



MANCHESTER
1824

The University of Manchester

Physics and Astronomy

2020
Undergraduate brochure

Physics and Astronomy at Manchester

// Whilst being one of the top physics departments internationally, we maintain a friendly, open and inclusive environment where our broad research portfolio underpins a rich and varied undergraduate curriculum with lots of choice and flexibility. **//**

Professor Sean Freeman

Head of Department, Physics and Astronomy

Ranked 1st in Europe and 9th in the world for our research (Academic Ranking of World Universities 2018)

Jodrell Bank Observatory, renowned centre for radio astronomy and home of the famous Lovell Telescope, is part of our Department

One of the UK's largest Departments of Physics and Astronomy, with top ratings for teaching and research, and 13 Nobel Prize winners, past and current

Well-equipped laboratories, including rooftop optical and radio telescopes

A new £10m extension, the Schuster Annexe, furnished with brand new state-of-the-art labs and facilities

Facilities & resources

Our facilities are second to none and provide students with the very best opportunities:

- Opened in 2017, the Schuster Annexe includes a new undergraduate teaching laboratory, additional space and facilities for student projects and new teaching areas specifically designed for active learning and skills training
- Jodrell Bank Observatory
- Rooftop optical and radio telescopes
- Our own Physics library with out-of-hours access for 3rd and 4th year students
- Dedicated quiet areas for physics students to study all year round
- Small-group teaching: in the first year, students have both physics and maths tutorials to support their lectures.



“The one thing that made Manchester really stand out to me was how modern and innovative the Department of Physics was. Not only are they at the forefront of new discoveries, such as graphene, but also, they are always trying to improve facilities, with the recently built Schuster Annexe providing even more study spaces.”

Amy Smith
MPhys (Hons) student





Learning support

Peer support scheme

Our peer support scheme is one of the largest in Europe. Peer mentors are higher-year students on the same degree programme as you, who will help you find your feet when you arrive here and adjust to student life. As they'll have already been a student at Manchester for at least a year, they should be able to help you with anything you might be worried or unsure about.

PASS (Peer Assisted Study Sessions)

Led by volunteer students, PASS sessions will often be based around a specific area of study. You'll have the opportunity to consolidate and build on your existing knowledge through discussion with other students in an informal and supportive environment, where you can compare notes, analyse, ask questions and talk through ideas. Here in the Department of Physics and Astronomy, we were the first in the University to launch the International PASS Scheme which is now in its third year.

Small group teaching

When we ask our UCAS applicants why they choose Physics at Manchester, the top 2 reasons are: 1) Course degree content and 2) small group tutorials including a physics and personal tutor. In the first year, students have both physics and maths tutorials to support their lectures.

Disability support

If you have additional needs arising from a medical condition, physical or sensory disability, specific learning disability such as dyslexia, or a mental health difficulty that affects your study, we can provide support. Contact or visit our Disability Advisory and Support Office before you apply, to discuss your needs and the support available.

In the Department of Physics and Astronomy we have a dedicated Student Support and Welfare team who have specialised experience in supporting Physics students throughout their academic careers.

www.manchester.ac.uk/dass

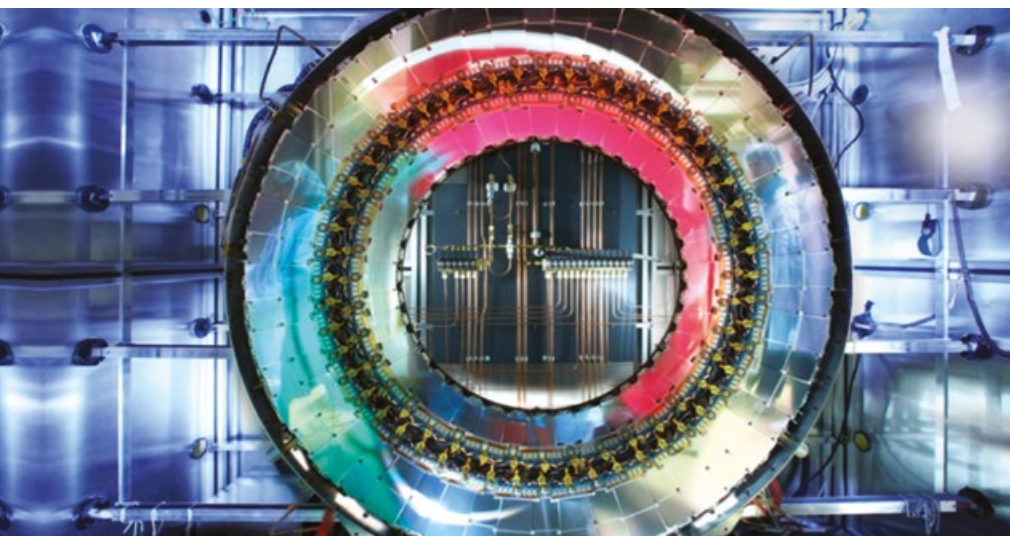
Find out more about the personal and academic support available to you throughout your studies:
www.manchester.ac.uk/study/experience/student-life/university/student-support



