Undergraduate Studies in

astronomy and Physics

theoretical Physics

chemical Physics

astro Physics

Physics

Physics and economics

Physics with computing

Physics and electronics

Physics and computer science

Physics and materials science

Queen Mary College
University of London

From the Head of Department

This booklet is about undergraduate courses in physics and related subjects at Queen Mary College. We try to answer questions that many of you ask. Will I be able to cope academically? Is the course structure flexible? What are my chances of a First Class degree? And what has a College in the heart of London's East End got to offer me? We deal with all these points, and more.

We also dare to suggest that physics, as well as being intellectually stimulating and an excellent preparation for a career, can be fun. Your time in higher education should be enjoyable, as well as a period when you are introduced to the scholarship of a scientific discipline.

If you like what you read about physics at Queen Mary College, and want to know more, please write to the Admissions Tutor at the address below.

The right choice is vital for you. I wish you success wherever your studies lead you, and look forward to meeting those of you who decide to come to QMC.

Dr John Edgington

For further information write to:

Tutor for Undergraduate Admissions
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Physics - the route to a career

- With a degree in physics, the world is at your feet. Literally, for some; Christopher Holmes, chosen for training as Britain's first civilian *astronaut*, graduated from our Department in 1972.

  Not all jobs are so glamorous but the opportunities are almost limitless. Here is what some of the men and women who graduated in 1986 are doing now. You will see that many jobs are labelled *engineer* since employers recruit both physics and engineering graduates to these posts.

Anne came to us with grade B in Physics and D in Maths. She gained a 2(1) degree and is receiving *graduate engineer* training at the BBC.

William has a First Class degree and is studying for a PhD in *astrophysics*. He had a B in Physics and an A in Maths at A-level.

Adrienne achieved grades of B, C and D. Her 2(2) degree has qualified her to study for an MSc in *bioengineering.*

John and David both had an A and two B grades at A-level and are researching in *nuclear* and *solid-state physics* respectively.

Steven had grades D and C at A-level, He is a *graduate engineer* with GEC Avionics.

Ian came to study Astronomy. When his interests changed he had no trouble changing to Physics, thanks to QMC's modular degree system. Ian obtained a 2(2) degree and is now a *health physicist* at Hammersmith Hospital.

Erwin also has a 2(2); he is working as a *design engineer* at Perkins Diesel of Peterborough.

- Some students come to University after long absences from formal education. Several graduated in 1986:

Norman has a First Class degree despite leaving school without A-levels; he joined the Civil Service, studied at night school and came to us as a mature student. GEC are sponsoring him for a PhD in *molecular electronics*. Robert also left school at 15. After a plumbing apprenticeship he too came as a mature student, was awarded a 2(1) and is taking a PhD in *celestial mechanics*.

- Here are more examples from the class of ’86:

Monica had grades C and D at A-level. She has joined Marconi as an *assistant production engineer*. Ashley, with similar A-level grades, is taking an MSc course in *modern optics*.

Clive has been commissioned into the Queen’s Regiment of the *Regular Army*. Sanford’s career choice also shows the versatility of a physics degree; he is a *Metropolitan Police Cadet*. And Nicholas, the British Universities judo champion, is teaching English and improving his judo in Japan.

Diana is taking a postgraduate certificate of education. She is one of six of this year’s graduates entering *school teaching*. Diana impressed at interview and achieved an Honours Degree despite having E grades at A-level.

Andre is one of three contemporaries taking the *Certificate of Advanced Studies in Mathematics* at Cambridge University, prior to a PhD degree course.

- Many graduates work in Government physics laboratories:

Kevin is a *scientific officer* at the Ministry of Defence. Graham joined the United Kingdom Atomic Energy Authority as a higher technical officer. Both, incidentally, had grades E in Mathematics and A in Physics among their three A-levels.

- A physics degree opens doors to computing and electronics:

Robert has a 2(1) and is taking a PhD in *satellite communications*. Steven came with grades C and D at A-level and is an *electronics design engineer* at British Telecom. Nigel works in *data communications* at INMAC Corporation.

- Physics is a subject from which accountancy and the City recruits:

Jonathan is with Deloittes as a trainee *chartered accountant*, while Mark is a *management accountant* with the glass manufacturers Pilkington.

- These examples are not exhaustive. Recent QMC graduates have entered *scientific journalism, plasma physics, oil exploration* and a host of jobs where training and ability count more than who you know or where you come from.

Undergraduate courses

Entry requirements

The minimum requirements are A-level passes in Physics (or Physical Science) and Mathematics. Most, though not all, successful applicants offer a third subject. If you have a choice (and many of you do not) we particularly welcome *either* a second Maths subject, *or* a subject that stresses communications skills (eg English, Economics or a modern language). Some joint codes have different requirements - see *How to choose your UCCA code* for details.

