

**Research Fields in physics at
United Kingdom Universities
and Polytechnics**

**The Institute of Physics,
London and Bristol**

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Preface

The Institute of Physics has pleasure in presenting the second edition of *Research Fields in Physics*. The more limited first edition, published in 1970, evinced gratifying interest and has been out of print for some time. On this occasion, the opportunity has been taken to include many of the polytechnics undertaking physics research and also other university departments whose research is related to physics. The indexing system has also been extended, and it now covers both the research subjects and the names of those involved.

It is hoped that the compendium will prove particularly useful to potential research students and their advisers, and also that it will provide a valuable reference source to the physics research in academic establishments in the United Kingdom.

Once again, The Institute of Physics would like to thank all contributors for their cooperation and patience in what has proved to be a longer exercise than expected. For the time being, the policy remains that updating will take place every two years, but the time of publication is under review.

It should be noted that one or two departments do not appear for reasons of their own.

P L Flowerday
Assistant Secretary
The Institute of Physics

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Head of Department: Professor R V Jones

RESEARCH FIELDS

1. Instrumentation

Senior Staff: Professor R V Jones (Fine measurement; Geophysical instruments); Dr J C S Richards (Electronics); Dr W J Bates (Optics); Dr J Edwards (Geomagnetism); Dr M A Player (Digital Systems).

Total Academic Personnel: 8 (5 staff, 3 research students)

Research program

A very loosely knit group; each member pursues his own particular interest except where collaboration is necessary or desirable. In particular, the first two named have produced several electromechanical and geophysical instruments; the group runs an SRC approved MSc Course in Fundamentals of Instrument Design.

The main objective is to take instruments, especially transducers, to the limits of sensitivity and stability with a view to application in fundamental experiments.

2. Radio Astronomy

Senior Staff: Dr C Henderson, Dr A M Flett

Total Academic Personnel: 5 (2 staff, 3 research students)

Research program

Radio astronomy at 9mm wavelength. Investigations into atmospheric attenuation, and propagation problems; lunar, solar, planetary studies; radio source flux density measurements.

Aerials:

- (a) 15ft. and 6ft. tracking paraboloids, equatorially mounted.
- (b) Horn antenna.

3. Upper Atmosphere Physics

Senior Staff: Dr M Gadsden, Dr P C Wraight

Total Academic Personnel: 2 (2 staff)

Research program

Investigation of the atmosphere from stratospheric levels upwards to high in the ionosphere, with emphasis upon remote sensing of the radiation emitted by the atmosphere. Development of a large-flux Michelson interferometer; a balloon-borne package to investigate sub-millimetre radiation; analyses of continuum and resonance emission from the day, twilight and night skies; noctilucent clouds.

4. Solid State Physics

(a) Crystal Growing and Optical Properties of Crystals

Senior Staff: Dr D A Jones, Dr I S Robertson

Total Academic Personnel: 2 (2 staff)

Research program

The growth of crystals from the melt of mixed oxides, especially those with incongruent melting points, and of mixed oxides with ferroelectric properties. The investigation of the absorption and emission spectra of rare earth and transition element ions in various host crystal lattices.

(b) Lattice Dynamics

Senior Staff: Dr T Smith, Dr J D Pirie, Dr H W T Barron,
Dr John S Reid

Total Academic Personnel: 7 (4 staff, 1 research fellow,
2 research students)

Research program

X-ray scattering experiments and augmented plane wave calculations are used to give understanding of (i) electron deformation in phonon modes, (ii) anharmonic cross sections and (iii) phonon eigenvalues.

(c) Mössbauer Effect

Senior Staff: Dr F W D Woodhams

Total Academic Personnel: 2 (1 Physics staff, 1 Chemist)

Research program

The Mössbauer spectra of Fe and Sn bearing minerals and compounds is being studied, in conjunction with X-ray scattering measurements to determine detailed atomic structure. This work is carried out in collaboration with the Chemistry Department.

(d) Elastic Properties of Crystals

Senior Staff: Dr S Hart

Total Academic Personnel: 1 (1 staff)

Research program

The elastic properties as a function of temperature for single crystals are being investigated by resonance methods at frequencies of up to 100 kc/s.

