MATHS AND PHYSICS

UNDERGRADUATE STUDY
2022/23

WARWICK
THE UNIVERSITY OF WARWICK
Mathematics and physics are a great combination to study at university, and provide the basis for a stimulating and enjoyable education.

Mathematics and physics are complementary subjects. Often, a way of thinking developed in one discipline leads to new insights into the other. The advances in the mathematical theory of dynamical systems and chaos are an example. Ideas from the theory are now applied in the modelling of physical systems such as the atmosphere, lasers and other complex systems.

In both subjects the emphasis is on learning how to recognise the surprising and how to reason. So, although the joint degree is the natural route into theoretical physics, the skills it teaches are universal and can lead to many different careers. Our former students have gone on to work in industry and in professions such as business, journalism and the financial sector.

There are two variants of the degree course: the three-year BSc and the four-year MMathPhys. You need to decide by the end of your second year which degree to aim for. BSc courses should be seen as part of a general rounded education, which should leave you numerate articulate and employable. The four-year course should appeal most to you if you intend to make direct use of your knowledge of mathematics and physics after you graduate.

Neil Wilson
Head of Undergraduate Admissions
In the first year you take essential (core) modules in both mathematics and physics. At the end of the first year it is usually possible to change to either of the single honours courses, providing you satisfy certain requirements in the end of year examinations. In the second and third years, there is considerable freedom to choose modules. By then you will have a good idea of your main interests and be well placed to decide which areas of branches of mathematics and physics to study in greater depth. In effect you design your own degree. Some modules may also be taken from outside of both mathematics and physics. We encourage you not only to consider the ‘obvious’ outside modules in computing or statistics, but also modules introducing secondary school teaching or a modern language.

The optional fourth year continues to cover the main areas of mathematics and physics. You can continue to study a broad spectrum of topics within both subjects. Alternatively, you may choose to concentrate on one or two areas. This can give time to take in and reflect on some of the recent developments in these areas. Our research is strong in a number of branches of mathematics and physics, and we are well placed to offer authoritative and coherent accounts of those recent developments likely to be of most interest to you as a joint degree student.

THE WARWICK DEGREE

FG31 MMathPhys

GF13 BSc

The Warwick joint degree course is among the best established in the country and the course includes a number of modules from both contributing departments designed specifically for joint degree students. Each year around 75 students start on this course.

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FIRST Year

The first year is currently:

Maths

Mathematical Analysis (60 Lectures), Sets and Numbers (30L), Linear Algebra (30L), Mathematical Methods and Modelling 1 and 2 (30L + 30L).

Physics

Physics Foundations (30L), Electricity and Magnetism (30L), Classical Mechanics and Relativity (30L), Quantum Phenomena (30L). There is also a Physics Programming Workshop.

Mathematics at university emphasises the importance of proof. All sciences test the validity of ideas and conjectures, usually by comparing with reality as seen in experiment. In mathematics, there are no experiments, so it is important to be able to construct watertight arguments or proofs. Mathematics is also concerned with the generality of results. The process of figuring out the most general form of some result from an initial example is an important and rewarding part of the subject. It is often what suggests new results and can reveal connections with other areas within mathematics.

Computers are increasingly important in all of mathematics and theoretical physics. The Programming Workshop teaches Python programming and how to solve numerically the mathematical models of physical systems. Overleaf is a typical (pre-Covid-19) first year timetable. With social distancing, tutorials and supervisions can run as shown. The traditional face-to-face lectures are currently a developing blend of recordings and on-line sessions. Face-to-face events are being reintroduced as Covid-19 restrictions are lifted.
The timetable for the first five weeks of the pre-COVID-19 first year should give an idea of the typical weekly workload of lectures and tutorials.

The tutorials involve smaller groups and a lecturer or postgraduate student. The idea is to work through examples sheets handed out in the lectures and to discuss any problems with the material. Wednesday afternoons are kept free of classes, as Wednesday is the main day for university activities such as sport, drama and music.

These core modules complete the treatment of basic material assumed by subsequent modules. There is then a broad range of modules covering all the main areas of mathematics and physics from which you choose a selection.

**Maths**
- Mathematical Analysis III
- Methods of Mathematical Physics
- Multivariable Calculus
- Norms, Metrics and Topologies
- Partial Differential Equations

**Physics**
- Hamiltonian and Fluid Mechanics
- Quantum Mechanics and its Applications
- Statistical Mechanics
- Electromagnetic Theory and Optics

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- Mathematical Analysis III
- Multivariable Calculus
- Norms, Metrics and Topologies
- Partial Differential Equations

**Physics**
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- Quantum Mechanics and its Applications
- Statistical Mechanics
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In the second year there are core modules taken by everybody.

**Maths**
- Mathematical Methods and Modelling III
- Multilinear Algebra
- Ordinary Differential Equations

**Physics**
- Computational Physics
- Environmental Physics

**Outside Options**
- Interdisciplinary modules from WBS (Warwick Business School), the Language Centre (Arabic, Chinese, French, German, Italian, Japanese, Portuguese, Russian and Spanish), and the Centre for Education Studies (Introduction to Secondary School Teaching).