“ As an international student, I initially found it difficult to keep up with a more independent and critical style of teaching and learning. However, this degree provides you with the resources to overcome any challenges. I find it quite amazing to look back and think of the learning progression between first-year - where I was agonising over how to solve a question on a dynamics worksheet - to now, where I am doing a master's project on finding dark matter at the LHC. Being able to work alongside brilliant academics who are experts in their fields has been one of my most rewarding experiences to date.

I'm so grateful for the experiences this degree has given me – from exploring my interests in science communication through the Physics Outreach group, to working with the Department in setting up the International Student Support network. These opportunities allowed me to be part of a truly wonderful community and, after four years here, Manchester truly feels like a second home.

Wei Ann Heng
 MPhys (Hons) Physics



Apply

How to apply

www.manchester.ac.uk/study/undergraduate/applications

Please note that the course units listed in this brochure only represent a sample of the full breadth of available units for each course. Units are reviewed on an annual basis and as such may vary slightly to those advertised.

For up-to-date course information, including unit detail and entry requirements in full, visit our course finder:

www.manchester.ac.uk/undergraduate

Typical offer

BSc and MPhys, MMath & MPhys

A-level: A*A*A-A*AA (to include Physics and Maths). We would normally require a pass in the Practical Assessment in the newly reformed science A-levels.

IB: 38-37 points overall. 7,7,6 - 7,6,6 in Higher Level subjects (to include Physics and Maths).

For full details of our entry requirements: www.manchester.ac.uk/ugcourses



Which course?

Choosing your course

Our physics and astronomy courses provide broad coverage of the science, principles, and applications and offer considerable choice, enabling you to specialise in areas of particular interest. Our interdisciplinary and joint courses combine core material from different disciplines, equipping graduates for jobs that require rich skill sets and cross traditional topic boundaries.

Study abroad

Students on the four-year degree courses have the opportunity of studying for the third year of their course at one of several universities abroad. The University has exchange partners across the world and students build up valuable experience spending time at these universities.

There are a wide range of partner universities in many different countries, with Canada, USA and Singapore being popular destinations.

There is no need to specify this option on your UCAS application form as applications are made once you are here. Availability of places is competitive and decisions are normally made during the second year of study.

Flexible options for changing courses

Undergraduate teaching is modular, with core course units shared by the different courses. This means that it is often possible to change between courses up to the end of your first year, and (grades permitting) transfer to the MPhys of your course.

Find out more information about our courses at: www.physics.manchester.ac.uk/study/undergraduate

Physics

The study of physics is an attempt to understand everything that we can observe and measure in the universe: from the infinitesimally small, to the infinitely large; from the beginning of the universe in the Big Bang, to its ultimate fate. The rich and varied research profile of Manchester physics generates an exciting and varied curriculum with lots of optional course units allowing you to develop your own interests in physics.

Our core physics units will provide you with a foundation in classical physics, with topics including dynamics, waves, electromagnetism, and thermodynamics. You'll be introduced to concepts such as the unification of space and time, the wave-like behaviour of particles and the relation between entropy and disorder.

These concepts are essential for the understanding of molecules, atoms, nuclei, quarks and leptons, condensed matter, solid state electronic devices, electromagnetic radiation, lasers, stars, and general relativity, all of which can be studied in detail later in your degree.

