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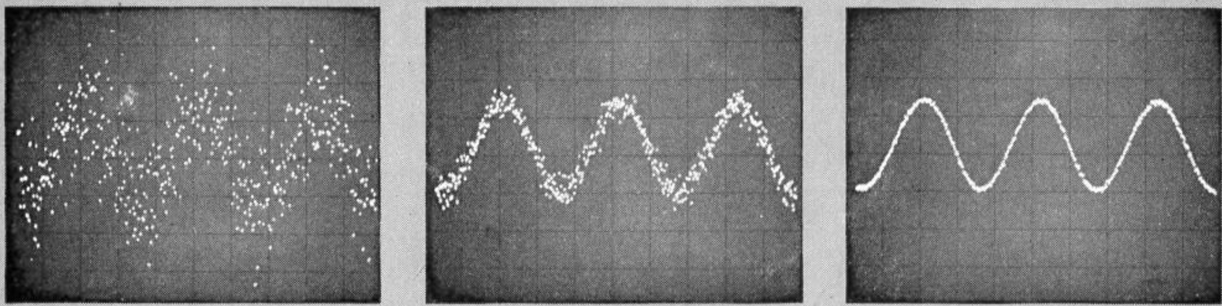

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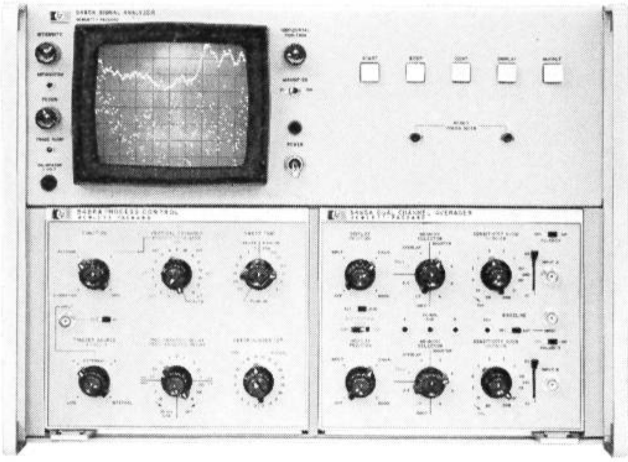

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Australian Institute Of Physics

REGISTERED OFFICE

Clunies Ross House,
191 Royal Parade,
Parkville, Victoria 3052.
Telephone: 34-4941.

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Assistant Secretary: Mrs J. A. Mackenzie.

The Australian Physicist

Editor: Dr J. L. Symonds,
C/- A.A.E.C.R.E., Private Mail Bag,
Sutherland, N.S.W. 2232.
Telephone: 531-0111 : 523-2247 (after hours).

Assistant Editor: Dr W. H. Steel,
C.S.I.R.O. National Standards Laboratory,
Chippendale, N.S.W. 2008.
Telephone: 68-0566 : 94-5818 (after hours).

Book Review Editor: Mr G. A. Bell,
C.S.I.R.O. National Standards Laboratory,
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Telephone: 68-0566.

Advertising Manager: Mr J. T. O'Mara,
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London Representative: Mr H. A. Mackenzie,
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THE AUSTRALIAN PHYSICIST

OCTOBER 1968

Australian Institute Of Physics

VOLUME 5, NUMBER 10

Undergraduate Physics Courses at Flinders University

M. H. Brennan

School of Physical Sciences, The Flinders University of South Australia, Bedford Park, South Australia.

Introduction

The Flinders University of South Australia was originally planned to be the second campus of the University of Adelaide. Planning for the University of Adelaide at Bedford Park (as it was then called) began in 1961 and the first undergraduates enrolled in March 1966. Early in 1966 the Parliament of South Australia passed legislation establishing the campus as an autonomous university—The Flinders University of South Australia. The Act was proclaimed on 1 July 1966. A connection with the earlier title is retained in the postal address of the university, via the specially created postal district of Bedford Park.

The work of the University is organized in Schools. At the present time there are Schools of Language and Literature, Social Sciences, Physical Sciences, and Biological Sciences. The School is the unit of academic and administrative organization and replaces both the department and the faculty in the 'traditional' university. Within each School various disciplines operate at the undergraduate level, whereas the post-graduate and research activities are organized in research groups. This arrangement allows the School to plan and administer an integrated programme of undergraduate instruction while allowing each Professor to develop research and post-graduate work with a high degree of autonomy. The School structure also results in considerable economies in the provision of technical services such as engineering, electronic, and glassblowing workshops.

The discipline of Physics is included in the School of Physical Sciences, together with the disciplines of Mathematics, Applied Mathematics, and Chemistry. At the present, the Physics staff comprises two professors, four senior lecturers, six lecturers, and one demonstrator. A third chair has recently been advertised.

Programmes of study for the B.Sc. degree

The Ordinary Degree of Bachelor of Science is a three-part course which can be completed in a minimum of three years. A further year's study is required for the Honours Degree.

In Part I of the Ordinary Degree course the student takes four subjects. Apart from variations in the quantity and level of mathematics taken, all students take a common Part I course consisting of Mathematics, Physics, Chemistry and Biology. The Part 1 Physics course, of three lectures and three hours' laboratory work per week, covers three main areas—mechanics (including special relativity), electricity and magnetism, and waves (including an introduction to quantum mechanics). Thermodynamics and kinetic theory are included in Chemistry I.

On satisfactorily completing Part I the student moves on to one of a number of possible Part II Programmes. The 'Programme' is an allowed combination of the various courses offered by the science disciplines, but may also include some courses from the two Arts Schools. The majority of the courses available run for three lectures a week for one term only. A typical Part II Programme will contain about ten or twelve courses.

The student intending to major in physics takes one of the two Programmes in Part II. In one Programme he takes five physics courses and eight mathematics/applied mathematics courses (averaging thirteen lectures per week) and attends the physics laboratory for six hours per week. In the alternative Programme, intended for students who wish to keep open the option of majoring in mathematics, applied mathematics, or physics, the student takes four physics courses, ten mathematics/applied mathematics courses, and an average of only three hours per week of laboratory work.

This arrangement of the Part II work has the advantage, over the more usual three-subject arrangement, that the balance between mathematics and physics, lecture courses and laboratory work,

TABLE I

Numbers of lectures given on the various areas of physics

Area	Part I	II	III	IV	Total
Mechanics (incl. relativity)	24	24*	24*	16	88
Electricity and magnetism	24	24	12	32	92
Waves and optics	12	24	12		48
Statistical mechanics and thermodynamics	12†	24	16	32	84
Quantum mechanics	12	24	24	32	92
Special topics:					
Atomic physics		12		16	28
Nuclear physics		12	24	16	52
Solid-state physics			24	16	40
Discharge and plasma physics			24	16	40
Electronics			16		16
Design of experiments				16	16

* Course given by the Applied Mathematics discipline.
† Course given by the Chemistry discipline.

can be adjusted to suit the needs of the potential theoretical and experimental physicists. One is freed from having to work within the constraint of three equally-weighted subjects.

