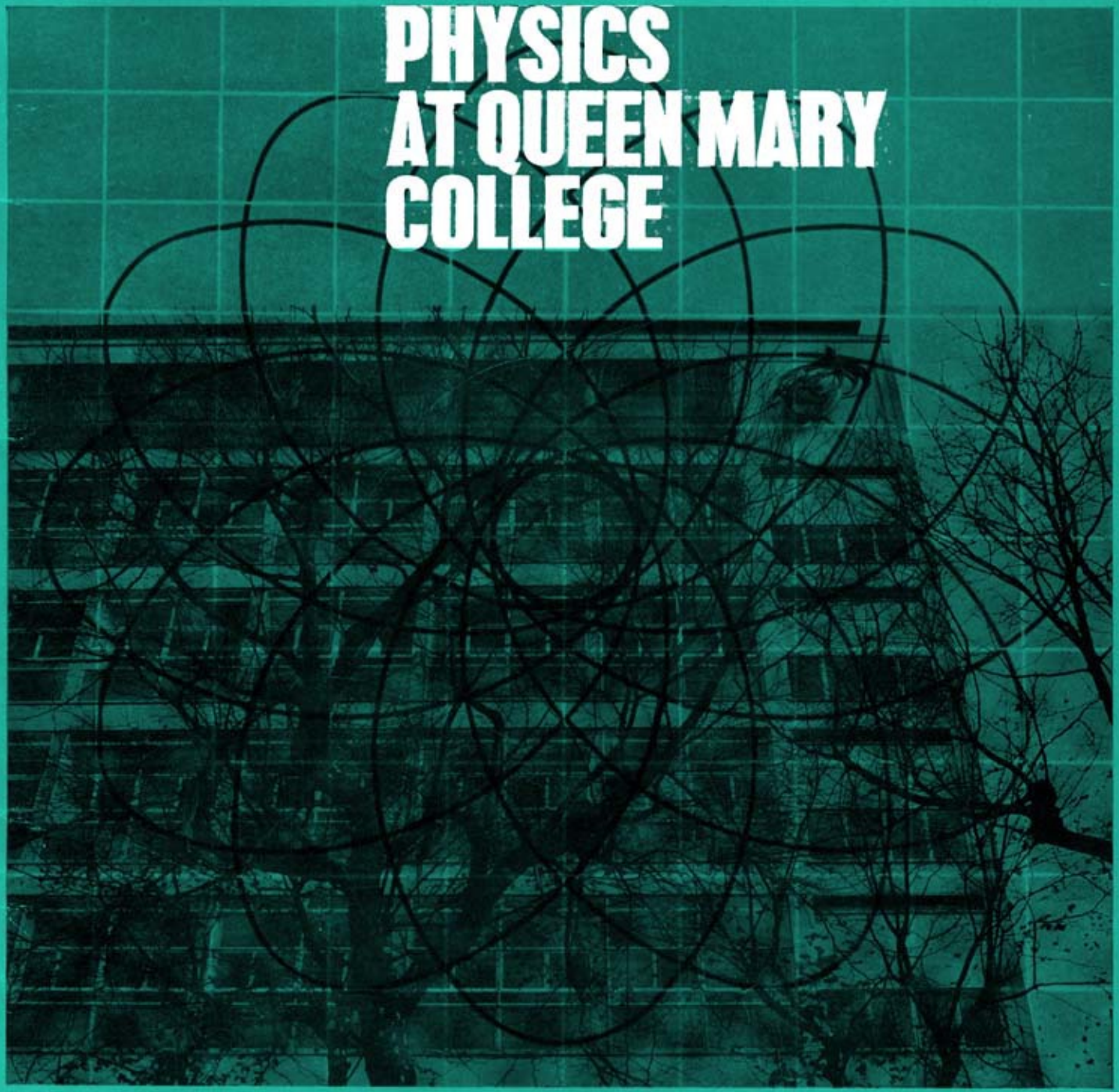
PHYSICS AT QUEEN MARY COLLEGE



PHYSICS AT QUEEN MARY COLLEGE

(University of London)
Mile End Road London E1
published on the occasion of the Opening by
Sir Nevill Mott FRS of the new building for the
Department of Physics 23 January 1963

The New Physics Building

We in the Department of Physics at Queen Mary College are fortunate that our new building has been designed as a whole, and not as an extension to an existing building. Our good fortune rests upon the misfortune of our predecessors, who worked in cramped and unsuitable accommodation, and upon the misfortune of the second War, which freed the present site by the bombing of St Benet's Church. We believe we have been unusually fortunate in the degree of understanding reached with the Architects, who began by finding out what we wanted, and ended by meeting our demands in a gracious building. We owe a great deal to the Chairman, Principal and Registrar of Queen Mary College, for their determined encouragement and help.

