Physics at Queen Mary College

University of London

PHYSICS AT QUEEN MARY COLLEGE

☐ This booklet answers some of the questions asked by applicants to study physics at Queen Mary College. If you are about to embark on a programme of University study in physics, you will be meeting the challenge and excitement which are both the cause and effect of the great surge in the understanding of the universe which modern physics has brought about. But you will in addition be acquiring the foundation for a career which will extend into the twenty-first century. It would be foolish to try to predict with precision in what sort of work you might then be engaged. But we have been at pains to see that the kind of study you would pursue in our department should hold you in good stead. To this end there is flexibility in the choice of courses which we regard to be imperative in this fast-changing world of today, and there is opportunity to explore the inter-relatedness of physics with other fields of study.

☐ The student of physics at Queen Mary College does not follow a rigidly defined course of study. Instead he is encouraged to select courses from a broadening range of topics to give a programme which suits his abilities and interests as they develop, and in a way most appropriate to his own circumstances. This flexibility is permitted by the Course Unit structure of the University of London B.Sc. degree which is accepted with enthusiasm by the teaching faculty in the Department. Of course counsel and guidance are given in making an effective choice of subjects to be studied.

The course unit structure

☐ The University of London regulations require that in order to graduate a student shall have been examined in a minimum of nine units, and have passed in a minimum of eight. In fact most students are encouraged to take closer to the maximum permitted number of twelve units. We have found it convenient to teach in courses valued at 1/2-unit each, so that a student will study three or four courses in each semester (half-year) of his undergraduate programme. And typically a 1/2-unit course consists of two one-hour lectures a week, together with course work, tutorials and in appropriate subjects, laboratory work. Courses are examined at the end of the session (year) in which they have been studied. There are no examinations in practical work, but the performance in laboratory and coursework is separately assessed and taken into account together with the examination results. Tutorials form an essential component of our teaching. Tutorial groups are small (three or four students) to

provide for more individualised instruction, and they afford the basis for the easy relationships between teaching staff and students proper to the function of a University. For most courses there is a tutorial session once a fortnight, so that a student attends one or two hours a week of tutorials. There are available for students in their second and third years project courses including an essay project and a computer project.

☐ Registration in a Department of the Faculty of Science means simply that the staff of that Department have primary responsibility for advising and counselling the student in his choice of courses. These would not be exclusively from courses taught in that Department. Thus Physics students would certainly take a number of courses taught in the Mathematics Departments, and many have interests which take them much further afield. The College Prospectus contains a complete list of courses currently taught in the Faculty of Science and of courses offered by other Faculties to Science students. But perhaps the simplest way to appreciate how the unit structure works in practice to permit and to encourage flexibility of curriculum is by means of case-histories. In the examples which follow, the Department in which the course is taught is indicated by the key:

B Biological Sciences Departments
C Chemistry Department
E Economics Department (Faculty of Arts)
EE Electrical Engineering Department (Faculty of Engineering)
H History Department (Faculty of Arts)
M Mathematics Departments
P Physics Department

☐ **A student interested in biology and biophysics.** He took in this order the following courses during his three years' degree work:-

Mechanics (P) Spirit of Physics (P) Introduction to Computer Science (M) Electronics (P) Optics (P) Mathematical Applications I & II (M); Basic Biochemistry (B) Atomic Physics (P) Electro-magnetism (P) Thermodynamics (P) Basic Computer Science (M) Introduction to Organic Chemistry (C); Physics of Matter (P) Atomic & Molecular Spectra (P) Physics in Design (P) Principles of Genetics (B) Experimental Practice (P) Comparative and Environmental Physiology 11(B).

Both the technical and basic aspects of Physics are becoming more and more recognised as a sound introduction to fundamental work in the biological sciences. This graduate is now carrying out re search in neurophysiology. Notice how the fraction of biological

courses increased throughout his three years- work but that Mathematics and Chemistry courses also featured in his choice.

☐ **A student, whose interest broadened beyond pure physics** took the following courses during his three years at College:-

Mechanics (P) Spirit of Physics (P) Optics (P) Electronics (P) Introduction to Computer Science (M) Mathematical Applications I (M) Introduction to Probability and Statistics (M); Quantum Mechanics I (P) Physics of Matter (P) Continuous Media I (M) Atomic Physics (P) Nuclear & Elementary Particle Physics (P) Basic Computer Science (M) Atomic & Molecular Spectra (P); Economic Theory I (E) Astrophysics (P) Essay Project: Galactic Structure (M) Economic Theory 11(E) Philosophy of Science (P) Economic History I (H) History of Science (P) Economic History II (H).