You choose about eight further modules (not all modules are the same length and may change over time) from:

**Maths**
- Mathematical Methods and Modelling III
- Multilinear Algebra
- Ordinary Differential Equations

**Physics**
- Computational Physics
- Environmental Physics

**Outside Options**
- Interdisciplinary modules from WBS (Warwick Business School), the Language Centre (Arabic, Chinese, French, German, Italian, Japanese, Portuguese, Russian and Spanish), and the Centre for Education Studies (Introduction to Secondary School Teaching).
THIRD Year
BSc

In the third year of the BSc you take a module on Communicating Science. You select modules from the lists of options, which currently are:

Maths
Functional Applied Analysis, Complex Analysis, Fluid Dynamics, Measure Theory, Theory of PDEs, Topics in Mathematical Biology

Physics

Outside Options
Modules from WBS, the Language Centre, the Mathematics, and other, departments.

You can choose to carry out a research-style project worth 30% of the year’s credit. A project brings you into contact with a research group, where you work with and alongside postgraduate students and research fellows. It can give fresh insight into the way research scientists work and think.

THIRD Year
MMathPhys

Opting for the MMathPhys allows you more time to explore the implications of what you have already learnt.

The third year, like the second year, consists of compulsory modules covering the material which will be assumed by many of the fourth year modules, and modules chosen from lists of options. The core modules are:

Physics
Quantum Physics of Atoms, Kinetic Theory, Electrodynamics

Mathematics
Fluid Dynamics

There is a Laboratory and Skills module. As a member of a group of three students, you complete an experiment and a computer-based simulation of a physical system.

You present your results both orally and in an extended written report.

Typically, you take a further six modules from the options listed for the third year of the BSc.

“The overlap – using cool maths to explain the phenomena we see around us – is what I am particularly interested in. I don’t just want to be told the answers though; being able to learn more deeply, and fully understand these problems is much more important to me. It has enabled me to develop so many useful skills, alongside learning more about my subjects.”

Beth Kynman
Civil Servant
2019 MMathPhys graduate
FOURTH Year

During the fourth year you join one of the research groups and work with a partner on a research-style project.

The project work gives you experience of working more independently. This experience should be valuable to you in your subsequent career, whether you choose to work as a scientist or not, and can help you when you are making decisions about possible careers.

You also take between six and twelve of the following modules (not all modules are the same length) choosing at least two from the list of mathematics modules and two from the list of physics modules. The lists are currently:

**Mathematics**
- Advanced Partial Differential Equations, Dynamical Systems,
- Fourier Analysis, Linear Analysis,
- Quantum Mechanics: Basic Principles and Probabilistic Methods,
- Statistical Mechanics, Topics in Mathematical Biology.

Modules from the third year lists can also be chosen.

**Physics**
- Advanced Quantum Theory,

You may also take modules from the third year which you have not already taken.

**Outside Options**
There is no formal list of outside options. However, you can follow modules from outside the department provided that the timetable permits this.

INTERCALATED Year

You may also extend the BSc degree by inserting an extra year (usually) between your second and what would otherwise be your third year.

You would spend this ‘intercalated’ year studying at a foreign university or working in a research laboratory.
HOW TO APPLY
Applications are made through UCAS ucas.com

If you are made and accept an offer, and meet any outstanding conditions, we will confirm your place and look forward to warmly welcoming you at the start of your life here at Warwick.

For more detailed information about how we process applications please visit: warwick.ac.uk/study/undergraduate/apply

OVERSEAS APPLICANTS
At Warwick, we welcome applications from across the globe, and have dedicated teams available to advise and support, as well as a global network of Agents and Representatives.
For more information on applying from your country see: warwick.ac.uk/io

STUDENT FEES AND FUNDING
We want to ensure that, wherever possible, financial circumstances do not become a barrier to studying at Warwick. We provide extra financial support for qualifying students from lower income families.
warwick.ac.uk/studentfunding

ACCOMMODATION
We believe that where you live underpins your University experience. Warwick Accommodation manages around 7,000 self-catering residences on campus. At Warwick, you’ll enjoy the freedom of independent living alongside your fellow students but with the security of knowing you’re surrounded by people who can support you should you need it.
For more information please visit: warwick.ac.uk/accommodation

DISCOVER MORE
To find out more about the University, including opportunities to visit and engage with your department of choice, please visit: warwick.ac.uk/undergraduate/visits

This course information was accurate at the time of publication (September, 2021). While the University tries to ensure that the information is accurate, it does not warrant that this is the case. The University may need to make changes including to the course content, syllabus, delivery, methods of assessment, or to comply with external accrediting or reviewing bodies. It is therefore important that you revisit the relevant course website before you apply and when you accept an offer to ensure you are viewing the most up to date information. This information should not be construed as an offer and nor does it create a contract or other legally binding relationship between the University and you or a third party. For full terms and conditions, please visit warwick.ac.uk/ugtermsandconditions

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