The size of the building was governed by the expansion programme of the College as a whole. The new Department was to admit annually 50 students for the B.Sc. Special Honours degree of the University of London; it is now therefore of about the same size as some of the larger physics departments outside Oxford, Cambridge and Imperial College, London, For us this has meant a rapid increase in numbers. The new building is to accommodate also 40-50 full-time me post-graduate research students working for the Ph.D. degree, an academic staff of about 20, 6-10 post-doctoral research fellows or research assistants and about 40 technical, secretarial and other staff.

In the design of the building, however, the over-riding idea has been that it is for occupation by human beings. Wherever it has been possible to combine comfortable—and even beautiful—surroundings with the necessities of modern physics, this has been done. It is hardly an exaggeration to say that the design began at the helical staircase preserved as the only souvenir of the old Department and now a feature of the physics museum. The museum is a spacious room with windows on two sides situated at the centre of the research area of the building. It is the departmental meeting place, used daily by all the 'residents' of the building (the academic, technical, secretarial and other staff and the research students) for their coffee and tea breaks. It is used also as a scientific museum and public art gallery.

For undergraduate students the building must seem somewhat different. Indeed, to a first year student it must appear to consist of an

(left and below) The new physics building. Architects: Playne and Lacey and Partners, 19 Queen Anne's Gate, Westminster, SW1.

(above) Architects' sketch of the physics building seen from Mile End Road.

(below) A view of the site of the new physics building photographed in 1906 showing St Benet's Church and Mile End Road.

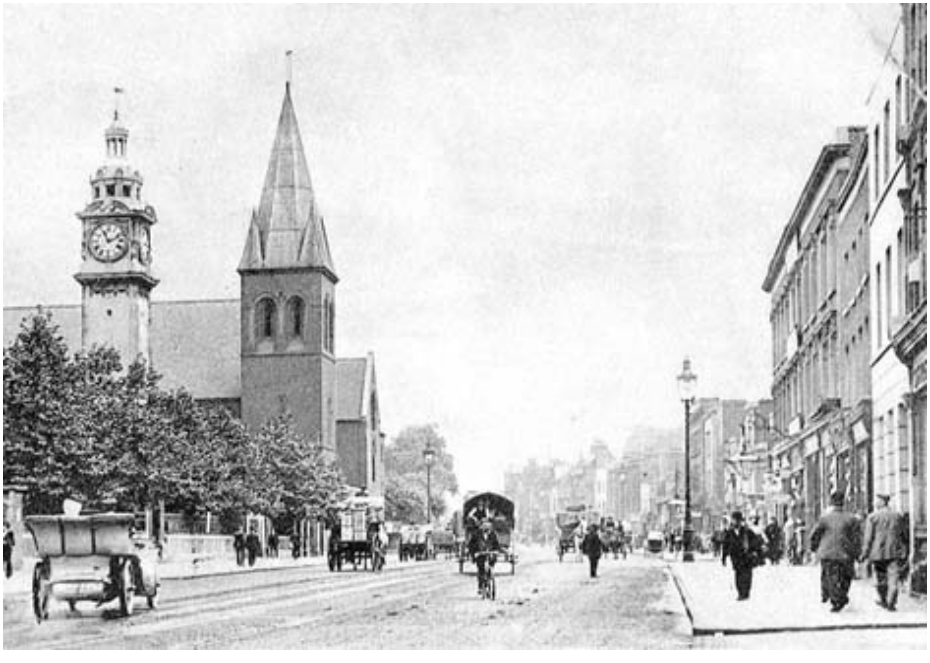
entrance hall and a lecture theatre on the ground floors, lifts, and his own laboratory at the top of the building. We hope that the two inter-penetrating departments interact just sufficiently to encourage undergraduates to hope that they may later become residents. The building was erected in two stages. The first stage, a large eight-storey block consisting mainly of teaching laboratories and lecture rooms, was completed in 1960. The final stage, a three-storey wing consisting mainly of research rooms, was completed in 1962. We now describe some features of the building.