This student is now taking an industrial accountancy qualification. The background of Science with Economics will be a valuable asset. A rather similar choice of courses could well be followed by students with interests in teaching, administration or the Civil Service.

☐ **A student interested in theoretical physics** took the following courses:-

Introduction to Computer Science (M) Algebra I (M) Methods of Mathematics I & II (M) Mechanics (P) Spirit of Physics (P) Optics and Wave Motion (P); Theoretical Dynamics (M) Continuous Media I (M) Atomic Physics (P) Electromagnetism (P) Mathematical Methods III (P) Quantum Mechanics I (P) Nuclear and Elementary Particle Physics (P) Electromagnetic Theory (P); Physics of Matter (P) Quantum Mechanics II & III (P) Statistical Physics I (P) Essay Project (P) Elementary Particle Physics (P) Methods of Theoretical Physics (P) Nuclear Structure and Reactions (P).

This student was from the time of her entry into the College keenly interested in the theory of elementary particles. She is now doing post-graduate work in that field at another University.

☐ **A student with astrophysical interests** took the following courses:-

Mechanics (P) Optics (P) Mathematical Methods I (M) Electronics (P) Theoretical Dynamics (M) Mathematical Methods II (M); Atomic Physics (P) Electromagnetism (P) Thermodynamics (P) Mathematical Methods III (P); Quantum Mechanics 11(P) Astrophysics (P) Structure & Evolution of Stars (M) Elementary Particle Physics II (P) Group Theory and Spectroscopy (P) Relativity and Cosmology (M).

This selection of courses gave this student a powerful background in theoretical Astrophysics. She is now reading for a research degree (Ph.D.) in this subject at another University.

☐ **A student interested in electronics** took these courses:-

Mathematical Applications 1(M) Methods of Mathematics 11(M) Introduction to Computer Science (M) Mechanics (P) Spirit of Physics (P) Optics and Wave Motion (P) Electrical Circuits and Electronics (P); Atomic Physics (P) Electromagnetism (P) Thermodynamics and Elementary Statistical Physics (P) Mathemati cal Methods III (P) Quantum Mechanics I (P) Nuclear and Ele mentary Particle Physics (P) Physics of Matter (P) Atomic and Molecular Spectra (P); Telecommunications I &II (EE) Essay Project (P) Elementary Particle Physics I & II (P) Astrophysics (P) Experimental Practice (P) Physics in Design (P) Computer Electronics (P) Experimental Project (P) Data Analysis (P).

This student obtained a broadly based physics degree, but at the same time chose particularly to emphasise topics related to electronics. He is now in employment with the Post Office.

☐ These examples show the versatility of the scheme. In fact about half the students registered in this department still select courses which yield a more orthodox programme of physics, modern in content but traditional in style. There is a continued demand in research, in teaching and in industrial science for people with such a background.

Admissions Procedure

☐ Students who wish to study Physics at Queen Mary College may apply under any of the three UCCA codes 3300 Physics, 3302 Theor Phys (Theoretical Physics) or 3340 Astrophys (Astrophysics). There are also codes appropriate for applicants who expect their studies to be more or less evenly divided between physics and some other field. These Combined Honours codes are 37EH Chem/Phys (Chemistry and Physics), 3220 Comp Sci/Phys (Computer Science and Physics) and 3200 Maths/Phys (Mathematics and Physics). It should be emphasised that acceptance under any one of these codes does not restrict the choice of course.

☐ In most cases, apart from meeting the formal entry standards of the University of London, an applicant will be required to have adequate attainment in physics and in mathematics at A-level. The A-level grades required for admission will vary according to the particular circumstances of individual applicants. Applicants for admission are strongly encouraged to visit the department, and appointments are offered for interviews. The department welcomes applications from mature students.

☐ Further information relating to the courses offered and to the appropriate UCCA codes is contained in the College Prospectus.

Research and Post-Graduate Study

☐ The staff of the Department are actively engaged in research. Their interests lie in four principal fields:

Theoretical Physics

algebraic methods in strong interactions of elementary particles
symmetries and symmetry breaking in elementary particle physics
theory of superfluids
solvable models for many body problems
Heisenberg's model of a ferromagnet
algebraic methods in statistical mechanics crystal field theory

High Energy Physics

Experimental investigations using:
the 25 GeV proton synchrotron at the CERN laboratory in Geneva
the 7 GeV proton synchrotron at the Rutherford High Energy Laboratory
the 150 MeV synchrocyclotron at the AERE Laboratory, Harwell.

