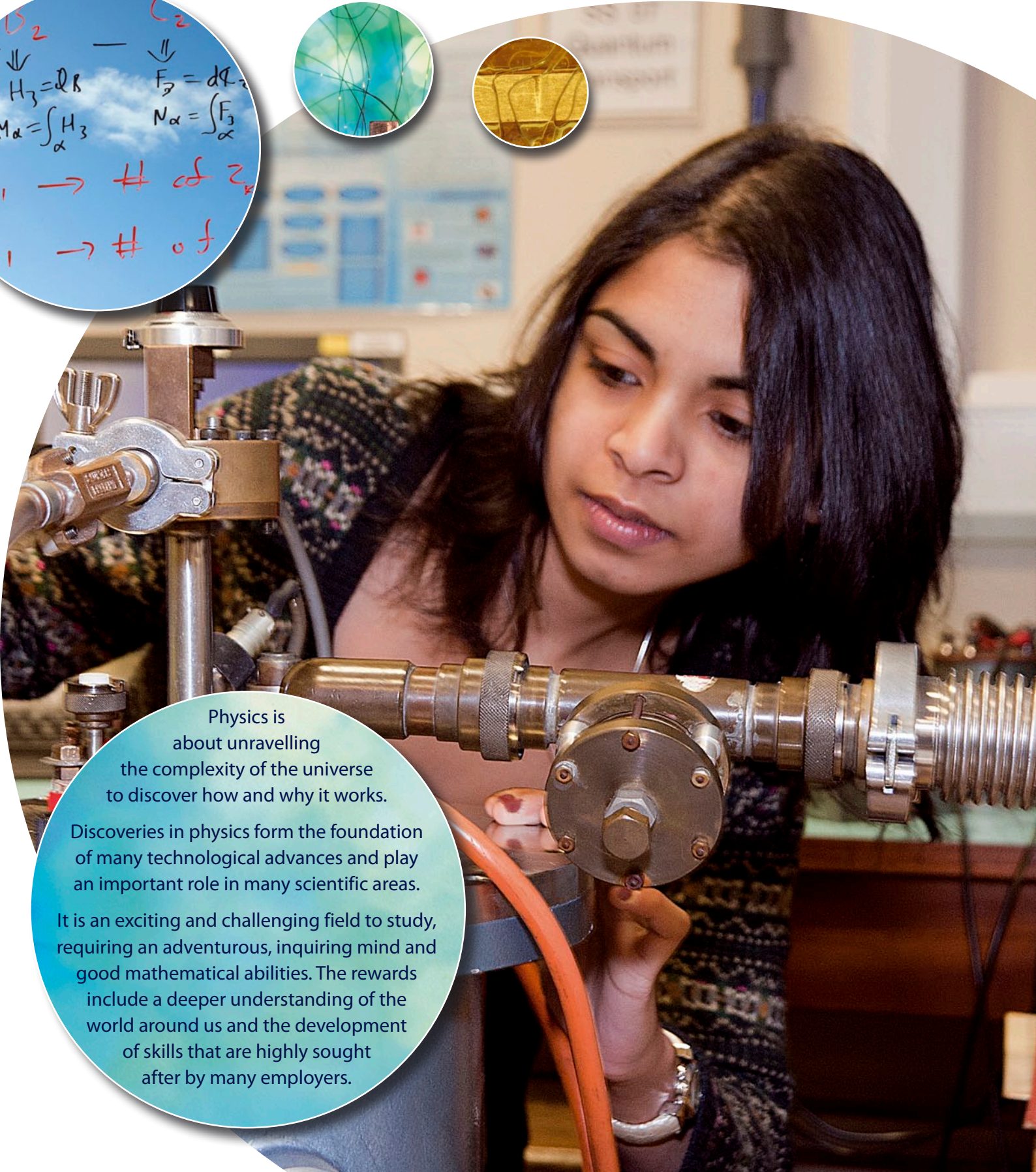
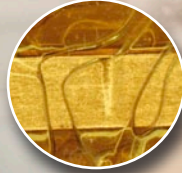
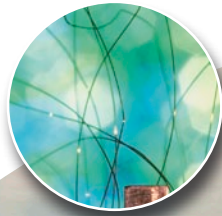
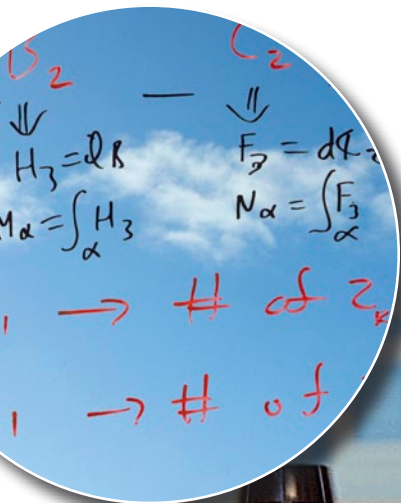


UNDERGRADUATE DEGREE COURSES AT THE
UNIVERSITY OF OXFORD FOR ENTRY IN 2012



UNIVERSITY OF
OXFORD

Physics at Oxford



Physics is about unravelling the complexity of the universe to discover how and why it works.