Lecture Theatre and Lecture Rooms
The main lecture theatre is entered directly from the entrance hall. It seats about 140 in a steeply raked terrace and is furnished in beech and mahogany with upholstered tip-up seats. An unusual feature is a set of double-glazed wooden louvres covering most of one side of the theatre. To the audience looking towards the lecturer only the woodwork can be seen. Walkers in the corridor outside can, however, look directly into the theatre, and the lecturer can look outside.
Two very large revolving chalk-boards are power-operated and cleaned. There are full facilities for showing slides and films from a projectionist's console; 2" x 2" slides can also be operated automatically from the lecturer's table. Service points are available for demonstration experiments but are normally hidden behind movable sections of the table.
A preparation room for lecture demonstrations is adjacent to the main lecture theatre. It connects also with two smaller lecture rooms, seating about 60 and 80 respectively, one (LG1) directly, and the other (UG1) by service lift.
Adjacent to the museum and in the centre of the research area of the building, there is a room (112) for research seminars, seating about 40.

Teaching Laboratories
The five upper floors of the building house the teaching laboratories, in most cases nearly the whole of one floor being allocated to the needs of a given group of student. The laboratories have their own preparation rooms, optics rooms, photographic dark rooms, seminar rooms and small libraries for private study, but because the needs of different groups of students differ greatly, the various laboratories are very different from each other in detail.
There is a vertical column of staff rooms at one corner of the building which make it possible to supervise the teaching laboratories conveniently.

6th Floor: 1st year Special Honours (S1) Laboratory (Room 602) The laboratory is designed for 50 students, who will all be studying experimental physics. First year Honours students, after an introductory laboratory course lasting six weeks, proceed to a variety of experiments on general and thermal properties of matter, thermal radiation, vacuum measurement, optical investigations (geometrical and physical optics), a.c. and d.c. circuits and electronics. The laboratory commands unusually fine views of the City of London to the west, and the East End to the east.

5th Floor: 2nd year Special Honours (S2) Laboratory (Room 503) This laboratory also accommodates 50 students. The course of experiments is continuous and integrated with those of the Si laboratory. The laboratory contains a small workshop for the maintenance and preparation of apparatus for both Si and S2 laboratories.



(bottom left, and right) The physics museum, used as a meeting place for staff, technicians and research students, as a scientific museum, and also as a public art gallery.

(top left) The physics museum viewed from the corridor with a research room on the right.

4th Floor: 2nd and 3rd year General Honours (G2, G3) and 1st and 2nd year Ancillary (Al, A2) Laboratories (Rooms 401, 404) The laboratory provides accommodation for over 100 students taking Special Honours in other subjects (botany, chemistry, geology and zoology) and also for a smaller number of students taking physics as one of the subjects for the General Honours degree. The experiments cover such subjects as radio activity, ultrasonics and transistor electronics as well as those of classical elementary physics.

3rd Floor: 1st year General Honours (G1) Laboratory (Room 302) The laboratory can accommodate about 25 students and is designed for the more elementary instruction of the first year of the General Honours degree course.

2nd Floor: 3rd year Special Honours (53) Laboratory (Room 205) In the final year of their course, Special Honours students either carry out an extended experimental projector concentrate on theoretical work. Normally about two-thirds of the class (about 30 students) choose experimental physics and work mainly in this laboratory. The projects are often associated with the research interests of members of the staff, and are supervised by them. Recent examples include studies of crystal growth, of phase-equilibria in solidified mixtures of the inert gases, and of problems involving, resistance network analogues. This laboratory has its own students' workshop, and a computing room.

Library
The Departmental library is open to all members of the Department except first and second year students. It contains about 1200 books and is a specialist library with good lists of books covering advanced physics and the research interests of the Department in particular. Borrowing of books is not allowed.

Research
There is a wide range of research in the Department, with a number of large and small groups and of individuals having their own interests, We regard the training of research students—who will shortly number 40-50—as an important part of the teaching work of the Department and try to engage in research work which is effective in providing worth while training. Work at present in progress is summarized below

(left) Sketch by Feliks Topolski in the physics museum.

(below) A view from the sixth floor.

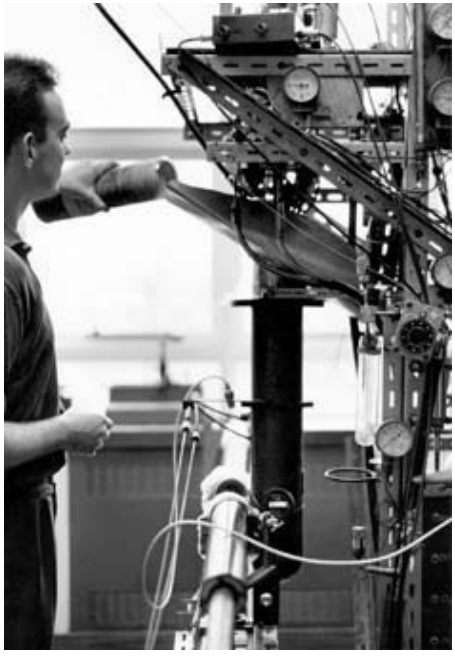
(top right) A view of the main entrance hall, showing a photographic enlargement of a drawing by Leonardo da Vinci.