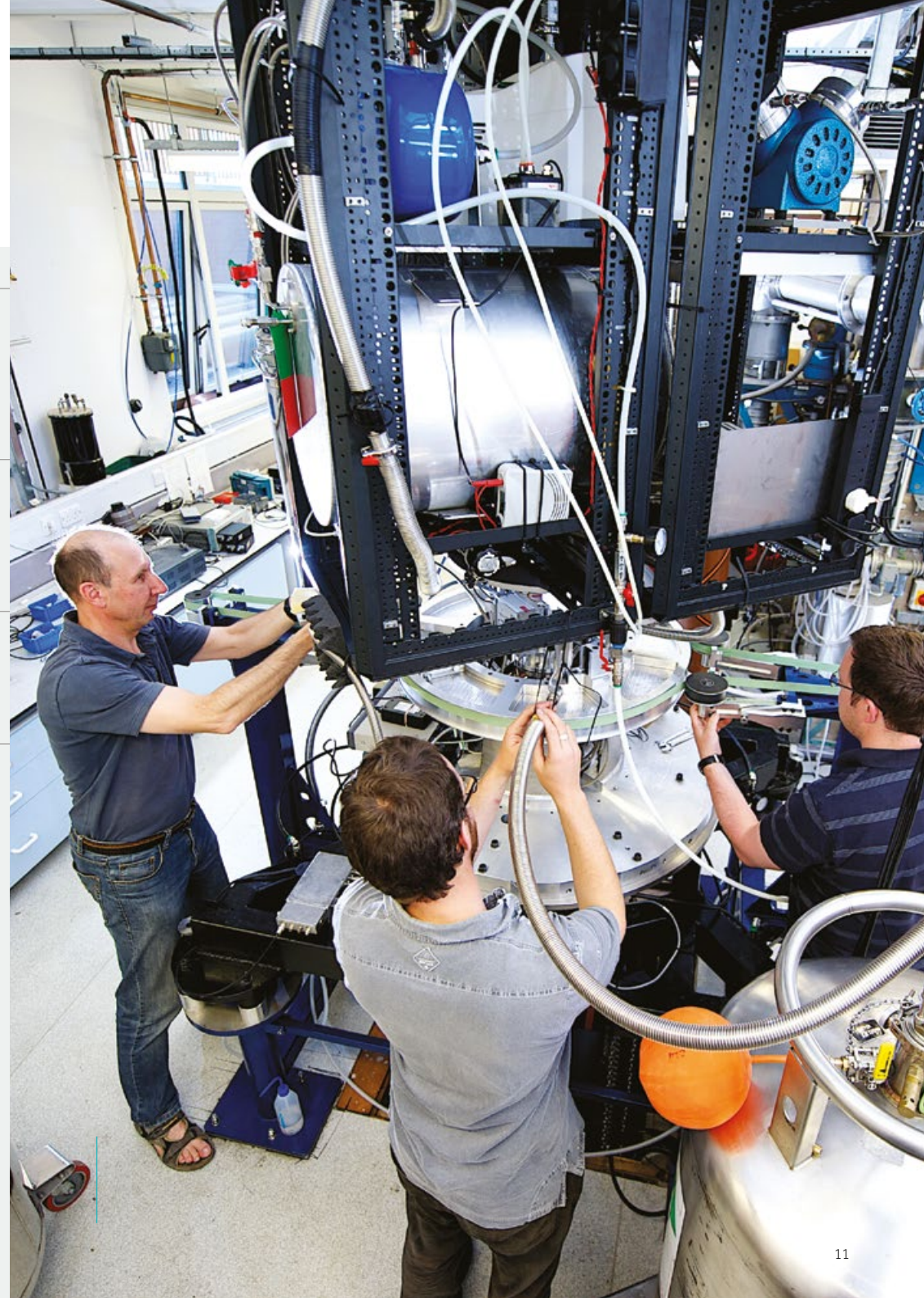
Course overview

- **Lots of choice and flexibility in a broad curriculum covering all areas of physics**
- **Gain a solid understanding of the key topics within physics**
- **Extensive laboratory work, giving you hands-on experience.**