Discoveries in physics form the foundation of many technological advances and play an important role in many scientific areas.

It is an exciting and challenging field to study, requiring an adventurous, inquiring mind and good mathematical abilities. The rewards include a deeper understanding of the world around us and the development of skills that are highly sought after by many employers.

Physics

First year

All first year students study four compulsory subjects. These consist of two physics papers covering fundamental aspects of classical physics: mechanics and special relativity, and circuit theory, electromagnetism and optics. There are also two mathematics papers introducing mathematical methods in physics that include differential equations and complex numbers, vibrations and waves.

Optional units

Students also choose one short option course from Quantum Ideas, Astrophysics or Complex Variables.

Practical work

For two terms students spend one day a week working in pairs in the laboratories. Practical work covers general physics, computing, electronics, optics and astronomy. It complements lectures and tutorials and introduces areas of physics that may be less familiar to students.

Examinations (Prelims)

At the end of the first year students take exams in each subject. Students must pass the written examinations and have a satisfactory record of practical work before they can proceed to the second year.

Second year

The second year provides a common core for both the BA Physics and MPhys courses. It has three main subject areas:

Thermal Physics

Thermal Physics is concerned with the nature and properties of heat and includes the kinetic theory of gases, classical thermodynamics and statistical mechanics – the ‘why’ of thermodynamics.

Electromagnetism and Optics

The topics started in first year are developed and covered in more depth.

Quantum Physics

This subject area introduces the mathematically beautiful and conceptually puzzling world of quantum mechanics.

Optional units

Students also choose a short option course. There are a variety to choose from, including Medical and Health Physics, Energy Studies, a Foreign Language Option and Teaching and Learning Physics in Schools, which involves spending a half-day each week (for one term) working with a physics teacher in a local secondary school.

Practical work

Practical work occupies two days a fortnight during the second and third years. Students normally do a total of 12 days, however half the practical work may be substituted by a second short option, or extra practical work may be done in place of a short option.

Examinations (Part A)

At the end of the second year students take the Part A examinations. These consist of three written papers on the core topics, a short option paper and practical work. Those who wish to take the MPhys must achieve a minimum standard, comparable to 2:1 honours, in this examination.



“The course has been amazing so far because of the diversity and at the same time compatibility of the two disciplines that I am studying. One of my favourite pastimes is to sit and study in the Physics Department cafe, while listening to academics converse around me. Sitting amongst them is truly inspiring.”

Noor-ul-hira Shaukat, 1st year
Physics and Philosophy,
Worcester College

Third year

In the third year the BA Physics and MPhys courses diverge and students must finalise their course choice. Three core papers, each containing two sections, are offered: MPhys students take all three and BA Physics students choose the equivalent of two to take alongside a short project or essay.

Flows, Fluctuations and Complexity, and Symmetry and Relativity

The dynamics of complex systems such as fluid mechanics, energy flows and stochastic processes are covered and there is an introduction to biological systems. The complex world of symmetry and relativity, including Lorentz transformations and classical fields, is also considered.

Quantum, Atomic and Molecular Physics, and Sub-Atomic Physics

The topics covered include multi-electron activity, lasers, theory of beta decay and the standard model.

General Relativity and Cosmology, and Condensed Matter Physics

The effect of gravity on light, Einstein's field equations, and our understanding of the expansion of the universe are among the topics studied. Condensed Matter Physics deals with the properties of solids, including thermal and magnetic properties and why they form insulators, metals and semiconductors.

Practical work

Students gain hands-on experience in relation to the topics covered in the core subjects, such as semiconductor devices and lasers.



Optional units

A variety of interesting short option papers are available for study by both BA Physics and MPhys students, for example Financial Physics and Plasma Physics.

Examinations (Part B)

MPhys students take three written papers on the core topics, plus a short option paper and practical work. BA Physics students take the equivalent of two written papers, a short option paper, practical work and a project report or essay. The BA Physics degree classification is made from the combined results of the second and third years.

Fourth year

MPhys students spend their fourth year working on two major options and a substantial project.

Major options

Astrophysics

Astrophysics is concerned with the application of the laws of physics to phenomena throughout the observable universe. Some of these phenomena present conditions so extreme as to challenge current physical knowledge. The course combines a study of important basic astrophysics with an introduction to topics at the forefront of current research.