In Part III there are four basic Programmes in which a major in Physics can be undertaken. These Programmes, by varying the amount of time devoted to lecture courses and laboratory work, span the range of interests from the mathematical physicist, through the experimental physicist, to the chemical physicist. The central Programme, intended for the experimentalist with average ability and interest in mathematics, comprises eight physics courses, four mathematics/applied mathematics courses (an average of ten lectures per week), and nine hours per week of laboratory work.

The Part IV (Honours) Programme is fairly conventional in construction. All students take a basic core of physics lecture courses (a total of eight lectures per week). In addition, the experimentalist undertakes project work in the laboratories under the individual supervision of a member of staff and the theoretical physics student does a small project and attends additional lectures in mathematics or physics.

Physics lecture courses

The lecture courses in physics emphasize fundamentals in the earlier years and touch on current fields of interest in the senior years. The number of lectures devoted to the various areas is shown in Table I.

All courses are given at one level only. When student enrolments increase to a suitable level, it is planned that at least some of the courses will be given at two levels—ordinary and advanced. It is also intended that alternative courses will be available in Part IV to cater for the diverse interests of both staff and students. In the meantime this diversity will be provided by the post-graduate lecture courses, some of which will be available to Part IV students.

Examinations on the lecture courses are held during the first weeks of second and third terms and during the normal November examination period. In addition, in Parts II, III, and IV, a General Examination embracing all aspects of the physics courses taken during the year is held in November. The student's performance in the year's work as a whole is assessed and a single grade—Distinction, Credit, Pass, or Fail—is given for the Part.

Physics laboratory courses

It was in the development of the laboratory work, where one began with a blank piece of paper headed 'Part I Physics Laboratory' and a reasonable sum of money, that there was the greatest scope for innovation and improvement.

As the laboratories for Parts I, II, and III developed a number of common features appeared; some through deliberate planning and some indirectly, as a result of the environment in which the laboratory was planned. The most significant of these common features are as follows:

1. The experiments are, on the average, longer than those found in most other Australian universities.

2. All students in a Part take the same set of experiments in first term.

3. The experiments in the second and third terms are arranged in sets of related experiments (two in Part I and Part II, four in Part III). The sets of experiments in these terms may be done in any order. Within a set, the experiments are performed in cyclic fashion, with arbitrary starting points wherever possible.

4. The experiments are designed to be independent of the lecture material so far as timing is concerned. This factor, which is of course consistent with 3 above, forces the student to carry out some real experiments where he meets concepts and situations for the first time in the laboratory instead of in the lecture room.

5. The laboratory notes contain suggested lines of investigation or, in some cases, only a brief description of the basic principles involved: the student is encouraged to plan the experiment him-

self, with the aid of the demonstrator. The experiments thus have an 'open-ended' character but with sufficient form to give guidance to the weaker student.

6. The equipment is modern and of good quality. Factors 1 and 3 assist here.

7. The student keeps a laboratory notebook which is assessed during the course of the experiment. He writes brief reports, often on groups of related experiments, once or twice each term. This approach is an attempt to approximate conditions in a research laboratory in contrast to the rather hurried and artificial approach prevalent in universities which retain the old-style notebook, with its artificial division between writing and graph paper, whch is marked at the end of the laboratory period.

TABLE II

Part I Physics Laboratory

Set A	**Experiments—Dynamics**
A.1	Frictionless linear dynamics—the air track
A.2	Frictionless rotational dynamics
A.3	Electron dynamics
A.4	Thermionic-diode characteristics and the magnetron effect
Set B	**Experiments—Waves and oscillations**
B.0	Introduction to the cathode ray oscilloscope
B.1	Optical diffraction and interference
B.2	Propagation, interference, and diffraction of ultrasonic waves
B.3	Microwaves
B.4	The harmonic oscillator and mechanical resonance
Set C	**Experiments—Quantum physics**
C.1	Spectra
C.2	Radiation
C.3	Photoelectric effect
C.4	Frank–Hertz experiment
C.5	Radioactivity

The titles of the experiments in the Part I laboratory are listed in Table II. The majority of the experiments are completed in two three-hour laboratory sessions. These are held in the same week, the student's laboratory load alternating between zero and six hours per week. In the first term the experiments on *Dynamics* provide a link between the school and the university laboratory. The mixture of the study of the motion of massive bodies and of electrons emphasizes the universality of the laws of mechanics and provides some variety in the experiments. In the second and third terms the Set B experiments on *Waves and oscillations* and the Set C experiments on *Quantum physics* relate to the lecture material of the third term. The second term lectures on electricity and magnetism are not reinforced by laboratory work until the first term of Part II.

The Part II experiments are listed in Table III. During the first term the experiments emphasize important techniques (for example, accurate timing techniques in no. 6, Period of a pendulum) or provide a link with the Part I work (for example, A.C. circuits). In the second and third terms two groups of experiments are available. The first group of experiments, nos 9–16, is concerned with optics and spectroscopy. The second group, nos 17–22, deals with the electromagnetic field in vacuo and in matter. Experiment 23, the vacuum evaporator, provides further training in techniques. In addition to these experiments, not all of which are necessarily done by each student, two demonstration experiments—Fourier interferometry and

TABLE III

Part II Physics Laboratory

	First term
1	A.C. Circuits I
2	A.C. Circuits II
3	A.C. Resonance
4	Hall effect
5	Bending of a beam
6	Period of a pendulum
7	Contact potential
8	Photoelectric devices
	Second and third term
9	Radiometry
10	Spectroscopy
11	Reflectivity
12	The Fabry–Perot interferometer
13	The Fabry–Perot interferometer as a recording spectrometer
14	Zeeman effect
15	The Michelson interferometer
16	Optical diffraction
17	Hall effect at low temperatures
18	Electric fields
19	Magnetic fields
20	D.C. hysteresis
21	A.C. hysteresis
22	The torque magnetometer
23	The vacuum evaporator

TABLE IV

Part III Physics Laboratory

A.	**Electronics**
A.1	Introductory electronics
A.2	Audio amplifiers; audio transformers
A.3	Transistor amplifiers
A.4	Video amplifier (valves)
A.5	Video amplifiers (transistors)
A.6	Linear pulse amplifiers
A.7	Waveform generation and wave shaping
A.8	Operational amplifiers and analogue computation
A.9	Servo systems
A.10	Digital logic and computing techniques
A.11	Phase-sensitive detectors, filters, noise
A.12	Transistor oscillators, frequency conversion
A.13	Stabilized power supplies, filtering
B.	**Discharge and plasma physics**
B.1	Collision cross-sections
B.2	Gaseous breakdown phenomena
B.3	The glow discharge
B.4	Microwave propagation in plasmas
C.	**Electromagnetic waves**
C.1	Slotted transmission lines
C.2	Microwave propagation in dielectrics
C.3	Faraday rotation in ferrites
D.	**Solid state physics**
D.1	Charge-carrier mobilities in germanium
D.2	Electron paramagnetic resonance
D.3	Nuclear magnetic resonance
D.4	Heat conduction in solids
E.	**Nuclear physics**
E.1	Scintillation-counter spectroscopy
E.2	Compton scattering
E.3	Mössbauer effect
E.4	Coincidence counting

holography—are performed during second and third term.