(bottom right) A lecture in progress in the main lecture theatre.
Sketches by Feliks Topolski (extreme right).

Low-temperature physics, sub-millimetre spectroscopy etc. (Dr R Heastie, Professor G O Jones, Dr D H Martin, Dr F E Neale, Rooms 114-120,308, 407, 506) Subjects of current interest are the study of the solidified inert gases and the spectroscopy of solids at extreme intra-red (sub-millimetre) wavelengths.
We are studying the optical and elastic properties of polycrystalline argon, krypton etc. by various methods and are preparing methods of growing single crystals. Work at sub-millimetre wavelengths carried out has so far included studies of ionic crystals, ketones and anti -ferromagnetics.
Experiments have been carried out at liquid helium temperatures and have also used super conducting bolometers working at these temperatures. We are continuing with studies of long molecules, of the solidified inert gases, of liquid helium II, and of the magnetic properties of crystals. The development of better sources, particularly harmonic generators, now forms an important part of, this work.
Until quite recently, our low-temperature experiments were based on miniature helium and hydrogen liquefiers designed and built in the equipment of the new building we now have installed an A. D. Little (Collins) helium liquefier and are in the course of adapting our experiments to use this central supply of liquid helium. Experiments in the liquid hydrogen range—which are quite common in this laboratory because of our interest in the solidified inert gases—will, however, probably continue to employ miniature liquefiers for some time.

Nuclear magnetic resonance (Dr J G Powles Rooms 109,110) We are studying molecular thermal motions in liquids and solids. The macroscopic nuclear magnetic parameters reflect the nature, rate and extent of these motions. Materials now of particular interest are simple organic and inorganic liquids, glass-forming substances such as glycerol and various polymers, crystals containing water of crystallization, and crystals having phase transitions in the solid state. The apparatus available for these studies includes a Varian 12" electromagnet and 3 permanent magnets. Most of the associated electrical equipment has been built in the laboratory.

(below) The Departmental library.

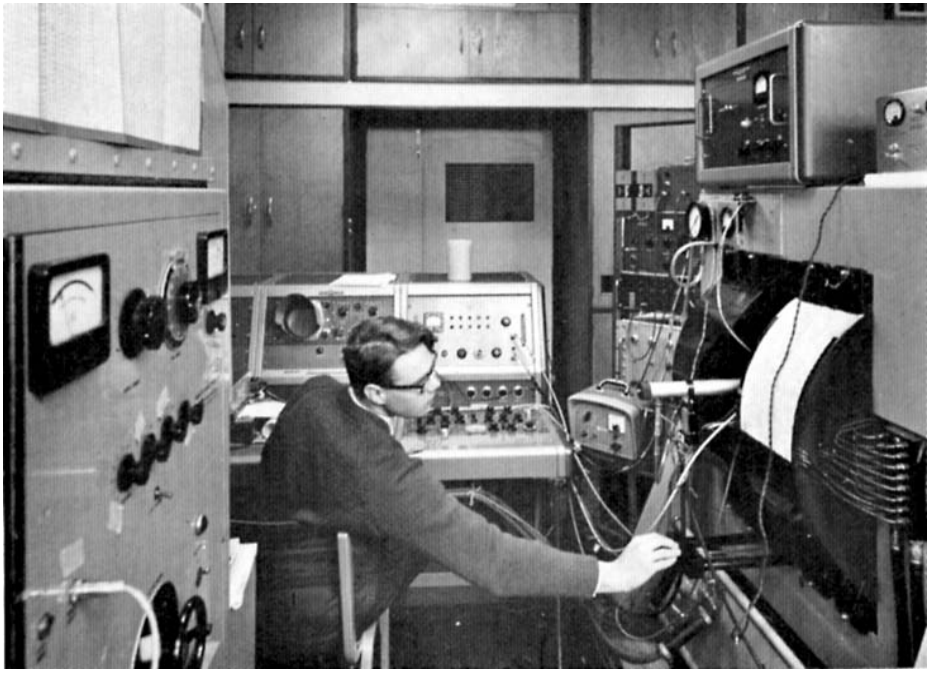


(top left) First year Honours students at work in their laboratory.

(top right) A cast rod of the inert gas argon solidified at a low temperature.

(right) A research student carrying out an experiment in low-temperature physics.