Biological Physics

The study of the physical processes of life is a rapidly growing interdisciplinary field, with links to biochemistry, bioinformatics, medicine and nanotechnology. The course covers the biological structures and physical mechanisms responsible for fundamental biological processes such as motion, energy generation, signal transmission and molecular transport. Since much of the knowledge in these areas is due to recent experimental advances, the course also describes modern techniques for the study of biological molecules and machines at the single-molecule level.

Condensed Matter Physics

The study of the fundamental properties of solids at a microscopic level. Interactions in novel materials give rise to many new phenomena, from high temperature superconductivity to low-dimensional electron behaviour in semiconductor nanostructures.

Laser Science and Quantum Information Processing

Coherent optical phenomena play a central role in research into the quantum nature of matter and radiation. This

course covers the basic properties of lasers and laser-matter interactions, including nonlinear optics and beam propagation, as well as applications to several important technologies and the emerging area of quantum information processing.

Particle Physics

The study of the fundamental nature of matter and forces. The course covers electrons and neutrinos, and quarks that make up the proton and neutron, as well as the heavier versions of these basic particles. We consider our theoretical understanding of the strong and electroweak interactions of these particles and look at recent discoveries, such as the very massive top quark and neutrino masses. Future possibilities, including the ongoing search for the elusive Higgs boson, are also explored.

Physics of Atmospheres and Oceans

Physics helps us understand and interpret a wide range of atmospheric and oceanic phenomena. This course starts with simple applications of thermodynamics and fluid dynamics to atmospheric behaviour and goes on to explore the greenhouse effect, atmospheric ozone depletion and details of modern space instruments, as well as our current understanding of climate and climate variability.

Theoretical Physics

Modern physics has revealed how fundamental laws are often encoded in beautiful mathematical structures. This course provides an introduction to three areas: classical field theory, including Einstein's theory of gravitation; advanced quantum mechanics, including Dirac's relativistic wave equation for the electron; and statistical physics, including the theory of phase transitions.

If you want to know everything there is to know about the universe, Physics and Philosophy is a good place to start.

Aron Pólos, 1st year Physics and Philosophy, Balliol College

MPhys projects

Each student works individually on a theoretical or experimental problem or topic of research in the Department under the supervision of a senior physicist. The work is completed by writing a detailed project report that may contribute to work published in a scientific journal. Projects give students valuable experience of open-ended work, solving real problems and are the equivalent of about one full term's work.

Examinations (Part C)

Part C comprises two written papers on major options and a project report. The MPhys degree classification is made from the combined results of the Parts A, B and C examinations and the project report.

Physics and Philosophy

Oxford also offers a joint Physics and Philosophy Masters degree (MPhysPhil) that aims to bridge the arts/science divide. Physics and philosophy complement each other as they both seek to reach a fundamental understanding of the nature of reality.

In this degree students will learn how to write, reason and argue with precision, as well as how to use physical principles and mathematical equations to solve problems. Graduates are equipped with the ability to think in abstract and general terms as well as to evaluate scientific claims as they arise in areas such as social sciences, policy making, media and business. In addition, depending on students' choices in the fourth year, the course provides an ideal springboard to graduate work in either physics or philosophy. Graduates regularly go on to the very best research programmes worldwide in physics, and likewise in philosophy.

The course covers topics in Physics, Philosophy and the Philosophy of Physics.

Physics and Philosophy

Physics and philosophy are studied in parallel for the first three years. Philosophy covers topics such as the theory of knowledge, metaphysics, philosophy of science and logic. There is flexibility in the fourth year to specialise in either physics or philosophy, or to continue with both.

Philosophy of Physics

Linking physics and philosophy throughout the course is the subject area 'Philosophy of Physics'. Topics covered include classical spacetime concepts, foundations of special relativity, conceptual problems in quantum mechanics, concepts of symmetry and foundations of general relativity and statistical mechanics.

This course is among the most demanding at Oxford. Students are expected to become as fluent in mathematics as their single honours peers in physics, and as skilled in writing essays as those taking other joint degrees involving philosophy.

College choice

Applications for MPhysPhil are accepted by most Colleges, however a small number of Colleges particularly welcome applications. These Colleges either have philosophy tutors with particular expertise in the Philosophy of Physics (Balliol, Brasenose, Oriel, Somerville and University College) or have a long-term connection with the subject (Exeter, New College, St Edmund Hall and St Hilda's).

“The challenge of thinking in new ways makes this course really stimulating.”



“‘Physics and Philosophy? That's a strange combination!’ – the response that nearly everyone will give when meeting a PhysPhil student. It is therefore ironic that the very reason I find Physics and Philosophy so interesting is the brilliant way in which the subjects relate. With the philosophy module of Logic being so mathematical and the Physics of Special Relativity so theoretical, my first term has already seen perfect subject overlap. I had never studied Philosophy before starting this course, but haven't felt held back at all.

The challenge of thinking in new ways makes this course really stimulating. The tutorials at Oxford are great and give you a chance to discuss the ideas you have been learning and to clarify any unclear points with those at the top of their field. Life at Oxford is definitely fast paced; with working and having fun, there is always something going on!”