The students enrolled in the full Part III laboratory course spend nine hours per week in the laboratory. The experiments are listed in Table IV. During first term the laboratory is directly associated with a two-lecture per week course in electronics. In second and third terms the student spends approximately half a term in each of the four section B–E. Within each section there is a good deal of flexibility in the number of experiments carried out. It is hoped that this flexibility can be retained as the pressure of numbers builds up.

Acknowledgements

The general structure of the Physics Programmes, the selection of lecture courses, and the development of the laboratories have been the responsibility of all the staff of the physics discipline but most notably of J. Fletcher, E. L. Murray, R. G. Storer, and W. D. Westwood, who were appointed during 1965/66. Their efforts were most ably supported by the technical staff under the direction of the Laboratory Manager, D. Atkinson.

Symposium on Physics Research in Australia

This report on the N.S.W. Branch Meeting of 9 September 1968 with invited speakers Professor C. N. Watson-Munro (Sydney University), Professor P. Mason (Macquarie University), and Professor L. W. Davies (A.W.A. Physical Laboratory and University of N.S.W.) has been prepared by Dr A. W. Pryor, Chairman, N.S.W. Branch.

Introduction

Physics is two things: it is a subject of massive intellectual content worthy of study and patronage and demanding withdrawal and dedication from its devotees, and it is a useful art with important and manifold obligations. This duality causes strain and, to add to the problem, physics is research—can one imagine the profession of physicist otherwise than as doing research?—and research is usually expensive. Where does the money come from and how is the whole business to be organized? These are the questions this Symposium was called to discuss and, in a very well attended meeting, they were discussed, vigorously, though inconclusively.

Direction of Research

On this subject there are two schools of thought: those who see a need for overall direction and who acknowledge a valid role for the scientific administrator, and those who believe in giving free rein to the spirit of scientific enquiry and think that the only healthy guidance is that provided by scientists themselves. Professor Watson-Munro came down firmly on the second side and fervently preached the personality cult of the brilliant scientist, suggesting indeed that directors, and the majority in committees, should be recruited only from those who had published original work within five years. Nor did he shrink from the conclusion that directors should rotate every five to ten years so that their essential amateurism at administration remains unimpaired. In universities, which should engage only in discipline-oriented research, he claimed, nothing is permissible but to choose the man and set him free, while in non-teaching establishments, engaged in project-oriented work, the leaders should be chosen for the designated fields and put to work unencumbered by supervision.

Professor Mason placed his bet both ways: he spoke mainly of the difficulties of successful direction and of the ludicrous errors of the past, but, nevertheless, could see no escape from the obligation to attempt rational direction. Professor Davies suggested four 'touchstones' for guidance, which appeared, however, to be so all-embracing that one would be hard put to conceive of any project whatever that they would discriminate against.

The standard of debate on this issue seemed inadequate. It no longer suffices to point to the glorious achievements of the free and un-administered giants of the past. Physics is now mature (perhaps even decadent); its scope and methods begin to be discernible; there is an obligation to invest wisely. Perhaps these workers, mentioned by Watson-Munro, who could manage on research grants of 25 per cent. of their salary, may yet lead the free life, but the golden age for the big spenders is passing.

Professor Mason quoted Auger's recommendation that expenditure on:

(i) pure, or free fundamental research,
(ii) oriented fundamental research,
(iii) applied research, and
(iv) development,

should be in the ratio 1:3:6:100. This approaches the type of thinking these problems need. How do we achieve, and pay for, that type of structure? What are the roles of university, commerce and government?

University Research

In universities, Watson-Munro favoured complete local control, except for a minimum of coordination in very expensive installations, and suggested that a university must, in its teaching and therefore in its researching, try to provide a reasonable coverage of all the main branches of physics. Professor Davies firmly stated his view that the A.R.G.C. was a mistake: it would be much better to hand out the money to the Vice-Chancellors, pro rata.

Most of the discussion of university problems centred around the Ph.D. system. Dr Haneman (Univ. of N.S.W.) suggested that Australian Ph.D.'s were not so well educated as American Ph.D.'s and should have many more examinable post-graduate lectures. Professor Watson-Munro replied emphatically that, though not familiar with the universities known to Dr Haneman, he would claim parity, or better, in a comparison between the Sydney Honours Course and the post-graduate courses of such American centres as Harvard. Professor Mason, after referring in passing to the 'catastrophic' American Ph.D. system, put forward, nostalgically, the ideal of a Ph.D. as the prestigious recognition of a dedicated man, as against Dr Haneman's implied concept of it as a step in a respectable professional career.

Mrs Makinson (C.S.I.R.O.), in a cogent submission, pointed out that the Ph.D. was outmoded in these days of team projects, just as the apprenticeship training of craftsmen was outmoded in this age of automation. Its processes were, moreover, frequently unfair and random; it imposed a bias against arduous and lengthy projects; and, in any case, why should the universities enjoy the advantage of a cheap and convenient source of skilled labour? Let them pay salaries to research workers like anyone else, and let us judge people by their achievements and not by parchment degrees.

Industrial Research

It appeared in this discussion that many university or government physicists—either pure or only slightly defiled—have a deep aversion to industrial research. To leave their familiar circle and enter a commercial firm would be to them unthinkable, like abandoning the world and all its pleasures to enter a monastery. Yet, for the good of this country, some *rapprochement* is necessary.

Dr Davies remarked that his own firm enjoyed good relations with the Sydney universities, and advocated that the Government should spend some of the money now devoted to its own research establishments on contracts with commercial firms. He also criticised the recent industrial Research and Development Grants Act of 1967. Professor Mason suggested that governmental support should be given only in exchange for equity in the firm. Professor Watson-Munro canvassed the possibility of research associations between firms in the same industry, but this suggestion was firmly discounted by Dr Davies and Dr Gipps (Philips).

Dr Davies also claimed that commercial research expenditure in Australia was by no means so negligible as many people thought; it was commensurate with the C.S.I.R.O. budget. In reply to an accusation that local firms thought only of buying their know-how from their overseas parents, Dr Gipps responded: 'Why not? It is the economical way of doing things.' Which may be so; just as a grazier, in time of drought, may cut down trees to feed stock; it is the only way he can get by, but it holds no hope for the future.