(extreme right) Sketch by Feliks Topolski.



(left) Varian 12” magnet used in nuclear magnetic resonance experiments

(above) The mobile astrophysics laboratory in Switzerland.

(left) A view of the astrophysics laboratory on the roof, showing one of the telescopes.

(right) A member of the staff making a measurement in X-ray crystallography.

Nuclear physics (Dr A Ashmore, Dr W H Range, Rooms 122, 123) We are able to make use of the facilities offered by the National Institute for Research in Nuclear Science at the Rutherford High Energy Laboratory, Harwell. Current experiments include measurements of triple scattering parameters and of polarization effects, using the 50 MeV proton linear accelerator. Work in the Department consists of the preparation of these experiments, of experiments for the 7 GeV proton synchrotron, and the development of methods for data handling on the experiments.

Astrophysics (Dr J A Bastin, Professor G 0 Jones, Rooms 701, 702) Arising out of the improvement in extreme infra-red, sub-millimetre and millimetre wave techniques, we have recently begun to perform astrophysical experiments at millimetre wavelengths. A number of reflecting telescopes (60" or 200" in diameter) in various mountings have been assembled in the laboratory and employed on the roof of the physics building, on a mobile laboratory—a 4-ton lorry—which has travelled to Switzerland, and at the College playing fields at Dytchleys, Essex, in studies of the sun, moon, planets and atmosphere at millimetre wavelengths.

Architectural acoustics (Dr E J Irons) A study is being made, in collaboration with the Building Research Station of the DSIR, of methods of artificially increasing the reverberation times of auditoria. Experiments have been performed in a disused factory in Hackney, in the Great Hall of Queen Mary College and in the Royal Festival Hall.

Ferroelectrics (Dr J C Burfoot, Room 508) We are studying ferroelectric domains by electrical methods, by etching, by deposition, with polarised light, and with an electron probe. Theoretical implications of the movements of domain walls are being considered, and we are investigating details of the transition to the non-ferroelectric state at the Curie temperature. We have also investigated the use of barium titanate in computer circuits, where it has possible applications, and are growing single crystals of various ferroelectrics.

X-ray crystallography (Dr E Sándor, Rooms 307, 310) We are studying the diffuse scattering of X-rays by molecular crystals (such as hexamethylenetetramine and anthracene) at various temperatures, attempting to separate the thermal diffuse scattering of the molecules from their disorder scattering, and to derive from the former the frequency spectrum of the molecular vibrations.
At present the group is equipped only for photographic registration of the diffuse scattering but an automatic counter diffractometer is on order. The group also co-operates with other research groups in the Department and in other Departments of the College which require the use of X-ray techniques.

Theoretical physics (Dr R O Davies, Dr S Doniach, Professor R K Eisenschitz, Dr J W Leech, Mr G Mandel, Dr D J Newman) The subjects studied follow, in part, the range of subjects studied in the experi mental researches of the Department In solid-state physics the main subjects studied are the space and time correlations of dynamical quantities and their application to the Mössbauer effect and to transport properties, the ground state electron structure of solidified inert gases, and the numerical evaluation of their thermodynamic properties, and the coupling of excitons and photons in solids. The line breadths of the low excited levels of rare-earth compounds are studied in relation to the spectroscopy of the sub-millimetre region.
Studies of the liquid state include the use of collective movement theory in the determination of transport and thermodynamic properties, electronic levels and electrical conductivity.
In nuclear physics a study is made of the collective movement theory of heavy nuclei and its application to collisions.
Research students in theoretical physics work in a suite of six small rooms (Rooms 216,8,9; 221, 2,4), each room accommodating two students.

Offices and Service Rooms
The main Departmental offices (Rooms 209, 211, 212) are adjacent to the Head of Department's room (Room 208) and near those of senior members of the Department. The Laboratory Steward's room and office (Rooms UG7, UG6) are adjacent to the main entrance hall. Technicians have a common room (Room UG4) and locker and shower rooms (Rooms UG2, UG3) also in this area. Most of the service rooms of the Department are centrally situated, near the main

(top left) A view of the main workshop.

(bottom left) The liquefier and compressor room.

(below) A typical service shelf with panel removed to show the arrangement of pipework; and a combined staff room and laboratory.