5. Theoretical Physics

(a) Dr C Strachan

Quantum Theory of Collision and Decay Processes.

(b) Dr R C Clark

Statistical Mechanics of Many-Body Systems.

(c) Dr D G Fincham

Phenomenological Description of the interaction between elementary particles

Total Academic Personnel: 4 (4 staff)

CORRESPONDENCE

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University of Aston at Birmingham
Department of Physics

Head of Department: Professor S E Hunt, BSc, PhD, FInstP.

Professor Solid

State Physics: Professor E Braun, MSc, DrRerNat, PhD, FInstP.

RESEARCH FIELDS

1. Applied Nuclear Physics

Senior Staff: Professor S E Hunt, Dr P E Francois ,
Dr A J Cox, Dr D Crumpton.

Total Academic Personnel: 11 (4 staff, 7 research students)

Research program

The capture cross-section for neutrons in the 14 MeV energy region is being measured for various nuclei and the results interpreted in terms of recent developments in nuclear theory.

The results of these measurements are being applied to the measurement of fast neutron fluxes and to the use of fast neutrons for analytical purposes. The application of charged particle induced reactions to analysis is also being investigated. These programs will be extended considerably with the commissioning of a 3.0 MeV Dynamitron Accelerator to be used jointly with Birmingham University. The relative merits of X-rays and neutrons for skeletal calcium estimations is being investigated.

2. Reactor Physics

Senior Staff: Mr R R Osborne, Dr P N Cooper

Total Academic Personnel: 5 (2 staff, 3 research students)

Research program

Neutron diffusion in a liquid moderated sub-critical assembly with simulated boiling is being investigated and the shielding properties of various materials to fast neutrons are also being determined for application to the fast reactor programs.

3. Field Emission and Vacuum Breakdown

Senior Staff: Professor E Braun, Dr R V Latham

Total Academic Personnel: 5 (2 staff, 1 EO, 2 research students)

Research program

The theory of field emission for metals is well established and experimentally verified. Measurements of the energy distribution of electrons field emitted from semiconductors have, however, shown discrepancies with theory. Further energy distribution measurements with improved experimental techniques are in progress in an effort to provide a firm experimental basis for further theoretical work which is planned.

The mechanism of electrical breakdown in high vacuum has been studied in great detail in recent years but the primary factors which lead to the flow of pre-breakdown current and thereby to eventual breakdown are still obscure. We are using a variety of advanced techniques, including scanning electron microscopy, to elucidate the initiating mechanism for the flow of pre-breakdown current.

4. Thin Film

Senior Staff: Dr W E J Neal, Dr R W Fane

Total Academic Personnel: 4 (2 staff, 2 research students)

Research program

The electrical and optical properties of thin films deposited on various substrates at varying temperatures in ultra high vacua are being determined and related to electron theory and film structure. Other investigations include the properties of superconducting films, conduction processes in very thin metal and dielectric films prepared by various techniques including radio-frequency sputtering and electron beam evaporation.

5. X-Ray Diffraction

Senior Staff: Mr N W Grimes

Total Academic Personnel: 2 (1 staff, 1 research student)

Research program

Studies are being made of X-ray diffraction line broadening due to disorder in magnetic oxides and the results are correlated with electric and magnetic properties. Other work includes the investigation of broadening in diffraction lines from thin metal films and the interpretation in terms of particle size and strain. The latter is in collaboration with the work on thin films described above.

6. Acousto-Electric Effects

Senior Staff: Dr R W Cotterhill, Mr J L Sullivan

Total Academic Personnel: 2 (2 staff)

Research program

Work is being carried out on the interaction of ultrasonic waves and electrons in the piezo-electric semiconductor Cds. Aspects of particular interest are the factors causing limitation and saturation of gain in the acoustic amplification process, and those causing departures from the Weinreich relation. A study of diffusion layer transducers is also being made.