Governmental Establishments

It is hard to reject the view that the Government should spend its Research and Development budget on contracts with industry and universities and, with the exception of activities such as standards, meteorology, and classified defence work, close down its own establishments. The Americans work this way and who can deny their technical hegemony. No one present from the governmental establishments tried to refute this view. One almost felt that they were conscious of living the good life and were trying not to attract fire.

In response to a suggestion that governmental laboratories should abdicate from pure research in favour of the universities, Mr Harper (C.S.I.R.O.) argued that prestigious pure-research groups were necessary to raise the tone of an otherwise humdrum environment sufficiently to attract staff. As his argument was advanced, it reminded one of those companies who try to have a Sir Somebody among the directors in order to seduce investors.

Conclusion

The only conclusion is that there are problems here, and we cannot, like the commercial firms, simply take over the results of overseas studies. We must work out our own solutions. I am convinced that our Institute should address itself again to these topics, define an area, examine data, reach conclusions, and promulgate them.

Bibliography

Auger, P. (1961). 'Current Trends in Scientific Research.' Paris: UNESCO.

Federation of Australian University Staff Associations (1965). 'Report on Research in Universities.'

Suits, C. G. (1960). 'UNESCO Proceedings of International Conference on Physics Education, 1960.' New York: Wiley.

Sutherland, Sir Gordon (1966). 'The organization and financing of research both nationally and internationally,' *Bull. Inst. Phys., Lond.* **17**:262.

Willmott, J. C. (1967). 'The employment of Ph.D. physicists,' *Bull. Inst. Phys., Lond.* **18**:141.

The Role of General Studies in the Education of Applied Scientists and Technologists

R. G. Baylis and A. Gardini,
Department of General Studies, S.A. Institute of Technology.

'We have to disregard the sentimentalists who say that faculties of technology fill the minds and starve the souls of the young. There is no evidence that the souls of technologists are starved: there is ample evidence that the minds of many technologists are deficient in certain arts subjects necessary for an understanding of contemporary society, and the prime purpose of studies in humanities for technologists should be to remedy these deficiencies.'[1]

'In the coming age of automation I suggest we shall find it impossible to consider anybody as adequately educated if he or she does not understand at least some science.

'Neither shall we be able to regard as an educated man a technician or scientist, however distinguished, who has failed to develop a substantial interest in the humanities and the arts or who shows no evidence of being aware of the significance of society and his part in it.

'We ought, in other words, to be making a determined effort to produce better balanced people.'[2]

Before 1967, in the South Australian Institute of Technology, it was apparently believed that a sufficiently broad education could be obtained by students taking specialist courses in science and technology without attendance at classes in such subjects as history and literature. However, the writings of people like Sir Eric Ashby and Leon Bagrit, whom we have quoted at the beginning of this article, have led educationalists to the conclusion that the education of scientists and technologists should include at least a minimal consideration of the humanities. Many professional bodies support this view: the Institution of Engineers, Australia, for example, have expressed concern on a number of occasions at the lack of participation of their members in public affairs, and have suggested that this has been largely due to the narrowness of their academic training.

With the introduction of the Diploma in Technology within the Institute, the opportunity was taken to include a General Studies area in the new courses. We called this area General Studies because we intend it to describe the pursuit of general intellectual culture, as against a narrowly vocational or professional training. The programme of General Studies, then, sets out to introduce the student to some fields of knowledge outside his professional or vocational courses; to maintain and broaden his interests in those humanities which were a part of his previous educational experience, and to help him to see his special field of study in a broad cultural and social context.

The aim of General Studies is to develop a student who should be better able to develop a critical and questioning attitude to the social, ethical, and aesthetic issues which he will meet as a citizen and professional man. He should be better able to avoid the error of considering problems outside his professional area with the inappropriate categories of thought derived from his professional training.

The subject of that great branch of knowledge, usually called humanism, is man. It offers an area of study of the kind needed to broaden the education of scientists and technologists. Before the student of literature, history, and philosophy are displayed all the forces and ideas that have governed and influenced man: personal, religious, and political. As he reviews them and compares them with the present he can see, as far as man can see, what ideas have come down to his own day, and what new elements are combining with them. As a result, he can forecast, in some degree, the future. With reference to the humanities, then, we planned a number of subjects emphasizing man—the individual, and man in society. At the same time, in some of the subjects, we followed sound educational practice by relating the subjects to the obvious bias of interest reflected by the student being a member of an institute of technology.

Social and Technological History was specifically designed to be relevant to the interests of undergraduate scientists and technologists and to lead them into a consideration of technological development and its social implications.

Literature and Society offers a study of literature which explores the problems of the individual and society. In this way, it is hoped to extend the environment of the student, particularly in those areas which the study of science and technology does not penetrate.

The two subjects that we have referred to define the approach to be found in all general electives. They offer to the student an extension of himself as a man, as a member of the society in which he lives and for which, as a scientist or technologist, he has an ever increasing responsibility.

One elective that may be of more immediate interest of physicists is *Science and Modern Society*. The subject as originally planned was to cover aspects of contemporary science and technology which appeared to be causing revolutionary changes in contemporary society. Though we realized that to understand contemporary science and society we would have to look back at earlier periods, it was thought, rather optimistically, that any historical framework would not draw from events earlier than the turn of this century.

With this principle in mind, it was thought best to exclude technological and scientific advances which had their largest social impact and their most significant theoretical development during the nineteenth century. Hence thermodynamics, the steam and internal combustion engines, electricity, chemistry, evolution, and bacteriology were excluded. So were discussions of the early stages of mechanization, of the advent of the Power Age, of assembly line mechanization and mass production. Transport systems, the earlier telecommunication systems, and the whole technology of modern cities also seemed best left out. These topics, it was thought, would be better discussed within the context of Social and Technological History. It was 'Big Science'—atomic and nuclear physics and their applications, rocketry, computers, computer based information systems, and automation—that seemed to be creating the most radical changes in both society and technology.

Thus, one purpose of the course was to investigate the claims of those who herald 'The Automation Revolution', 'The Atomic Revolution', 'The Third Industrial Revolution', 'The Age of the Mass Media', 'The Electronic Revolution', and 'The New Man: a Mixture of Wizard, Scientist, Intellectual Sponge, and Electronic Robot'.

The atomic and nuclear physics section was to be presented from an historical point of view, with an emphasis on biographical and autobiographical details of the life and work of men such as Planck, J. J. Thomson, Kelvin, Einstein, Bohr, Sommerfeld, Dirac, de Broglie. We wished to show the creative and speculative nature of their work, the intellectual problems they overcame during the formative periods of their theories, what they considered to be the sociological and philosophical consequences of their theories, and to what extent they saw themselves as revolutionaries knocking down the Euclidian–Newtonian edifice of the world.