Levels of offer range from ten points (eg BBC) for some popular joint subject codes, to six points (eg CC), an offer which may be made after a particularly favourable interview. We marginally prefer students who do well in one subject rather than moderately in several; thus, ADD is preferred to CCC. This happens to be our average offer, but as you can see from the previous pages, entrants with lower grades can do well.

The course unit system

QMC operates a modular teaching system in which courses are selected from a menu to construct a degree programme. The choice is relatively unconstrained giving students the opportunity to plan their studies according to their own aptitudes and abilities. As most of you will have little idea of the suitable combinations, standard programmes have been constructed, each corresponding to an UCCA code. The main programmes in Physics are described overleaf.

Advising and course selection

Each student is assigned to a member of the teaching staff who advises him or her on choice of courses, changes of programme, academic and pastoral matters. Normally students keep the same Adviser throughout their three years.

Students are not restricted to the UCCA code under which they enter and may choose whatever blend of courses best suits their interests as they develop at QMC. This freedom permits significant changes in programme. The main field of study which appears on the graduation certificate can be quite different from the UCCA code at entry. Indeed over a quarter of our students in Physics change their programme during their time at QMC.

We value this flexibility; it represents a style of teaching geared to the student and not the system. The existence of the same set of core courses in each programme ensures that all graduates have a common foundation in physics, yet in most years no two physics graduates will have taken identical sets of courses!

Programmes of study

Programmes taught within the Physics Department

Astrophysics

Year 1
- Optics
- Astronomical Phenomena
- Astrophysics
- + core courses

Year 2
- Electromagnetic Phenomena
- Electrical Circuits and Electronics
- Astrophysical Techniques
- Interstellar Medium
- + core courses

Year 3
- Observational and Interpretational Astronomy
- Atomic and Molecular Spectra
- Elementary Particle Physics
- Computing in Physical Science
- Optical Communications and Optoelectronics
- Atoms Molecules and Crystals
- Extragalactic Astrophysics
- + project

Physics

Year 1
- Optics
- Electrical Circuits and Electronics
- Physics Laboratory
- + core courses

Year 2
- Electromagnetic Phenomena
- Atoms Molecules and Crystals
- Computing in Physical Science
- Modelling of Physical Systems
- + core courses

Year 3
- Semiconductor Materials and Devices
- Atomic and Molecular Spectra
- Elementary Particle Physics
- Condensed Matter Physics
- Optical Communications and Optoelectronics
- Radiation Physics in Medicine
- Microprocessor Applications
- + project

Theoretical Physics

Year 1
- Analysis 1A
- Analysis lB
- Physics Laboratory
- + core courses

Year 2
- Electromagnetic Phenomena
- Atoms Molecules and Crystals
- Mathematical Methods Ill
- Electromagnetic Theory
- + core courses

Year 3
- Quantum Mechanics II
- Atomic and Molecular Spectra
- Elementary Particle Physics
- Condensed Matter Physics
- Methods of Theoretical Physics
- Physics of Continuous Media
- Statistical Mechanics
- + project

Also available: **Physics with Computing · Astronomy and Physics**
Details of these programmes appear under How to choose your UCCA code

Core courses

All degree titles will include Physics provided that the core courses shown in the centre panel are included. Subject to this you may select courses other than those listed and still have a valid programme.

Year 1
- Mathematical Methods I
- Mathematical Methods II
- Classical Mechanics
- Electromagnetism
- Quantum Physics and Relativity

Year 2
- Quantum Mechanics I
- Vibrations and Waves
- Statistical Physics
- Nuclear and Elementary Particle Physics

Year 3
- Project

Programmes taught jointly with other Departments

Physics and Electronics

Year 1
- *Choice from:*
- Basic Electrical Circuits
- Fundamentals of Telecommunication
- Digital Electronics
- Programming Fundamentals
- Electric Fields and Materials
- + core courses

Year 2
- *Choice from:*
- Microwave and Optical Transmission
- Microprocessor Electronics
- Signals and System Theory
- Digital Systems Design
- Communications Systems Electronics
- Control Systems Technology
- + core courses

Year 3
- *Choice from:*
- Microwave Electronics
- VLSI Physics and Circuits
- Advanced Control Systems
- Digital Transmission
- Antennas and Propagation
- + Physics options

Physics and Economics

Year 1
- Basic Pure Mathematics I
- Basic Pure Mathematics II
- Microeconomics I
- + core courses

Year 2
- Macroeconomics I
- Microeconomics II
- + core courses

Year 3
- Statistical Methods in Economics
- Macroeconomics II
- Computing and Numerical Techniques
- + Physics options

Physics and Materials Science

Year 1
- Thermodynamics and Chemical Kinetics
- Structure of Crystalline Materials
- Stress Analysis I
- Engineering Materials
- + core courses