UCAS code	BSc	3y	F300	IOP Institute of Physics
	MPhys	4y	F305	

Year Sample course units

- | | |
|----------|---|
| 1 | <ul style="list-style-type: none"> > Quantum Physics and Relativity > Random Processes in Physics > Introduction to Astrophysics and Cosmology > Laboratory |
| 2 | <ul style="list-style-type: none"> > Electromagnetism > Fundamentals of Solid State Physics > Lagrangian Dynamics > Physics of Energy Sources |
| 3 | <ul style="list-style-type: none"> > Applications of Quantum Physics > Electromagnetic Radiation > Introduction to Nonlinear Physics |
| 4 | <ul style="list-style-type: none"> > Frontiers of Solid State Physics > Nuclear Forces and Reactions > Superconductors and Superfluids |





After a year in Manchester, leaving wasn't really on my radar. Although I already spoke Spanish, studying abroad hadn't crossed my mind, until one of my professors took the time to suggest the European Study programme. Going abroad ended up being the best decision of my degree. Life in Madrid was obviously great, and my first two years in Manchester had left me prepared for whatever the Spanish university system could throw at me. It's during this year, while working on a project in Particle Cosmology, that I've come to appreciate that Manchester is a centre for world-renowned research. The department is full of field-leading professors, who are enthusiastic about passing on their knowledge.

Chris Shepherd
MPhys (Hons)

Mathematics and Physics

This joint-honours degree provides a solid foundation in the fundamental aspects of degree level mathematics and physics. This allows you to choose from a wide range of advanced options in your third and, where appropriate, fourth years.


Teaching is enhanced by the wide variety of research fields in both Departments. Applied mathematics and theoretical physics frequently overlap and research is carried out on theoretical astronomy, chaos, fractals and fluids. Other research topics in applied mathematics include hydrodynamics, waves, elasticity, boundary layer theory and modelling of industrial processes.

Course overview

- Designed for students who wish to study both mathematics and physics in depth.
- Excellent links with employers, including an annual maths-specific careers fair and an employer interview programme.
- Attend lectures, tutorials, examples classes and laboratory sessions covering a broad range of topics in mathematics and physics.

Year Sample course units

- | Year | Sample course units |
|------|--|
| 1 | <ul style="list-style-type: none"> > Quantum Physics and Relativity > Calculus and Applications > Linear Algebras > Laboratory |
| 2 | <ul style="list-style-type: none"> > Algebraic Structures > Metric Spaces > Electromagnetism > Solid State Physics |
| 3 | <ul style="list-style-type: none"> > Nuclear and Particle Physics > Advanced Quantum Mechanics > Applied Mathematics (including fluid dynamics, numerical analysis and applied complex analysis) > Pure Mathematics (including group theory, Lie algebra and topology) |
| 4 | <ul style="list-style-type: none"> > Cosmology > Superconductors and Superfluids > Further Pure and Applied Mathematics modules > Project work |

UCAS code	BSc	3y	FG31	
	MMath & Phys	4y	FG3C	

Physics with Astrophysics


Astrophysics involves the application of the laws of physics to distant regions that cannot be accessed by man-made apparatus, and in which the physical conditions can only be interpreted from the electromagnetic radiation that is emitted. You'll learn about our Sun and Solar System, the stars and our Galaxy, distant galaxies and quasars and the beginning of the Universe in the Big Bang. In addition, you'll learn how to apply basic physics in situations that are often extreme compared with those on Earth.

Students can perform observations at our Jodrell Bank Observatory, where a dedicated undergraduate radio observatory based on a seven-metre telescope enables you to make your own observations.

You may also observe the sky at visible wavelengths. Some examples are: using a solar telescope to observe the sun in the first year; imaging the moon in the second year; and using optical telescopes (both in Manchester and at Jodrell Bank) to analyse the light from stars in your third year.

Course overview

- Perform at least two sets of observations at Jodrell Bank Observatory as well as on-campus astrophysics experiments
- The wide range of world-leading experts in many different areas of physics also results in a large range of experiments in our teaching labs, a large choice of MPhys projects.

UCAS code	BSc	3y	F3F5	
	MPhys	4y	F3FA	


Physics with Theoretical Physics

This course is based on core physics units, together with the theoretical physics option stream. Half of the core laboratory work is replaced by lecture course units and project work on theoretical physics and mathematics.

This degree covers topics such as advanced dynamics, mathematical methods, and computing. You can specialise in areas that interest you most, and relate more of the course content directly to theory. Here, the core material of your earlier years forms the foundation for advanced subjects such as quantum theory, electrodynamics, and general relativity.