Elise Bailey, 1st year Physics and Philosophy, Exeter College



Physics at Oxford

Oxford has a unique approach to undergraduate physics teaching, drawing upon the breadth and quality of the research programme and a wealth of expertise.

Teaching involves both the Physics Department and the Colleges. The Physics Department determines subject matter, arranges lectures and practicals, and sets and marks the examinations. The Colleges organise tutorials, where work is submitted and discussed, and also provide pastoral support and advice.

Tutorials

Tutorials give students direct and regular access to physicists actively involved in research and provide an opportunity to explore scientific ideas face-to-face with experts in the field. Tutors take a personal interest in the academic progress of their students and offer help and advice. Students normally have one or two tutorials a week, typically with one other student.

Our students

We seek to recruit highly-motivated students who have exceptional ability in physics and mathematics. Successful applicants need to be able to analyse and solve problems using a logical approach and see how one part of a physical system connects with another. Studying physics at Oxford provides the opportunity to learn about and understand a wide range of exciting topics.

The courses

We offer two undergraduate physics degree courses: a three-year BA Physics and a four-year MPhys. We also offer a four-year joint degree in Physics and Philosophy leading to the MPhysPhil.

The BA Physics and MPhys courses are identical for the first two years. The basic principles of modern physics, their mathematical formulation and applications are investigated in both courses. Students do not have to decide which course they wish to pursue until the beginning of the third year.

BA Physics

The three-year course provides a general education in the basic principles of physics and is probably the more appropriate degree for those not seeking a career in physics.

MPhys

The majority of students study for the four-year course, which allows students to pursue two or more fields up to the research frontier and complete a longer research project. It should be of interest to those who seek a possible career in physics and is comparable in level with advanced European degrees.


MPhysPhil

Physics and philosophy are studied in parallel for the first three years and then students may specialise in one subject or continue with both.

"I joined the Department convinced that my path lay in studying astrophysics and becoming an astronaut (who doesn't?). Four years later I am leaving to continue my graduate studies in biological physics and nanotechnology. What changed my mind? The opportunity to work with cutting edge biophysics research equipment in the teaching lab. In particular, being allowed to study my own blood with an atomic force microscope was an incredible experience. It opened up a whole area of physics to me that I had never even considered, and the support I received in the lab was superb."



Karla-Luise Herpoldt, 4th year Physics,
Lady Margaret Hall





"Oxford definitely lived up to my expectations and probably even surpassed them: the course is intense and really engaging. The unmatched opportunity to be tutored by leading experts in your field, together with the friendly academic environment fostered by the Colleges, makes Oxford a wonderful place to study."

Deyan Mihaylov, 2nd year Physics,
Merton College



“ Along with the core modules and the practical tasks, you can choose from a variety of short options; from Complex Analysis to Medical Physics. ”

Deyan Mihaylov, 2nd year Physics, Merton College

Further information

Entrance requirements

Candidates are expected to have Physics and Mathematics to A-level, Advanced Higher, IB Higher Level or other equivalent. Offers are A*AA or the equivalent, specific details can be found at www.ox.ac.uk/admissions/undergraduate_courses/.

An A-level or an AS-level in Further Mathematics may be helpful for doing this course.

How to apply

- All applicants must apply through UCAS by Saturday 15th October 2011
- All applicants must sit the Physics Aptitude Test on Wednesday 2nd November 2011

For more information about how to apply see www.physics.ox.ac.uk/admissions/.

Student finance

The cost of studying is an increasingly important consideration when applying to university. In October 2010 the Browne Review recommended changes to the way all universities in the UK are funded. Following the release of this publication and the government's comprehensive spending review, it is likely that there will be significant changes to the funding arrangements for all universities in the UK. We are not yet

certain of what these arrangements will be or when they will come into effect. When there is more certainty about the arrangements, the University will ensure these are made available on the Admissions website (www.admissions.ox.ac.uk/finance). You can also find details of student funding arrangements on the government website (www.direct.gov.uk/studentfinance). Irrespective of the financial arrangements, the University of Oxford remains committed to ensuring that UK students with the talent and academic ability to obtain a place are able to attend Oxford regardless of their background.

Open Days

Potential applicants are very welcome to join us at a full Open Day on Wednesday 6th or Thursday 7th July 2011 or the smaller Information Day on Friday 16th September 2011. You do not need to book to attend a physics Open Day, however, many Colleges also hold events on these days, which you may like to combine with your visit to the department. Booking is normally required for College events. For more information see www.ox.ac.uk/admissions/.

Careers

The skills acquired by our students are in high demand, especially in professions requiring numerate problem solving ability such as IT, finance, and technical consultancy. A large proportion (40%) of graduates take higher scientific degrees.