As well, the atomic physicists seemed to provide a particularly striking example of the drift of modern science away from the individual pursuit of pure knowledge and towards socialized and applied research. To see the change in the social role of the scientist one has only to read the biography of J. J. Thomson[3] and contrast it to the life of Oppenheimer or Teller, of Fermi or Einstein, who were faced with the moral doubts and fatal decisions of those involved in making and using nuclear weapons.

Clearly, the aim of our course was not to teach physics or any other science (though, obviously, some central concepts of physics such as the main assumptions of special relativity and some of its consequences, the quantization of energy, indeterminacy, and symmetry had to be introduced). The subject had to remain within the spheres of the humanities; and, as in all history, the aim was to reveal man's motives, his desires to create, to understand and to conquer, his achievements and his failings.

By contrast, the communication sciences seemed to be less suited to historical analysis in such a brief course of lectures and tutorials. The plan here was to introduce the students to some elementary principles of computing, some uses of computers, and some elementary techniques of data processing drawn from flow charts, network analysis, and computer languages and logic, illustrated by simple examples. Again, the aim was not to compete with the appropriate academic disciplines of data processing: the techniques were demonstrated only to give some concrete information on which to base more sociological discussions on issues such as the effects of automation on employment, education, and scientific documentation.

A second aim was to discuss changes in the philosophy and technology of management arising from (among other factors) the application of computers. While traditional organizations had put a premium on skill, role, personality, social class, heredity, mystique, and craftsmanship today's organizations seemed more set on rationalizing processes and activities. The image the large corporation wants the public to have is one clear-cut decision criterion, well defined information content, rationally planned input, output and process specifications, purposive analysis, rationalization, mechanization and automation of processes, and a dash of creativity and old-fashioned know-how.

Three other main topics were also viewed as important. The first was a brief survey of the range of answers contemporary scientists were giving to such final questions as the nature of life, the nature and origins of the universe, and the body-mind problem. The sciences most involved were genetics, molecular biology, psychology, neurology, and cosmology, each presenting us with several competing schools of thought on these questions of recent and even contemporary origin. In view of the traditional bias for the closed systems of Newtonian physics and classical mathematics in our secondary schools, it was felt that the living debate of the life sciences and cosmology would provide a much-needed contrast. As well, these sciences gave us some basis for informed discussion on such problems as: reason, revelation, and faith in science and religion, the distinction between fact and decision, between physics and metaphysics, Socratic doubt and religious agnosticism.

The second of the three topics was the study of science as an institution, of scientific methods of justification and discovery, of research techniques and tools.

Lastly, we wished to see what scientists and others saw as the future of science and society. One vehicle for studying man's hopes for the future was such prognostications as those of Nigel Calder and others.[4] The other means were the literarily respectable science fiction and utopian works of Verne, Wells, Huxley, Orwell, Wyndham, Golding, Pohl, Bradbury, Asimov, and Efremov.

These were our original intentions, but they had to be modified in the lecture room.

The course expected too much of students whose relevant historical knowledge was practically nil. Asked to discuss the Second Law of Thermodynamics or DNA molecules—those two hallmarks of the educated man in the opinion of C. P. Snow[5]—our students usually replied with a blank stare. It was equally as difficult to discuss the revolutionary nature of J. J. Thomson's discovery of the electron with students who had never heard of Maxwell and his contributions to electricity; or to discuss contemporary views of man and society with the majority of science and engineering students who could not name one psychologist, sociologist or political philosopher, not even Sigmund Freud. And faced with some Social Work students whose scientific knowledge did not even encompass such elementary notions as mass and charge, let alone gravitational and electrical fields, we knew we had to modify the content of our course.

The course is now redefined to begin with a substantial History of Science section, in which some of the great achievements and some central ideas of modern science are reviewed briefly. The revolutionary effects of Copernicus and Kepler, of Galileo and Newton, of Lavoisier and Dalton, of Darwin and Mendel, of Franklin and Maxwell, are to be at least hinted at within the limited time available.

Two comments must be made about these changes in our courses lest they be misinterpreted by being judged with criteria more applicable to professional courses. Firstly, change and intelligent experimentation, as well as a fair degree of individual variation from both lecturers and students, are very much in place in General Studies courses. Secondly, the lack of adequate historical knowledge among our students is no reflection on them, or on the standards of the Institute of Technology. It is the unfortunate result of our secondary education; of science courses in which the history of science is only hinted at; of history courses which do not deal with science and technology as significant historical factors; and of the narrow emphasis on physics and chemistry which is detrimental to the full understanding of modern science and to culture in general. It is one of the aims of General Studies to remedy this situation.

It is perhaps too early to judge the influence of General Electives and whether they are going to achieve the aims that we have defined. However, it is clear that the cross-fertilization of ideas and points of view resulting from the meeting of students from varied professional backgrounds is widening the areas of communication amongst students: no man is allowed to remain an island, at least for the two hours of General Studies.

It is also interesting to note that more books are borrowed from the General Studies section of the library than any other.

Bibliography

1. Ashby, Sir Eric (1959). *Technology and the Academics*, Macmillan.
2. Bagrit, Leon (1965). *Age of Automation*, Pelican.
3. Thomson, Sir George (1964). *J. J. Thomson and the Cavendish Laboratory In His Day*, Nelson.
4. Calder, Nigel (Ed.) (1965). *The World in 1984*, Pelican.
5. Snow, C. P. (1964). *The Two Cultures: And A Second Look*, Mentor.

The Register

Changes in Membership from 13.8.68 to 10.9.68

FELLOWSHIP

Transfer

Haneman, D., University of New South Wales.

ASSOCIATESHIP

New Elections

Kevi, L., Geological Survey of Queensland.

Mauger, K. E., University of Melbourne, Victoria.

GRADUATESHIP

(*a*) *Transfer*

Fielding, A. J., Quesnel Secondary School, Quesnel, B.C., Canada.

(*b*) *New Elections*

Farrell, P. A., Aeronautical Research Laboratories, Melbourne, Victoria.

Robertson, A. G., Australian National University, Canberra, A.C.T.

Robins, B. W., University of New South Wales.

Subramanian, V., Master Instruments Pty. Ltd., Marrickville, N.S.W.

Sussex, G. A. M., University of Melbourne, Victoria.

Tang, J. C. N., University of Melbourne, Victoria.

Veau, F. O. C. A., Kodak Research Laboratory, Coburg, Victoria.

STUDENTS

(*a*) *New Elections*

Kotler, L. H. (Vic.)

Read, B. J. (Vic.)

(*b*) *Resignations*

Newell, E. B. (A.C.T.)