7. Tribology

Senior Staff: Dr T F J Quinn

Total Academic Personnel: 5 (1 staff, 4 research students)

Research program

Tribology, the study of the interaction of surfaces in relative motion, is being carried out through the application of several complementary physical analytical techniques to industrially important sliding systems, such as steel upon steel, and graphite upon metal. Electron Microscopy, Electron Diffraction, X-ray Crystallography, Electron Probe Microanalysis, and other physical techniques are being used in order to obtain information about the various changes which occur at surfaces during sliding.

This information is correlated with measurements of friction, wear, surface temperatures, contact resistance, etc., in order to obtain a complete picture of the tribological process involved.

8. Modern Optics

Senior Staff: Dr G L Rogers

Total Academic Personnel: 4 (1 staff, 2 research fellows,
1 research student)

Research program

The work of this section involves the study of holography, and the stabilization of lasers for holography and communications. High resolution wavelength interferometry.

Incoherent Fourier Transformation and its application to Character Recognition. Character separation and presentation, using photodetector arrays. Electronic and logical circuitry are developed in connection with the above.

9. Electron and Vacuum Physics

Senior Staff: Dr T Mulvey, Dr R K Fitch, Mr W James,
Mr G Knott, Mr C G Pearce.

Total Academic Personnel: 7 (5 staff, 2 research students)

Research program

Current research work in collaboration with NPL is concerned with the imaging properties of new types of electron lenses so as to improve the capabilities of analytical techniques such as electron probe analysis and electron microscopy. New lenses for X-ray Kossel cameras are being developed. In the field of electron microscopy itself, optical diffraction methods are being applied to the problem of interpreting the fine structures that are often observed in high resolution instruments. Theoretical work is also in progress in re-formulating the dynamical theory of diffraction in relativistic terms. This is especially relevant to high voltage electron microscopy.

Electron and ion-optical principles are being applied to the design of new devices for producing and measuring extremely low pressures. Such devices are aimed at holding an electron beam in a stable orbit thereby causing considerable ionization at pressure well below 10^{-10} torr, without the inconvenience of an applied magnetic field. A new type of ion source for the controlled etching of metals and ceramics has been devised.

Work is also in progress on ionization potentials and mass spectrometry.

DEGREES AND DIPLOMAS AWARDED

MSc, PhD.

SCHOLARSHIP AND FELLOWSHIP SOURCES

SRC Scholarships

University Scholarships

A limited number available,
awarded by competitive interview.

MOT Fellowships

)

Industrial Fellowships

)

NPL Fellowships

)

Fellowships and associate fellow-
ships are awarded as a result of
contract work and collaboration
with industry.

CORRESPONDENCE

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Birmingham, Gosta Green, Birmingham B4 7ET.

Head of Department: Professor W D Chesterman

RESEARCH FIELDS

1. Marine Geophysics

Group Leader: Professor W D Chesterman

Other Senior Staff: Professor A M Hardie

Other Academic Personnel: Mr J R Acton, Mr J C Hopkins,
Dr D W Parkin (staff), Dr N G Pace
(PDF), Mr A P Salkield, Mr M E Perring
(research students)

Total Academic Personnel: 8 (5 staff, 1 Postdoctoral Fellow,
2 research students)

Research program

Studies are being made of Continental Shelf sediment patterns around the British Isles and elsewhere. Specialised sonar instrumentation devices are being developed in the School of Physics for isometric surveys.

Terrestrial and extra-terrestrial dust transport studies are being made in relation to deep sea core information.

The mechanism of formation of sand wave structures in bays and estuaries is being examined theoretically and by simple models.

Studies are being made of the acoustic scatter from sea bed sediments under laboratory conditions using a model tank. This work will be extended to attempt the identification of sediment types from the nature of the responses.

2. Physics of Electron in Gases

Group Leader: Dr J D Swift

Other Academic Personnel: Dr R P Jones, Mr G J Lloyd (staff),
Mr A M Newton, Mr D L Jordan,
Mr S L F Richards (research students)

Total Academic Personnel: 6 (3 staff, 3 research students)

Research program

Langmuir probes are being used to investigate the distribution of electron energies in low pressure gaseous plasmas. Both D.C. and H.F. excitation are being employed. It is of