Volume 4
Number 1

JANUARY, 1967

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THE AUSTRALIAN PHYSICIST, JANUARY, 1967
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From the Editor
The Future of 'The Australian Physicist'

It is now close on three years and the completion of three volumes since the Executive recommended to Council that the Australian Institute of Physics should run its own journal. A review of the journal's activities and some consideration of what we should do in future issues seems warranted, for although there have been complimentary remarks made about production and content of the journal, there are undoubtedly criticisms being made also.

As far as I am able to ascertain from members, two criticisms are being levelled at the journal. The first concerns the content of the journal, its level of advertising, and the lack of Institute news and discussion of activities. The second is directed towards the expenditure which is covered by the Institute, on the grounds that a much less elegant production would do and that the funds should be spent on scientific activities. To quote Dr. G. K. White (December 1966 issue), "It is disturbing to note that the deficit has occurred through increase in Council Meetings, printing The Australian Physicist, etc., and not through such scientifically productive pursuits as support of seminars, speakers, summer schools, etc."

These criticisms are worth investigating since it is important that we periodically review the material in the journal so that it meets members' requirements. Council has already indicated earlier that the production of the journal will be continuing.

Co-ordination and Co-operation

The total number of articles available for each issue has been such that on average only one main article appears with one or two of smaller content. It is instructive to see from what areas we receive our articles.

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<tr>
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Qld. 4 7
Tas. 0 1
A.C.T. 3 13
Other 0 2
Editor 0 10
Biophysics 0 8
Geophysics 5 2
Education 0 2

Couple this with the Branch News which should be provided, as sought by Council, and we find that the Table shows a direct relationship between co-ordination of Branch affairs with the publication of the journal. While no one wants to be continually pressed for information he agreed to provide (or maybe didn't), this is in fact what is a vital and necessary condition for the operation of the journal. Further support for this contention is shown by the figures for the Groups. Group Secretaries and Correspondents have been exceptionally helpful in providing material on group activities.

Members have expressed the wish that material from other Branches should be made available through the columns of the journal on a national basis. Council proposed that each Branch and Group should nominate Correspondents whose job it would be to collect local news and notes and to urge speakers at Branch and Group meetings to provide a manuscript. It is obvious that an active correspondent will provide the stimulus necessary to fulfill this membership requirement but he needs to possess persuasive powers and persistence well beyond the average plus a well-developed sense of what goes on and from whom he can squeeze information in the Branch and State generally. Some correspondents have been active enough to provide some articles and news but on an irregular basis. I suggest that there is interesting material to be found in Branch and Group activities which never sees the light of day elsewhere; a very careful inspection of this aspect of the Institute's activities should be made by both Branches and Groups.
Journal Content

Let me make it clear from the outset that the journal we produce is as interesting, as informative and as provocative as you, the Members of the Institute, wish to make it. As Editor, I can assist and encourage you in asking for articles, comment and information but, unless members cooperate and want to have material made available to them, it is not practicable for an Editor or an editorial body to produce what is needed entirely.

There have been interesting articles, even some provocative ones. Discussion between members has increased through Letters to the Editor, especially lately through Group work. As Editor, I have sought articles which are topical and relevant to some conditions in the Australian Physics scene. More needs to be done and, during 1967, we hope to extend the number of people whose task it will be to seek out articles from inside and outside the Institute Membership.

I believe the journal should reflect the Institute's desire to study the Australian scene with attention to wider social, economic and national implications of physics. There are indications that Members are beginning to think along these lines, using the journal as their medium for debate. The present time sees changes in the attitudes of Government to Science and Research. There are local rumblings on the effects these changes will have, yet I see no obvious inclination for Members to discuss the topic nationally. There is a parochial air about still, and national topics are only vaguely coming to the surface now because each local community of physicists finds itself affected by the availability of funds.

At this point Members should look at the original intention of Council in setting up the journal and ask themselves whether they go along with Dr White's contention, Sir Leonard Huxley, then President of the Institute, said that the A-P "will be very warmly welcomed by all its members as a further evidence of the vigour of our youthful Institute". It was a new and dynamic enterprise then—is there vigour being shown now? Does it contribute to or constitute scientific activity? You, as Members, will have to decide. Does it provide what you want? Would you use it as a debating medium, a place to discuss general scientific problems, or to advertise that you have some scientists visiting your laboratory who could possibly spend time elsewhere effectively and to the advantage of others? What proportion of the journal should be devoted to articles; to book reviews; to Institute Branch and Group affairs; to information of concern to Members such as a calendar of events? Have you any suggestions on how this effort should be organized? If you have answers and suggestions, let me hear them, the yes and the no, not just an uninformative silence or muttering.