Course overview

- Aimed at students interested in the more mathematical and theoretical aspect of physics
- Gain a solid grounding in all aspects of physics, both theoretical and experimental
- Learn from internationally-renowned theoretical physicists including in astronomy and cosmology, biological physics, high energy particle physics, condensed matter, complex systems, and nuclear physics.

UCAS code	BSc	3y	F345	
	MPhys	4y	F346	

Year	Sample course units
1	<ul style="list-style-type: none"> > Introduction to Astrophysics and Cosmology > Physics of the Solar System > Laboratory
2	<ul style="list-style-type: none"> > Galaxies > Astrophysical Processes > Laboratory
3	<ul style="list-style-type: none"> > Nuclear Fusion and Astrophysical Plasmas > Cosmology > Stars and Stellar Evolution > Dissertation
4	<ul style="list-style-type: none"> > Electromagnetic Radiation > Nuclear Fusion and Astrophysical Plasmas > Exoplanets

Year	Sample course units
1	<ul style="list-style-type: none"> > Random Processes in Physics > Advanced Dynamics > Quantum Physics and Relativity
2	<ul style="list-style-type: none"> > Lagrangian Dynamics > Complex Variables and Integral Transforms > Theory Computing Project Thermal > Statistical Physics
3	<ul style="list-style-type: none"> > Introduction to Nonlinear Physics > Thermal Physics of Bose and Fermi Gases > Introduction to Nuclear and Particle Physics
4	<p>In the fourth year of the MPhys course, research skills are developed by work on research projects hosted by our research groups.</p> <ul style="list-style-type: none"> > Quantum Field Theory > Advanced Statistical Physics > Gauge Theories

A large radio telescope dish is shown in the foreground, its metallic structure silhouetted against a vibrant sunset sky. The sun is low on the horizon, casting a warm orange glow. The sky is filled with wispy clouds, some of which are illuminated by the setting sun. The telescope dish is a complex lattice of metal, and its support structure is visible. In the background, there are some trees and a fence line.

Physics with Philosophy

This degree provides a solid grounding in all aspects of physics, both theoretical and experimental with a substantial amount of laboratory work replaced by courses and project work in philosophy.

Throughout this course, the areas of philosophy you'll explore in most detail are those relevant to the overlap with physics; namely, the nature of scientific knowledge and the status of science as a means of achieving understanding.

Physics with Philosophy students take similar core physics course units to the Honours Physics students, and follow the philosophy option stream. The course also promotes areas of physics that complement the option stream in philosophy.

Course overview

- Gain a solid grounding in all aspects of physics, both theoretical and experimental
- Explore the areas of philosophy that overlap with physics; the nature of scientific knowledge and the status of science as a means of achieving understanding
- Offered in conjunction with the University's Philosophy Department, which is committed to ongoing research and teaching in the tradition of analytic philosophy.

UCAS code	BSc	3y	F3V5	
	MPhys	4y	F3VM	

Year	Sample course units
1	<ul style="list-style-type: none">> Dynamics> Quantum Physics and Relativity> Introduction to Ethics> Introduction to Metaphysics and Epistemology
2	<ul style="list-style-type: none">> Electromagnetism> Philosophy of Science> Introduction to Logic> Locke, Berkeley, Hume
3	<ul style="list-style-type: none">> Applications of Quantum Physics> Introduction to Nuclear and Particle Physics> Cosmology
4	<ul style="list-style-type: none">> Metaphysics> Gravitation> Nuclear Structure and Exotic Nuclei



“ I originally applied to study physics with astrophysics, but realised that there was a whole world of other fields that I had not even touched at A-level and decided that I wanted a chance to try them before settling on a specialism. The Department of Physics and Astronomy at Manchester stood out as the place that would allow me to get a taste of the wide variety that is available within physics as they have a huge department with experts in fields ranging from astronomy and particle physics to biophysics and liquid crystals. There are also plenty of active societies, both within the Department and in the university as a whole. Staying in physics there are opportunities to go stargazing on the roof, visit Jodrell Bank or CERN, or go out to schools in the local area and inspire a new generation of physicists! ”

Josh Hayes
MPhys (Hons) student

Physics with study in Europe

In your first year, you will mainly follow the core physics course units with the addition of a language unit. Your language unit will include two lectures per week and is supplemented with language laboratories and tutorials as needed.