Year 2
- Polymer Synthesis and Characterisation
- Structure and Properties of Engineering Alloys
- Fracture Creep and Fatigue
- X-ray Analysis and Electron Microscopy
- Mechanical Properties of Materials
- + core courses

Year 3
- *Choice from:*
- Shaping and Fabrication
- Materials Technology
- Thermodynamics of Materials
- Engineering Polymers and Composites
- Polymer Technology
- Phase Transformations
- + Physics options

Also available: **Physics and Computer Science · Chemical Physics**
Details of these programmes appear under How to choose your UCCA code

How to choose your UCCA code

Physics (F300 Physics) offers a wide range of options including computing, electronics, medical physics and communications technology, as well as topics at the frontier of research.

Astrophysics (F526 Astrophys) and *Astronomy & Physics (FF35 Astron/Phys)* differ in the final-year project (interpretational or observational) and the extent to which theoretical modelling is applied to celestial phenomena. Those who see astronomy as a possible career should select *Astrophysics*. Others, not wishing to specialise, should choose *Astronomy & Physics*. (NB The serious study of astronomy at University requires a large body of physics and mathematics, a fact reflected in our use of the joint code rather than the single subject *Astronomy* used by some Universities).

Physics with Computing (F3GS Phys/Comp) equips graduates with hardware and software skills that they can apply in industrial or commercial situations. Previous experience of computing is not needed but applicants should be interested in problem-solving and good at thinking logically.

Theoretical Physics (F320 Theo Phys) includes a number of mathematical courses and good grades in A-level Mathematics are desirable.

Physics & Electronics (F3H6 Phys/Electron) has a strong vocational element and will suit those looking for a career in instrumentation or device development.

Physics & Economics (FL3J Phys/Econ) provides opportunities for managerial or administrative careers. If you have good mathematics but do not wish to specialise in physics you should consider this programme.

Physics & Materials Science (PF23 Phys/MatSci) is another vocational programme, dealing with metals, semiconductors, polymers and ceramics. An interest in chemistry is desirable.

Physics & ComputerScience (FG3S Phys/CompSci) teaches the theory and principles of computing and is a good preparation for a career in information technology. You should have an aptitude for formal computing if applying for this programme.

Chemical Physics (F334 Chem Phys) requires Chemistry at A-level and is as interdisciplinary as its name suggests.

- If you are unsure which course to choose, select *F300 Physics*. Options can be discussed at interview.

Studying physics at QMC

Taught courses

The teaching year is divided into two semesters, each of twelve weeks, and students study three or four courses each semester. Many courses include experimental work or other practical components (writing and testing computer programs, for example; or astronomical observations). In a typical week a student will attend about ten lectures, two tutorials and two exercise classes, and two practical classes - a total of 20 hours of directed learning. As much time again is spent in private study -reading textbooks, revising lecture notes, analysing experimental data and solving exercises. This is a demanding schedule: being a student is a full-time job!

Industrial placement

Students in their second year are offered the opportunity of summer work in a variety of commercial and Government laboratories. These posts are varied and rewarding and can prove helpful in choosing subsequent careers.

A limited number of longer-term placements may also be offered to outstanding students.

Project work

The final year project is very important. It enables a student to conduct a serious investigation which bridges the gap between the taught courses of earlier years, and the problems the graduate will be faced with in his or her subsequent career.

The project may be an *Experimental* investigation, carried out in one of the research groups; a *Computer* project, involving data analysis, systems modelling or a hardware interfacing task; a *Measurement* carried out by attaching the student's own apparatus to fully instrumented permanent facilities; *Theoretical* analysis of an outstanding problem in physics; or an *Astronomy* project using one of the Department's telescopes. Recent titles include:

Interfacing a Raman Spectrometer · Quasars and the deceleration parameter of the Universe · A tunable fibre optic laser · Is gravity getting weaker? · A programme to draw molecules
Calibration of a thermal neutron source.

Students find these projects extremely enjoyable and often say that only after completing them do they fully appreciate the coherence and relevance of material taught in earlier courses.

Assessment

Projects and a few other courses are assessed by report and interview. The rest have written examinations with a pass mark of 40%. You must pass about three-quarters of your courses to proceed from year to year and obtain a degree.

Total failure is unlikely - it is only achieved by failing two resit exams. For example, 67 students entered in 1983. Three years later, 66 graduated. A few students fail courses and withdraw from College to resit, but others return after successful resits and the net failure rate is low.

Degrees and Prizes

Some statistics may be interesting. Of 153 graduates in 1984-86, 28 (18%) obtained a First Class degree, 35(23%) an Upper Second, 46 (30%) a Lower Second, 33 (22%) a Third and 11(7%) a Pass degree. Some students do outstandingly well. The Granville Prize for the best physics graduate of London University has been awarded to a QMC student in five of the last eleven years.