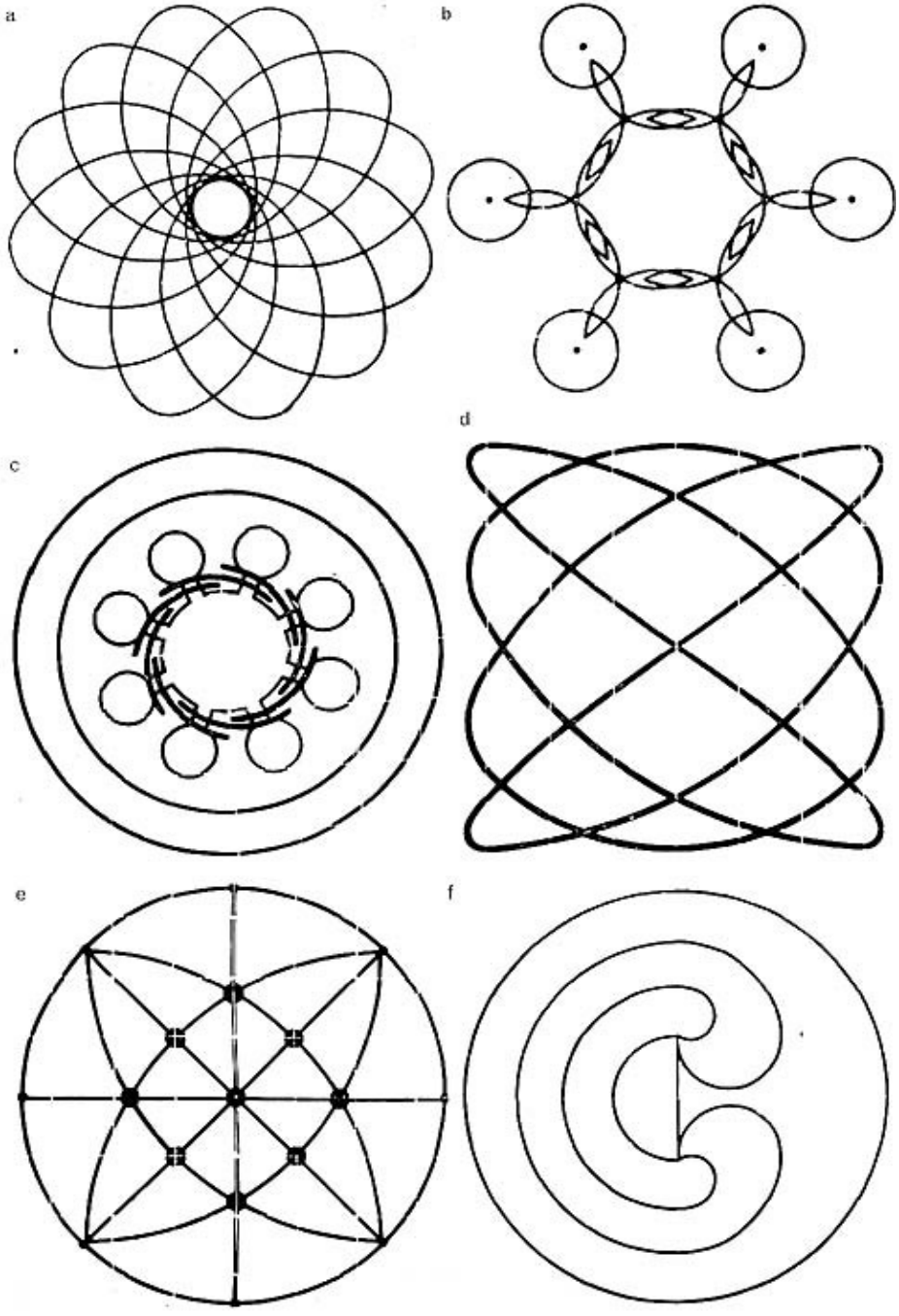
research area of the building. They include the main store (Room 107), a suite of darkrooms (Room 101.3), and rooms for specimen preparation (Room 104), instrument repair (Room 106), drawing (Room 210), computing (Room 215), tape preparation for the University computer (Room 225) and a first-aid room (Room 121). There is a large main workshop (Room G9) with an office for the technician-in-charge (Room G10), and subsidiary workshops for research students and for brazing (Rooms G6, G4). There is a large room for compressors and liquefiers (Room G5) which houses two Philips air liquefiers and an A.D. Little helium liquefier, and an office for the technician-in-charge (Room G1).
At semi-basement level there is a further set of service rooms which include two radioactive laboratories (Rooms LG2, LG2A) and a chemical laboratory (Room LG5).