During your second year, you will again follow the core physics units, and replace two optional units with a language package designed to continue your development and introduce the more specialised vocabulary of physics.

You'll spend your third year studying physics at a university in Europe, as part of the ERASMUS programme. You'll return to Manchester for your fourth year, where you can choose course units from a large list of options, including a number from other Departments in the University.

Course overview

- Gain a thorough grounding in all areas of physics
- Enhance your language skills in the first two years, including by physics tutorials taught in your target language by a native speaker
- Spend your third year abroad at a European university, and gain a working knowledge of a European language and a different culture
- Return home to Manchester for your fourth year to complete your MPhys studies.

Year Sample course units

- | | |
|----------|--|
| 1 | <ul style="list-style-type: none"> > Quantum Physics and Relativity > Random Processes in Physics > Introduction to Astrophysics and Cosmology > Language |
| 2 | <ul style="list-style-type: none"> > Electromagnetism > Fundamentals of Solid State Physics > Lagrangian Dynamics > Physics of Energy Sources > Language |
| 3 | In your third year, you'll study physics at your host university in the native language. This may include laboratory work. |
| 4 | <ul style="list-style-type: none"> > Frontiers of Solid State Physics > Nuclear Forces and Reactions > Superconductors and Superfluids > MPhys Project |

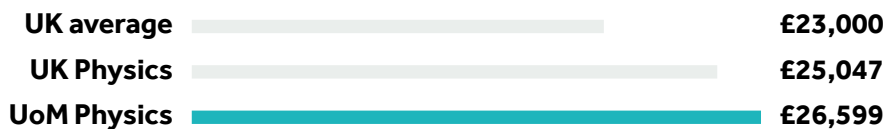
UCAS code	MPhys 4y	F301	IOP Institute of Physics
-----------	----------	------	-----------------------------

Career opportunities

Physics and Astronomy graduates from The University of Manchester :



Salaries



Further study options

PhD – 57%
MSc – 16%

PhD
Physics



Most popular qualifications

Most popular course title

Most popular institution

What our graduates do:

Geophysicist
Field seismologist
Metallurgist
Nanotechnologist
Research scientist
School teacher
Physicist
Finance

Where our graduates work:

BAE Systems
RAF
Meteorological Office
NHS
QinetiQ
Bank of England
Deutsche Bank
Merril Lynch

Source: HESA, Destinations of Leavers from Higher Education (DLHE)





Women in science

The Department has a strong commitment to diversity and women in science. We hold both an Athena SWAN Silver award and Institute of Physics JUNO Champion status.

The Athena SWAN Charter is owned by the Equality Challenge Unit and the awards recognise and celebrate good practice in recruiting, retaining and promoting women in science, technology, engineering, mathematics and medicine.

The aim of the Institute of Physics JUNO scheme is to recognise and reward departments that can demonstrate they have taken action to address the under-representation of women in university physics and to encourage better practice for both women and men.

Read about our Women of Wonder:

www.se.manchester.ac.uk/people/women-of-wonder

Watch the stories of some of the women in our Faculty:

www.mub.eps.manchester.ac.uk/science-engineering/2017/03/06/women-of-wonder



Professor Philippa Browning

Professor Browning is a Professor of Astrophysics. Her research focuses on plasma and its interactions with magnetic fields, in particular plasmas in the sun's corona, and the origin of solar flares. This research contributes to the effort to one day produce a fusion-based power station. Furthermore, Professor Browning's studies on solar flares are helping gain a greater understanding of 'space weather', an important issue facing our society as solar storms can have a significant effect on satellites, power systems and communications.

Professor Browning is a Fellow of the Institute of Physics, and was the chair of the Institute of Physics Plasma Physics Committee and the UK Solar Physics Council. She is a member of Science and Technology Facilities Council's Astronomy Grants Panel, chairing the Solar System sub-Panel, and was formerly Chair of the Science and Technology Facilities Council's Women in Science, Engineering and Technology group.



Professor Anna Scaife

Professor Scaife is head of the Jodrell Bank Interferometry Centre of Excellence at the University of Manchester. Professor Scaife holds a European Research Council Fellowship, which funds her group's work investigating the origin and evolution of large-scale cosmic magnetic fields. Professor Scaife also holds a number of other grants which support technical radio astronomy research and development as part of the international Square Kilometre Array (SKA) project.

