www.studentfinancenir.co.uk](http://www.studentfinancenir.co.uk)

## Postgraduate Loans (SAAS) Scotland and EU

The Student Awards Agency Scotland offers eligible students tuition fee loans for taught and research programmes at diploma and masters level, which will be paid directly to the University. Full-time students resident in Scotland can also apply for a non-income assessed living cost loan: [www.saas.gov.uk](http://www.saas.gov.uk)

## Postgraduate Master's Finance Wales

Student Finance Wales offers eligible students postgraduate finance for taught and research masters programmes: [www.studentfinancewales.co.uk](http://www.studentfinancewales.co.uk)

## US Student Loans

The University is eligible to certify loan applications for US loan students. Full details on eligibility and how to apply can be found online: [www.ed.ac.uk/student-funding/us-loans](http://www.ed.ac.uk/student-funding/us-loans)

## Other sources of funding

The following are examples of the many scholarships and support schemes available to students from particular countries who meet certain eligibility criteria.

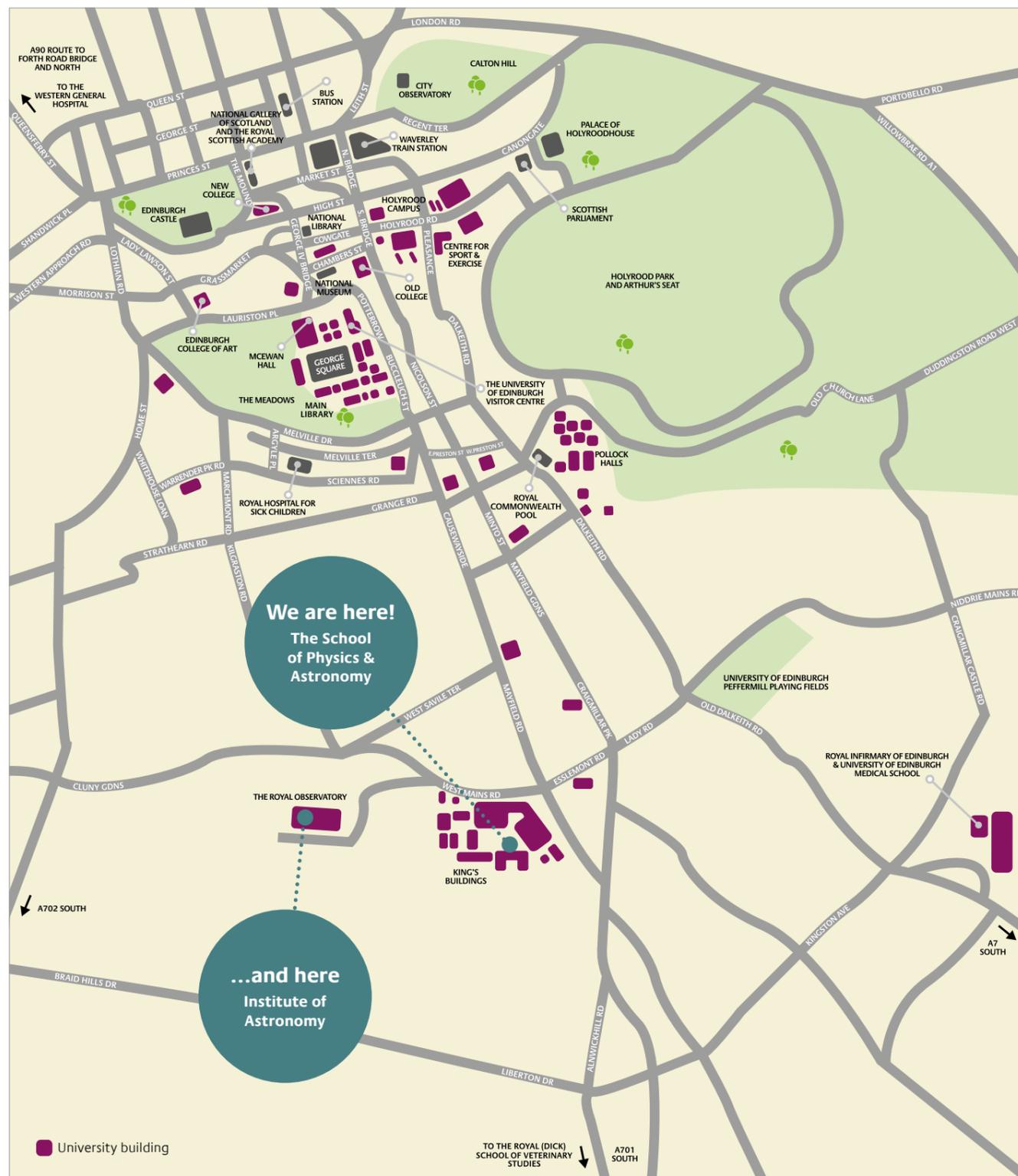
- **Chevening Scholarships** ●●  
A number of partial and full funding scholarships are available to one-year masters students: [www.chevening.org](http://www.chevening.org)
- **Commonwealth Scholarships** ●●●  
Scholarships available to students who are resident in any Commonwealth country, other than the UK: [www.dfid.gov.uk/cscuk](http://www.dfid.gov.uk/cscuk)
- **Marshall Scholarships (USA)** ●●●  
Scholarships available to outstanding US students wishing to study at any UK university for at least two years: [www.marshallscholarship.org](http://www.marshallscholarship.org)

## Campus map

The School of Physics & Astronomy's teaching and administration centre is in the James Clerk Maxwell Building, on the University's King's Buildings campus, about two miles south of the city centre. The Institute for Astronomy is based at the Royal Observatory, also in the south of the city.