General Features of the Design of Rooms and Laboratories

Although rooms and laboratories are of many shapes and sizes, they share the same general design features. Throughout the building the built-in furniture is either of beech and sapele, or of beech and afromosia, matching with the movable furniture in use. Wherever experiments are to be done, there are aluminium slotted strips and strips of soft wood attached to the wall at several fixed heights. Window walls are kept quite clear of services so that desks and tables may be used at the windows. Walls opposite windows, leading into the corridors, are provided with as many built-in cupboards as can be fitted. Piped services are brought to service shelves which project from the walls at bench height. Among the unusual piped services are return lines for helium gas, waste lines for gases to be discharged at the top of the building, and lines for high-pressure and low-pressure gas supplies (such as hydrogen and oxygen) and for high-pressure water.
To avoid flooding all laboratories have drains at floor level. A feature of many research rooms is that the doors, like those of railway train compartments, have large glass windows which can be lowered.
Electrical supplies are brought to service panels immediately above the service shelves. A feature of these supplies is that a very large number of 240V a.c. points are supplied for 13A fused plugs with relatively few points for other supplies, which include 240V d.c., 12V a.c., 1 kc/s a.c., 415V 3 phase a.c., and spare lines. Considerable care has been taken to avoid electrical interference. All the steelwork of the frame of the building was carefully bonded during construction. Filters are provided on all the electrical supply systems—particularly at joints—in order to reduce pick-up from outside and to prevent interference generated within the building from being distributed. Special care has been taken to shield the supply cables A limited access special earth is provided in selected laboratories quite separate from the ordinary a.c. earth. No commutator motors or other devices producing sparks are allowed in the building. All heavy electric motors and devices requiring large currents (such as workshop machinery) are supplied separately direct from the sub-station. The laboratory a.c. outlets are fed via a voltage stabiliser. Some laboratories have tungsten lighting, although fluorescent lighting is generally used and is satisfactory if properly maintained.
One room extending over two floors (Rooms G3/116) is designed for high-voltage apparatus and completely screened, with a shuttered opening leading to an adjacent research room (Room 118) at the upper level.
Where there is heavy vibration, as in the main workshop and in the liquefier and compressor room, the whole floor is mounted separately from the rest of the building. Two first floor rooms have especially strengthened floors for heavy equipment and one (Room 110), in which a Varian 3-ton magnet is installed, has a remov able wall and window so that heavy equipment may be hoisted directly into position from outside the building.
A feature of nearly all rooms is that the pipes and cables are brought in behind panels or above the false ceilings and cannot be seen. Moreover, alterations and additions to services can be made without defacing the building. The delivery area for the building is a yard with entrance at lorry tail-board height to the goods lift which serves all floors. Gas cylinders are stored in the yard with underground connections to the main distribution points inside the building. There is also an underground store here for acids and solvents. All the air supplied to the building is cleaned by filtering.

Artistic Features of the Building

In the entrance hall a drawing by Leonardo da Vinci is reproduced by photographic enlargement from the original at Windsor Castle, by kind permission of the Queen.
At the north end of the research wing there is a mural painting by Feliks Topolski.
A sculpture by Mr T B Huxley-Jones

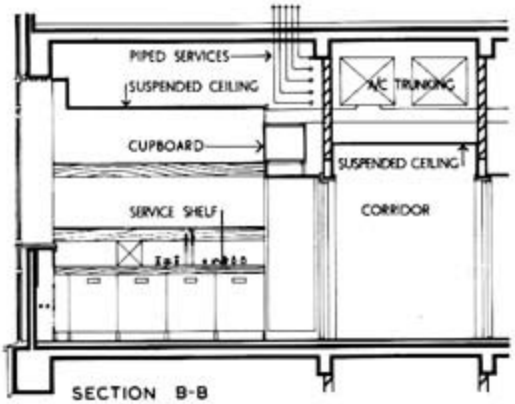


decorates the external wall of the building at the top floor level.
It is proposed to hold regular artistic exhibitions in the museum. At present these are one-man shows organised in conjunction with the Whitechapel Art Gallery, Upper Gallery. The museum is open to the public and known as Gallery 273.

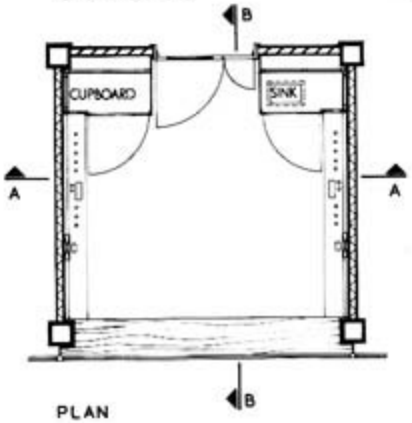
The Tile Patterns
The six tile patterns decorating the lower part of the exterior wall of the building refer to well-known ideas in various branches of physics. Each pattern is complete in itself, is intrinsically two-dimensional and has a natural symmetry.
a. the path of a particle in a precessing orbit
b. the electron-orbital scheme of benzene
c. a cavity magnetron
d. a Lissajous figure
e the stereographic projection of a cubic close-packed structure.
f. the spreading of dislocations from a Frank-Read source

(below) The mural by Feliks Topolski painted in the north staircase of the research wing.