Institute Affairs

FOURTH A.I.P. SUMMER SCHOOL MELBOURNE: FEBRUARY 1969

The fourth Summer School of the Australian Institute of Physics will be held in Glen College, La Trobe University, Melbourne, from 24 to 28 February 1969. The School will consist of concurrent lectures and discussion on three topics:

(a) physics of the stratosphere,
(b) diffraction methods in solid-state physics,
(c) surface physics.

The lectures will be at a post-graduate level but will be comprehensible to non-experts in these fields. A special course on elementary diffraction theory will be given if there is sufficient demand.

(a) *Physics of the stratosphere*: will include discussion on the dynamics of the atmosphere and lower stratosphere, radiation and temperature structure, experimental and theoretical tracer studies, and aspects of ozone formation and measurement. The lectures will include C. H. B. Priestley, R. H. Clarke, P. Schwerdtfeger, G. B. Tucker, D. Jensen, B. Morton, K. Bigg, A. J. Dyer, B. Pittock, and B. Hunt.

(b) *Diffraction methods in solid-state physics*: will cover the basic theory and techniques of the X-ray, neutron, and electron diffraction methods and the application of these to the study of lattice dynamics, atomic and magnetic ordering, bonding, and crystal defects. Lecturers will include S. C. Moss (M.I.T.), J. M. Cowley, R. Street, A. F. Moodie, B. Dawson, E. N. Maslen, T. M. Sabine, and A. Pryor.

(c) *Surface physics*: will cover fundamental physical aspects of surfaces, the structure of crystal surfaces at macroscopic and atomic levels, and the techniques which are used to investigate surface structure and properties. Lecturers will include N. H. Fletcher, E. Davies, D. E. Haneman, A. J. W. Moore, J. V. Sanders, B. Baker, I. Ritchie, and D. Lynch.

The final day of the Summer School will be devoted to conference sessions in each of the sections. Contributions in the form of short papers on research related to the topics of the School are invited.

The course fee for the Summer School will be $12.00 for professional people and $6.00 for students. This covers the cost of the School Dinner, conference, and excursions. A fee of $5.00 will apply to those who attend only the conference sessions. Accommodation has been reserved in Glenn College, the cost being $6.00 per day.

It is hoped to assist student members of the A.I.P. who wish to attend the School but are unable to obtain financial support from their own universities. Branch secretaries of the A.I.P. should be contacted in regard to this.

Prospective attendees are asked to complete the attendance form in this issue and return it to Dr A. E. C. Spargo as soon as possible, but not later than 30 November, 1968. Additional copies can be obtained from Branch Secretaries, University Departments, and other Laboratories.

Notes and News

1968 Einstein Memorial Lecture

The Einstein Memorial Lecturer for 1968 was Dr C. H. B. Priestley, F.R.S., Chief of the Division of Meteorological Physics, C.S.I.R.O. The lecture was delivered by Dr Priestley on Tuesday, 10 September, to a large audience in the Bragg Lecture Theatre at the University of Adelaide.

The title of Dr Priestley's lecture was 'The Future of Meteorology'. As pointed out by Dr Priestley, meteorology is a tremendous pace-setter for computer development because of the necessity for solving the multiplicity of simultaneous equations associated with better weather forecasting.

Dr Priestley showed some very well chosen slides illustrating the recent advances made in computer-based weather maps. He also showed an excerpt from a film, taken from a satellite, of clouds moving over the earth's surface. In this exciting glimpse of the possibilities that satellite technology can offer, cloud formations were seen to form fronts and move across Australia in the familiar prognosticated manner of the television weather men, the observations being vastly speeded up to show the turbulent global air changes in a very dramatic way.

During his lecture Dr Priestley made the plea that meteorology involved 'big physics'. There was no doubt in the mind of the audience at the conclusion of his lecture that he had proved his point. Dr Jacka, Vice-Chairman of the S.A. Branch, returned to this aspect in his brief vote of thanks to Dr Priestley for his excellent and lucid talk. Dr. Jacka expressed what many physicists in the audience felt, namely, a feeling of shame for being unaware of the extent to which physics was involved in the modern developments in meteorology, but at the same time a feeling of gratitude to Dr Priestley for being made aware of the exciting possibilities ahead.

It is hoped that Dr Priestley's talk will be published in a future issue of the Australian Physicist.

IUPAP News

News-Bulletin No. 7 from the International Union of Pure and Applied Physics includes the following items.

General Assembly of I.C.S.U.

IUPAP is one of the 16 International Scientific Unions making up the International Council of Scientific Unions (I.C.S.U.) whose headquarters are in Rome. I.C.S.U. also has about 60 national members.

The Council's General Assembly will take place in Paris from 28 September to 3 October. Prominent on the agenda will be the matter of the International Data Centres.

The Union will be represented by President D. I. Blokhintsev and by Sir Gordon Sutherland.

The European Physical Society

The Union has been informed of the imminent establishment of a European Physical Society. Eighteen countries from both Western and Eastern Europe have sent delegates to preliminary meetings which have resulted in a proposed constitution, budget, etc. The inaugural meeting is planned for 8–11 April in Florence, Italy.

Secretary of the Steering Committee has been Dr L.-Etienne Amberg. An interim executive Committee to be elected in September at a Geneva Meeting will plan the inaugural session.

Information about the proposed Society was received with much satisfaction by the Union Executive at its last meeting.

1969 General Assembly

The 1969 General Assembly of IUPAP will take place at Dubrovnik, Yugoslavia. Proposed dates are from 11–14 September.

Australian Chemical Engineering Conference, 1970

The Australian Academy of Science and the Australian National Committee of the Institution of Chemical Engineers are organizing a Chemical Engineering Conference, to be held in Melbourne and Sydney, 18–26 August 1970.

The Organizing Committee wishes to attract papers of international standard describing original research or development or original practical experience in chemical engineering. A tentative list of proposed Symposium topics is: (1) Particle Mechanics (2) High-Temperature Processing (3) Chemical-Reaction Engineering (4) Biochemical and Biomedical Engineering (5) Rheology and Mixing (6) Diffusional Processes (7) Process Dynamics and Control (8) Scientific Management. It is intended to preprint papers, and to publish the full papers with edited discussion in bound form as the Conference Proceedings.

Persons interested in submitting papers and/or attending the Conference are invited to write for particulars (Circular No 1) to the secretary of the Academy.

Letter to the Editor

Amalgamation of Grades

SIR.—In reply to Dr Smith's letter in the August edition of The Australian Physicist, in which he argues for the amalgamation of the grades of Associate and Graduate in the Australian Institute of Physics, I would like to make the following points.

Firstly, the grade structure as it stands at present is a direct copy of that of the U.K. Institute of Physics, in which the grade of Graduate is a real qualification. Many technical colleges and polytechnics which do not offer a formal Bachelor's degree prepare students for the Graduateship examination, which is set and marked by the U.K. body, and is readily accepted as being directly equivalent to a special honours degree in physics. The standard of the Graduateship examination is certainly without question, and pass B.Sc. graduates cannot be admitted to the I.P.P.S. without taking Part II of the examination, which requires one year of full-time study.