Detailed maps  
can be found at:  
[www.ed.ac.uk/maps](http://www.ed.ac.uk/maps)



## Get in touch

### Contact us

For more information about applying for an MSc, contact:

#### MSc Administrator

Tel +44 (0)131 651 7067  
Email [msc.tpmp@ph.ed.ac.uk](mailto:msc.tpmp@ph.ed.ac.uk)  
or [msc.pnp@ph.ed.ac.uk](mailto:msc.pnp@ph.ed.ac.uk)

For more information about the application and admissions process for taught MSc programmes, contact:

College of Science & Engineering  
Recruitment and Admissions Team  
Tel: +44 (0)131 650 5737  
[www.ed.ac.uk/science-engineering/contact/undergraduate-or-postgraduate-taught-enquiries](http://www.ed.ac.uk/science-engineering/contact/undergraduate-or-postgraduate-taught-enquiries)

For more information about applying for our doctorate programmes, contact:

#### Graduate School Administrator

Tel +44 (0)131 651 7837  
Email [gradschool@ph.ed.ac.uk](mailto:gradschool@ph.ed.ac.uk)

For any other enquiries, contact:

#### School of Physics & Astronomy

The University of Edinburgh  
James Clerk Maxwell Building  
King's Buildings  
Peter Guthrie Tait Road  
Edinburgh EH9 3FD, UK  
Tel +44 (0)131 651 7067  
Email [enquiries@ph.ed.ac.uk](mailto:enquiries@ph.ed.ac.uk)

#### Institute for Astronomy

The University of Edinburgh  
Royal Observatory  
Blackford Hill  
Edinburgh EH9 3HJ, UK  
Tel +44 (0)131 668 8403

### Visit us

The University's Postgraduate Open Day is your opportunity to come and meet current staff and students. Our next campus-based Open Day takes place on 13 November 2019. For more information, visit: [www.ed.ac.uk/postgraduate-open-day](http://www.ed.ac.uk/postgraduate-open-day)

The Open Day is an opportunity to learn about our taught and research programmes and to meet our staff and current students. PhD students will be able to visit research groups and meet current PhD students. We can also arrange interviews with prospective supervisors, subject to availability and sufficient notice.

If you are unable to attend our Open Day but still would like to visit us, please get in touch. We are happy to organise individual visits for prospective students so that you can have a tour around our buildings and talk to staff.

### Our visits to you

If you are unable to visit the University, we attend events throughout the year so you can meet and speak to us in person.

UK and Europe: [www.ed.ac.uk/postgraduate/events](http://www.ed.ac.uk/postgraduate/events)

International: [www.ed.ac.uk/international/our-visits-overseas](http://www.ed.ac.uk/international/our-visits-overseas)

### Chat online

We offer all postgraduate students online information sessions. To find out more and see when the next session will be: [www.ed.ac.uk/postgraduate/online-events](http://www.ed.ac.uk/postgraduate/online-events)

For international students, Edinburgh Global also offers regular online chats. To find out more: [www.ed.ac.uk/international/chat-to-us-online](http://www.ed.ac.uk/international/chat-to-us-online)

This publication is available online at [www.ed.ac.uk/postgraduate](http://www.ed.ac.uk/postgraduate) and can be made available in alternative formats on request. Please contact [communications.office@ed.ac.uk](mailto:communications.office@ed.ac.uk) or call +44 (0)131 650 2252.

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We have made every effort to ensure the accuracy of the information in this prospectus before going to print. However please check online for the most up-to-date information: [www.ed.ac.uk](http://www.ed.ac.uk)

On 23 June 2016 the UK electorate voted in a national referendum to leave the European Union. EU postgraduate taught students enrolling in the 2020/21 academic year will be admitted as Scottish/EU fee status students and eligible for the same tuition support as Scottish domiciled students for the duration of their studies. This will still be the case in the event of a Brexit no deal scenario. For the latest information for students and applicants from the EU, please visit our website: [www.ed.ac.uk/news/eu](http://www.ed.ac.uk/news/eu)

The University's standard terms and conditions will form an essential part of any contract between the University of Edinburgh and any student offered a place here. Our full terms and conditions are available online: [www.ed.ac.uk/student-recruitment/terms-conditions](http://www.ed.ac.uk/student-recruitment/terms-conditions)

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