Professor Scaife leads the SKA Imaging Pipeline development for this high-profile Big Data project, as well as playing an active role in defining its scientific direction. In 2014, Professor Scaife was honoured by the World Economic Forum as one of 30 scientists under the age of 40 selected for their contributions to advancing the frontiers of science, engineering or technology in areas of high societal impact.

Make your mark with Stellify

// I wanted to try something completely new. Transforming unused and overgrown land into areas where fruit and vegetables can be grown gave my volunteering an environmental focus.

Volunteering is a different experience from study. For me, as a chemical engineering student, it's enabled me to think outside my discipline, which by its nature is very technical.

Here at Manchester, volunteering is embedded in the very heart of the University's culture – there are so many opportunities to try something new, which in turn can have such a positive impact on our communities.

Alessia Xu
MEng Chemical Engineering
with Industrial Experience

Read Alessia's story at:
www.manchester.ac.uk/make-your-mark

At Manchester you'll find a whole host of transformational academic and extracurricular activities to help you stand out and make your mark on the world. You could even prove your abilities to potential employers by gaining a prestigious award.

We call this process **Stellify**: to change, or be changed, into a star.

Stellify offers you opportunities to develop and grow at a university leading the way in social responsibility. Here's how.



Learn without boundaries

Enjoy interdisciplinary, international and entrepreneurial study options outside your course.



Understand the issues that matter

Become ethically, socially and politically informed on some of humanity's most pressing global issues.



Make a difference

Contribute to and learn from local and global communities through volunteering.



Step up and lead

Gain confidence and experience by assisting and inspiring your peers.



Create your future

Explore countless opportunities for professional career development.

STELLIFY

www.manchester.ac.uk/stellify

UoM Physics Outreach

UoM Physics Outreach (UMPO) is a student-led public engagement body in the University of Manchester's Department of Physics and Astronomy. With an ever-growing team of over 100 volunteers, the group works to challenge preconceptions about science as a field, break down barriers between communities in Manchester, and promote studying physics as an option for young people from all backgrounds. UMPO regularly sends students out either 'science busking' around Manchester or into schools to deliver specialist workshops, as well as to festivals and large-scale events further afield.

Read more about UMPO:
www.umpo.co.uk



“ My experience at the University of Manchester started when I was invited for interview. I met enthusiastic and inspired lecturers and staff, and their passion for their research areas was addictive. The Department has infrastructures in place for students to pursue their studies, get inspired, ask questions and develop as part of a greater, international physics community. My personal growth has been uniquely impacted by individuals who took an interest in me personally. ”

Stephanie Baines
MPhys (Hons)

“ I came to Manchester for the more rigorous maths, but I also found an incredibly welcoming and stimulating environment. You can see the enthusiasm of the student body in the huge range of extracurricular activities on offer in the Department through sports, academic societies, and socials. I'm very proud to have been on the committee for the UoM physics outreach, an entirely student-run outreach organisation that brings physics to schools, festivals, and even pubs all over the city. It's been a lot of fun and a really unique experience! ”

Sara Summerton
BSc (Hons) Mathematics and Physics

The University of Manchester

**Department of Physics and Astronomy
Student Recruitment and Admissions
Schuster Building
Brunswick Street
Manchester
M13 9PL
United Kingdom**

**t +44 (0)161 306 9220/3673
e ug-physics@manchester.ac.uk
w manchester.ac.uk/physics**

 [@UMANCPhysicsSupport](https://www.facebook.com/UMANCPhysicsSupport)

 [@UoMPhysSupport](https://twitter.com/UoMPhysSupport)

This brochure was printed in 2019 for the purposes of the 2020 intake. It has therefore been printed in advance of course starting dates and for this reason, course information may be amended prior to you applying for a place. There are a number of reasons why changes to course information and/or published term dates may need to be made prior to you applying for a place – more details can be found on our website. Prospective students are therefore reminded that they are responsible for ensuring, prior to applying to study, that they review up-to-date course information by searching for the relevant course at:

www.manchester.ac.uk/undergraduate/courses

Further information describing the teaching, examination, assessment and other educational services offered by The University of Manchester is available at:

www.manchester.ac.uk/undergraduate

Royal Charter Number RC000797