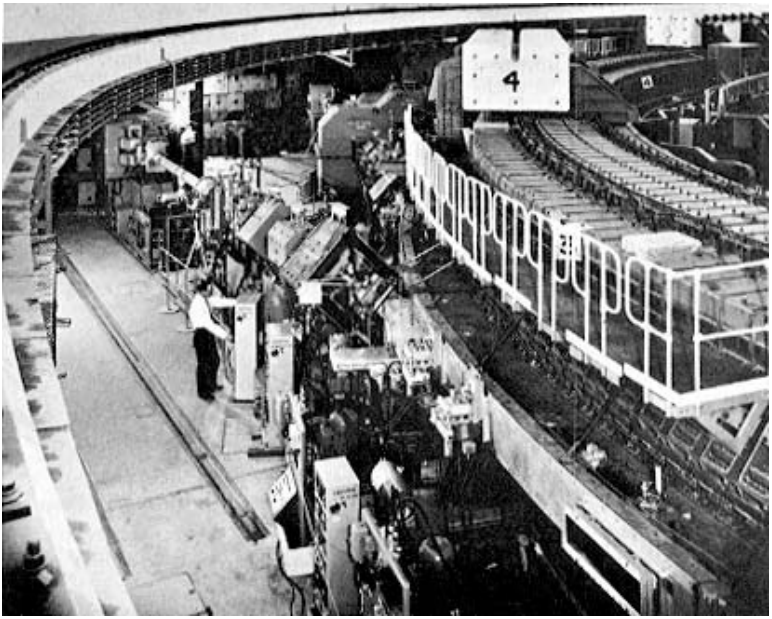
Present techniques utilise
scintillation and Cerenkov counters
wire spark chambers
on-line computers.

Polymer and Solid State Physics

Experimental investigations of excitations in magnetic, di-electric and polymeric solids - using submillimetre and far ultra-violet spectrometry and neutron scattering
phase transitions in solid hydrogen halides
phonons in rare-gas crystals
thin-film properties of ferro-electric and pyro-electric materials
preparation of polymers in chain-extended form.

Infra-red Astronomy

Investigations using detectors cooled in liquid helium in con-junction with:
a 1 .5 metre equatorial telescope on the roof of the Department
the Isaac Newton 2.5 metre telescope at the Royal Observa tory, Herstmonceux
the 1 .05 metre Cassegrain telescope at the high altitude Pic-du Midi Observatory in the Pyrenees
balloon-borne interferometers flying at 40 km from Palestine, Texas.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Observations are presently being made of:-

luminescent, infra-red and thermal properties of lunar samples
sub-surface lunar radiation
far infra-red solar activity
the radio sources Orion A and Taurus A
3°K cosmic background radiation

☐ Students with adequate first degrees are accepted to do research leading to the University of London Ph.D. In addition there is a part-time M.Sc. course in Astrophysics, for which the formal teaching is arranged on one evening a week.

Statistical Data*

The Department of Physics	138	undergraduate students	
	47	post-graduate students	M.Sc.
	31	post-graduate students	Ph.D.
	13	post-doctoral fellows	
	23	teaching staff	
The Faculty of Science	7	departments	
	863	undergraduate students	
	188	post-graduate students	
	36	post-doctoral fellows	
	122	teaching staff	
The College	4	faculties	
	2296	undergraduate students	
	486	post-graduate students	
	55	post-doctoral fellows	
	272	teaching staff	
The University	15	colleges (non-medical)	
	14	institutes	
	23,000	full-time internal undergraduate students	
	8,800	post-graduate students	

The College Library has about 150,000 volumes and subscribes to some 1,500 periodicals and journals.
The University Library has about a million volumes and subscribes to some 5,000 periodicals and journals.

*1970-71

Undergraduate Residence

☐ The College has four Halls of Residence in South Woodford, providing accommodation for 556 students. Some places are also available in the University Halls of Residence. Over 90% of applicants for accommodation in Halls of Residence in their first year are successful. The College figures on residence for full-time under graduate students in 1970-71 were:

	Hall	Lodgings or Flats	Home
Men	503	739	380
Women	147	337	133

Activities of Interest to Schools

☐ Four evenings of activities intended mainly for 5th and 6th forms are held in the Department in May. Each evening consists of demonstrations and displays and a lecture about some aspect of current interest in physics. Booking for these evenings is recommended.

☐ The Department has a pool of apparatus which is available for loan to schools.

☐ Visits to the Department can be arranged.

☐ **The photographs**

Inside front cover : a winter view of the physics building

Page 6 (top) : beam lines emerging from the NIMROD 7 GeV accelerator at the Rutherford High Energy Laboratory. One of these supplies protons for an experiment mounted by the high energy physics research group. (Photograph by courtesy of RHEL of the SRC.)

Page 6 (bottom) : members of the infra-red astronomy research group at the high altitude observatory in the Pic-du-Midi.

Opposite : visitors from a school examining a fragment of lunar rock in the lunar laboratory.

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