Secondly, a case could be made for the Australian Institute to set its own Graduateship examination, especially with the emergence of the new institutes of technology, which, one presumes, are ultimately going to expect university status and the right to confer degrees. Should this arise, then the vicious circle is once again complete, and new institutes will have to be founded to cater for students who do not desire, or are not capable of, reaching the standard required for a B.Sc. Perhaps, therefore, rather than attempting to disband the Graduate grade, the Australian body could endeavour to bridge the gap by setting its own Graduateship examination, to cater for the exceptional students at the institutes, and for which it is possible (although to be cynical, not probable) that the Government would finance.

Thirdly, the U.K. Physical Society, which is apparently to be liquidated on the granting of a Royal Charter to the I.P.P.S., has always had only one grade of membership—that of Fellow. The sole requirement for election to this grade is an interest in physics, and as such, the spectrum of members extends from high school students to Fellows of the Royal Society. The fact of the intending liquidation of this Society shows it to be unsatisfactory and few would dispute this. However, the trend of Dr Smith's letter suggests that if the saving of paper work is of prime importance, this method of membership could be adopted in Australia.

Fourthly, I think Dr Smith's claims about the aspiring young physicist being unable to become a Fellow on the grounds of seniority alone to be somewhat questionable, and few members would be academically equipped enough to fulfil the requirements until after the present 'Ph.D. plus 5 years' experience'. Assuming that the structure of both the U.K. and Australian bodies is the same, then the standard required for a Fellow is claimed (probably erroneously) to be near that required for a D.Sc. and I doubt if many physicists have enough material to be awarded a D.Sc. within 5 years of attaining their Ph.D. On the junior end of the scale, it is usual to expect a new B.Sc. to take 3–5 years to settle down and 'learn the ropes' and it is with this in mind that the Associate grade comes into its own as being an indication that the profession has judged such physicists to be of sufficient calibre to be able to carry on the profession competently, which few people would expect new B.Sc.'s to do.

Fifthly and finally, I would like to suggest that the Institute make some attempt to enforce members to take the grade for which they are qualified. It is ludicrous to find university professors and senior lecturers in the Graduate grade. The Institution of Engineers (Australia), which incidentally has about 8 grades of membership, makes the annual subscription higher after a certain length of time in each grade. This idea could easily be adopted, and professors who insist on being Graduate members could remain so—but at the subscription rate for Fellows! I would predict an increase in the number of Fellows plus Associates and a decrease in the number of Associates plus Graduates.

M. F. WESTCOTT

School of Physics
The University of New South Wales

Book Reviews

COULOMB EXCITATION, Edited by K. Alder and A. Winter. Academic Press, N.Y. and London, 1966. viii + 374 pp. $8.50.

Reviewed by J. L. Cook, A.A.E.C. Research Establishment.

This text is a collection of reprints concerning the theory of Coulomb excitation and its applications. Books of this kind are rather difficult to justify, since they merely reproduce, in toto, information that has already been published elsewhere, contribute nothing original to the field, and are usually expensive. Their merit lies in the fact that they have convenient and carefully selected accounts of the theory, as originally presented.

In this particular case, the papers reproduced do seem to represent an accurate historical development of the most significant advances. Beginning with the early general papers by Mottelson and Ter-Martirosyan on the excitation of nuclei by the Coulomb field of charged particles, notably electrons and protons, the presentation then branches into particular areas. The papers include one by McClelland and Goodman on heavy nuclei excitation, Temmer and Heydenburgs' treatment of light nuclei, Huss and Zupancics' discussion of rotational states, and McGowan and Stelsons' calculations on the angular distribution of gamma rays produced by excitation. These each make significant contributions to the theory.

The rest of the papers deal with multiple Coulomb excitation, ion excitation, and inelastic processes, and the listing of a computer program for calculating multiple Coulomb excitation effects is presented. This compilation is very reasonably priced in comparison with most modern texts and should prove a good buy for the specialist.

BUBBLE AND SPARK CHAMBERS, Vol. 2, R. P. Shutt Ed. Academic Press, New York, 1967. xi + 319 pp. $16.00.

Reviewed by E. M. Lawson, A.A.E.C. Research Establishment.

This book is intended primarily for the high-energy or elementary-particle physicist and is too specialized for the layman. The title is misleading, because the book deals not with the principles and modes of operation of the various types of bubble and spark chambers, but rather with the associated and complementary apparatus required in a high-energy physics experiment. Each chapter is a review of a particular topic and, in keeping with the high degree of specialization required in high-energy physics, is written by an expert in that topic. A consequence of the multi-authorship of the text is a lack of correlation between chapters but this is an advantage because each one can be read as a separate review.

The topics are chamber-magnet design, data processing and interpretation, on-line precision digitizers, and secondary beams. Each author assumes that the reader has more than a passing knowledge of his subject and most reviews are comprehensive. The one exception is the chapter on secondary beams which concentrates on recent developments. In all chapters the different requirements of bubble and spark-chamber experiments are successfully pointed out. However, the book is biased towards bubble-chamber experiments, and to experiments performed with proton rather than electron accelerators. Many details are given of apparatus in use at laboratories in the U.S.A. and Europe. Each chapter contains an up-to-date and comprehensive list of references, which includes relevant review articles.

The last and summarizing chapter is more general than the others; it reviews the requirements, equipment, and personnel, of a high-energy physics experiment and an attempt is made to predict future developments.

THEORETICAL MECHANICS. T. C. Bradbury, John Wiley and Sons, New York, 1968. xiii + 633 pp. $12.95.

Reviewed by H. M. Nelson, University of Sydney.

This fairly lengthy (641 page) text contains a somewhat strange and oddly ordered selection of topics in theoretical mechanics. It opens with three chapters on vectors, tensors, and matrices, which seem somewhat out of place for two reasons: firstly, that they fall between the two stools of adequate mathematical rigour on the one hand and appeal to the motivation of necessity on the other; secondly, they are not needed at all in the chapter immediately following. It seems strange, too, that so much space is devoted to the presentation of this readily available material without any illustration of its use in either the mechanics of deformable media or of fluids, both of which might have been expected from the all-embracing title.

The book is mainly concerned with an exposition of particle mechanics and with the derivative problem of the mechanics of solid bodies. It contains excursions into wave and relativistic mechanics. With the exception of its purely mathematical sections, which tend to be conventional, occasionally circuitous, and somewhat pedantic, it is well presented. However, a book of this sort invites inevitable comparison with a classic such as Joos (Theoretical Physics, first published in English translation in 1934). All Bradbury's basic material is to be found in Joos, but Joos' ordering seems to be more logical and his presentation is no less acceptable.