Other prizes are awarded by the College, by the Drapers' Company, and by various benefactors. We particularly value the annual Renishaw Prize of £100 for the best project. This is the gift of an industrialist, one of our Visiting Professors, and symbolises our links with life outside the ivory tower, and the Department's determination to prepare its students for worthwhile careers.

The Physical and Astrophysical Society

This student-run society helps to keep students in touch with developments in physics and astronomy, to learn about careers and generally to experience some of the excitement of science today. It organises meetings, excursions, book fairs - and of course parties! The impressive list of regular speakers includes Patrick Moore, a Fellow of the College and a frequent visitor.

Living in London

Accommodation is available in either College or University Halls of Residence, or in privately rented flats or bedsitters. All housing is checked for suitability by the Accommodation Office.

- Any applicant who firmly accepts our offer of entrance through UCCA and requires accommodation in the College Halls has a near-certainty of obtaining it.

Research in the Department

Research goes hand-in-hand with teaching. Recent highlights include the Nobel Prize-winning discovery of the W and Z particles at CERN; the pioneering voyage of the infra-red astronomy satellite IRAS; discovery of the principles behind a possible molecular memory device; and the theory of superstrings, which seeks to unify gravity with the other forces of Nature.

- In its survey of Universities in 1986, the University Grants Committee ranked QMC among the top 20% of Physics Departments in the United Kingdom.

Major Research Themes

The Department has nearly thirty permanent academic staff who teach and conduct research and a similar number of research staff with limited teaching duties. Research is concentrated in five main areas. *Experimental nuclear and particle physics* ranges from studies of phenomena at ultra-high energies, to measurements of the nuclear properties of constructional materials. The *astrophysics* group operates a programme of ground-based and satellite observations at infrared and millimetre wavelengths, while the *polymer physics and molecular electronics* group works closely with industry in the study of the electrical, mechanical and optical properties of novel materials. Interests in *theoretical physics* include general relativity, the foundations of quantum mechanics, and a number of its applications as well as the modelling of properties of matter which have technological relevance. The *engineering physics* group conducts research into advanced communication and receiver systems and related topics, in close collaboration with the Faculty of Engineering and industrial research laboratories.

Research and teaching

These activities interest students and we introduce them, as appropriate, into the undergraduate curriculum. We believe that a Department ranking as one of the leading research institutes in the country should ensure that its own students benefit from this. Indeed every one of our academic staff, from senior professors to the most junior recruit, undertakes lecturing, tutorial and demonstrating duties, and acts as personal Adviser to a group of students.

There are, of course, opportunities to proceed to a higher degree (MSc or PhD) after graduation. Students interested in research within the Department are encouraged to discuss the possibilities with their Adviser during their final year.

QMC and its surroundings

The past

Our students come from the whole of the United Kingdom, and beyond. Nearly 20% are from overseas, while only one in four is a Londoner. This diversity of backgrounds and cultures matches the College's situation in the heart of the East End.

Descended from the People's Palace, a philanthropic institution for the urban poor, the College has attained great distinction in teaching and research yet has refused to turn its back on its origins. The blitzed slums around it were replaced by local authority housing, and the area is now experiencing an equally dramatic change - the development and rehabilitation of the Docklands, putting QMC at the centre of one of the most exciting areas of London.

The present

North along the campus boundary, past the new College Library (the first University Library designed to exploit modern information technology) runs the Regent's Canal. Its canalside path, a favourite route of our joggers, runs through the rejuvenated Lea Valley Park to the West End and beyond.

To the east Britain's newest airport, London City, has brought Europe's major cities within easy reach. And a mile or so to the south, past the Dockland Light Railway with its direct connection to the City of London, lies the Thames. Through the foot tunnel, a marvel of Victorian engineering, is Greenwich Park and the Old Royal Observatory. Our students can use its antiquated but delightful 28" refractor.

Westward, the Mile End Road leads to Whitechapel, Aldgate and the City. Home of the explorer James Cook; birthplace of the Salvation Army; site of Britain's oldest bell foundry, newest mosque, best kosher restaurant, the road is a lively microcosm of London's history.

The future

QMC is experiencing a major expansion in teaching and research. The pre-clinical teaching faculties of the London and St Bartholomew's Hospital Medical Schools are moving to new premises on the College campus. Another new building will house an enlarged Arts faculty arising from a merger with Westfield College on the QMC site. These developments will add further distinction and variety to the College's academic life. Generous donations have allowed the College to plan new student residences on the banks of the canal to accommodate the growing student body.

If you like bustle, urban living, friendly teaching staff, and the opportunity to explore the capital while studying at London University, we should be pleased to hear from you.