SECTION A-A

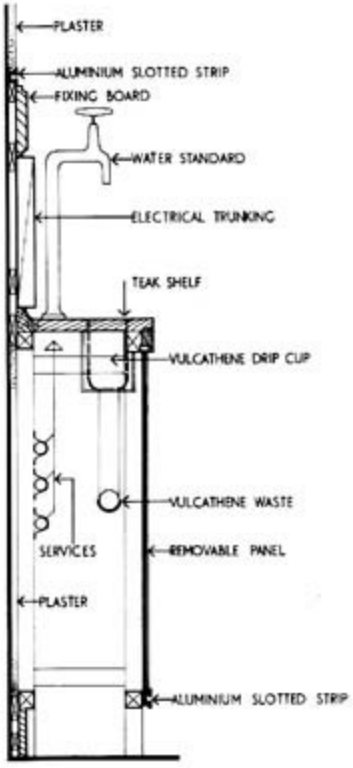


SECTION B-B

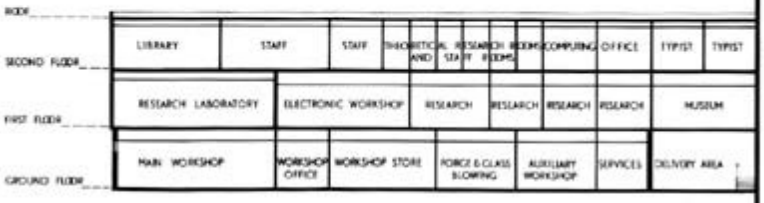


PLAN

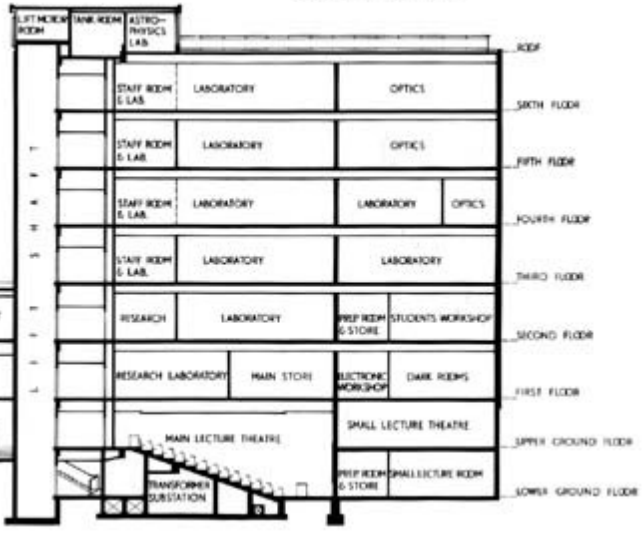
TYPICAL RESEARCH LABORATORY



SERVICE SHELF



TYPICAL SECTION



(below left) A staff meeting being held on the roof.

(below right) Staff and students in 1961.

Staff

Professor of Physics and Head of Department	Professor G 0 Jones
Professor of Theoretical Physics	Professor R K Eisenschitz
Readers in Experimental Physics	Dr J G Powles
	Dr A Ash more
Reader in Theoretical Physics	Dr R O Davies
Senior Lecturer	Dr E J Irons
Senior Lecturer and Assistant Director of Laboratories	Dr J W Leech
Lecturers	Dr R Heastie
	Dr J C Burfoot
	Dr D H Martin
	Dr FE Neale
	Dr E Sándor
	Dr S Doniach
	Dr J A Bastin
	Dr D J Newman
	Dr W H Range
Assistant Lecturer	Mr G Mandel
Research Fellows and Research Assistants	Dr D F Falla
	Dr K Krynicki
	Mr L Bowen
	Mr C M Platt
	Dr A E Woodward
	Dr J C Fletcher
Laboratory Steward	Mr C D Murray

Former Heads of Department

Professor C H Lees FRS
Head of Department from 1906 to 1930
Vice-Principal of the College

Professor H R Robinson FRS
Head of Department from 1930 to 1953
Vice-Principal of the College
Vice-chancellor of the University of London
1954 and 1955

Designed by Larry Carter

Photographs by John Donat

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