The sections concerned with the solution of ordinary linear differential equations are unduly laboured and could have been presented much more succinctly, either by assuming an elementary knowledge of integral transformation methods, or by firmly introducing the phasor concept instead of elaborately skirting round it. The author is unduly restrictive, too, in his treatment of dynamical analogies. He chooses to write his equations for electrical systems with charge as the dependent variable. Had he chosen voltages instead he would have arrived at an equally valid, but different identification which, as has been pointed out by Trent and Firestone, has the advantage over the author's choice of topological as well as algebraic similarity.

The book is well provided with problems for solution by the reader and some, but by no means all, the chapters have appended references to related texts.

The errors and inadequacies of a textbook of this sort as a teaching aid often begin to show when it is used as such in other than its place of origin. It would be interesting to know if this experiment has yet been made.

COMPUTERS AND THE HUMAN MIND. Donald G. Fink, Heinemann, London, 1968. vii + 301 pp. $4.90.

Reviewed by C. H. Gray, C.S.I.R.O. Computing Research Division, Sydney.

Fink's book is extremely interesting. He gives a very clear account of computer electronics, logic, and programming. He compares the physiological brain function with the basis of some of the most respected examples of artificial intelligence. He concludes with a FORTRAN program to compute π.

Several criticisms, however, could be made of this book.

Admittedly he covers a wide field in his book, but the important role of System Analysts who have to appraise the introduction of computerization in particular spheres is overlooked. Also, Fink passes over statistical methods as outside the scope of his book although simulation studies are taking on greater importance in computing. I would have liked to have read more on the versatility of computers in the scientific environment rather than the stress on the artificial intelligence example. One may get a wrong slant from Fink's emphasis in this field.

These criticisms are minor in terms of the service Fink's book will provide to those entering computing or, for that matter, those already caught in the net.

ENERGY BANDS IN SEMICONDUCTORS, D. Long. Wiley, New York, 1968. xiv + 212 pp. $9.95.

Reviewed by D. Haneman, University of N.S.W.

The subject matter covered in this volume represents a field in which a great deal of progress, both experimental and theoretical, has taken place in the last 15 years. The contents can in the main be found in various review articles and other books of wider subject matter, but it is undoubtedly a convenience to have a single, small book in which the experimental data are all together and the relevant theory is included. The author has devoted the first half of the book to a discussion of theoretical and experimental methods of obtaining band-structure parameters, and the second half to a compilation of results for Group IV, III–V, II–VI, IV–VI and some other semiconductors. The book is undoubtedly useful to experienced workers in the field. To others, however, the theoretical explanations are too concise to give real illumination. The author touches on most of the key points but does not amplify any sufficiently to make the contributions in this volume unique. The important k.p. method is illustrated by one worked example for a simple case but a broader discussion would have been welcome in a book of this kind. Likewise a short chapter on group theory is included which can do little more than assemble formulae conveniently.

In summary the principal virtues of this volume are that it provides a compendium of current data on band structure for most semiconductors of interest and sufficient theoretical discussion to be a useful guide in consulting more extensive texts. The treatment is clear and to the point, and the book can be recommended to research scientists in the field.

THEORY OF FINITE FERMI SYSTEMS AND APPLICATIONS TO ATOMIC NUCLEI. A. B. Migdal, Interscience, 1967. viii + 319 pp. $17.50

Reviewed by J. L. Cook, A.A.E.C. Research Establishment.

Amongst the many tracts in modern physics there appears the occasional book that is noteworthy for its completely original content and freshness of approach. This is one such book. Professor Migdal's quasi-particle treatment of nuclear structure is a method he developed independently, based on the Feynman diagram technique for Fermi systems, and the only feature that the theory lacks, in my opinion, is a rigorous connection with the S-matrix formalism.

The introduction deals with general properties of Fermi systems, followed by a chapter on the Green's function quasi-particle picture of such systems for infinite and finite assemblies. The second chapter discusses Fermi systems in the presence of external fields. Pairing correlations are taken into account, conservation laws derived, transition probabilities deduced, and properties of the density matrix considered.

The third chapter applies the theory to nuclear systems. The shell model is justified, nucleon-nucleon interactions discussed, properties of nuclear matter derived, and other features such as the nuclear magnetic moment, isotopic shift of spectral lines, moments of inertia, multipole transitions and β-decay are all evaluated in terms of his theory. The book concludes with a useful list of abstracts of papers on nuclear theory.

In all, it is a brief, readable and well documented account of nuclear properties in terms of a particular theory and a useful addition to any private library kept by specialists in nuclear structure.

FOURTH A.I.P. SUMMER SCHOOL: MELBOURNE, FEBRUARY 1969

Attendance Form

To Dr A. E. C. Spargo,
School of Physics,
University of Melbourne
Parkville, Victoria 3052

It is likely that I shall attend the 4th A.I.P. Summer School. ☐

It is likely that I shall attend the Conference Session of the School. ☐

I will probably submit a paper at the Conference. ☐

My main interest is the: Stratosphere Section, ☐ Diffraction Section, ☐ Surface Section. ☐

I shall require accommodation in Glenn College. ☐

I am a student member of the A.I.P. with finance to attend ☐ without finance to attend. ☐

I am interested in the course on Elementary Diffraction Theory. ☐

NAME AND TITLE: ....

POSTAL ADDRESS: ....

....

TO BE RETURNED BY 30 NOVEMBER 1968.

AUSTRALIAN INSTITUTE OF NUCLEAR SCIENCE AND ENGINEERING

A.I.N.S.E.
RESEARCH FELLOWSHIPS ANNOUNCEMENT

A.I.N.S.E. Research Fellowships are offered by the Australian Institute of Nuclear Science and Engineering for suitably qualified persons wishing to undertake research projects within the Institute's fields of interest. Nominations and enquiries will be received by the Institute at any time. Candidates for these awards will normally be nominated by an Australian University or the Australian Atomic Energy Commission.

Research Fellowships are intended for scientists and engineers who have qualifications equivalent to the Degree of Ph.D., and are at a relatively early stage of an independent research career. Minimum tenure is two years, and the award may be extended for a third year. Emolument will be within the range of \$5,000 per annum to \$7,000 per annum (Australian currency), and the Institute may contribute to the costs involved in travelling to and from Australia.

A research project within the field of nuclear science and engineering must be proposed in the nomination after agreement between the candidate and the nominating organisation. It is normally expected that a Research Fellow's project will require some use of the specialised facilities located within the Australian Atomic Energy Commission's Research Establishment at Lucas Heights, near Sydney, N.S.W., and that a Fellow will spend some part or the whole of his working time attached to the Institute at Lucas Heights, for that purpose.

Further information may be obtained from the Scientific Secretary, Australian Institute of Nuclear Science and Engineering, Private Mail Bag, Post Office, Sutherland, N.S.W., Australia.

17/9/68.

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