Journal Format and Expenditure

During the initial phases of a journal's life, there are problems such as those indicated above and in the establishment of advertising activity, with its consequent financial support. The advertising support depends largely on a balance between the expenditure incurred by the advertiser and his returns through the contact he makes—and an obvious but not always recognized statement. Our fluctuating fortunes in this field are no different to those suffered by any other new journal—some advertisers wait to see what will happen to the journal while others dive in and find the water too cold only to jump out again. 1966 saw just such an effect in withdrawal of early supporters through a retraction, followed by some later continuity of contracts. Such journals as the A-P tend to suffer first because the effect of advertising is indirect since advertised material is often purchased through the laboratory in which the Member works, the source of the information being submerged by the system. Does the prospect of a reference card call system appeal to members in relation to advertised material? Do you consider the advertising emphasis is reasonable? What suggestions have you for making the advertiser's material more useful to you—material, books, equipment? Would you prefer some editorial, descriptive information rather than eye-catching blocks—some advertisers have shown an interest in such a change?

A factor which materially affects the acceptability of a journal is its presentation and format. This was taken into account in the original decision to publish a journal on high quality paper with lineotype and block setting. In the expenditure on printing, the quality of the paper only slightly affects the cost while the changes incurred by use of lineotype are a considerable proportion of the overall cost. It would require drastic change to a completely different printing process to change the printing costs markedly. For the present we intend to stick with our existing procedure.

The balance, which the Institute provides, between income from advertising and external subscriptions, and overall expenditure has represented something less than ten cents per copy averaged over the three volumes. The early disappointments in advertising in 1966 were offset by income and expenditure balancing late in 1966. As the journal becomes recognised and established, I believe that advertisers will use it and that they and you will benefit from its presence if you are prepared to indicate what use you can make of it.

Constructive criticisms are always welcome and will help immensely in gaining for us an understanding of your needs. It is costing you less than ten cents per copy at present to keep the journal up to your desk—your effort and ours can make it worth many times more than that if there is positive action to ensure that its content is interest-
ing to all the membership. It is within your capabilities to discuss matters of national concern to Physics and physicists, to provide general technical articles and to bring to light many other aspects of Physics in Australia. The Institute can be a body which represents the opinions of Australian physicists on scientific, technological, social and economic aspects of physics and its journal can publish that information for others to see.

We extend our best wishes to you all for a successful 1967—may all your New Year resolutions include a resolve to write and say more on topics in Australian Physics. Our resolution is to give you more for less!

**Notes and News**

The increasing impact of Physics in Medicine and Biology was demonstrated most strikingly in the latest meeting in this series, jointly sponsored by the Australian Regional Group of the Hospital Physicists' Association, and the Biophysics Group, Australian Institute of Physics. A record attendance of 91 delegates registered for a full five-day programme of lectures, demonstrations and exhibits. Among the delegates were 15 medical graduates and 5 scientists from other disciplines. The growth of interest in these meetings is indicated by the fact that the first meeting held at Adelaide in 1961 consisted of a two-day programme of 20 papers attended by 20 members.

This year the meeting was held at the Cancer Institute, Melbourne, from 29th August, to 2nd September. It was opened by Dr. John Lindell, Chairman of the Victorian Hospitals and Charities Commission, and several Medical Directors, Medical Superintendents and Hospital Managers attended. Mr. R. W. Stanford, F.A.I.P., Chairman Australian Group, H.P.A. and Biophysics Group, A.I.P., gave the opening address "Physics in Medicine—the last 2,500 years".

The programme contained 31 papers covering many diverse topics. In one group, examination was made of the biological damage by radiation ranging from neutrons and X-rays to microwaves and ultrasonics. In some papers radiation dosimetry and the measurement of radioactivity in human beings was discussed and applications of computer techniques to these and related medical and biological problems was explored. Other papers included the use of radioisotopes and ultrasonics in diagnosis and methods for the enhancement of information in radiographs.

The mechanism of the Circadian Rhythm, the "biological clock" which regulates the activity of many forms of life was demonstrated by time lapse photography and an investigation into the structural binding of anaesthetic gases to proteins was discussed.

A notable visitor to the meeting was Professor J. E. Uhlmann, of Columbia University, New York, who gave a paper on Radioisotopes in the Study of Anaemia of Malignancy.

A notable feature of the programme was a half-day demonstration of equipment and techniques covering 29 items ranging from miniature radiation detectors for use in vivo, generators for the production of short-lived isotopes from longer lived parents and a high-pressure tank for the treatment of patients by radiotherapy under 4 atmospheres of oxygen. Of particular interest was a film on Endoscopy describing the development of a miniature television camera weighing 10 oz. and of equipment with remote film transport for colour cine-photography of the internal organs of the body, e.g., lung, oesophagus, bowel, etc. This film, produced by the Department of Surgery, University of Melbourne, was awarded the Combined Royal Colleges Bronze Medal for 1965. The medal is awarded annually by a committee in London representing the Royal College of Surgeons, the Royal College of Physicians, the Royal College of Obstetricians and Gynaecologists and the Royal Photographic Society of Great Britain, and is given for the outstanding contribution of photography in medicine and surgery. It is the highest award that the Medical Group of the Royal Photographic Society can bestow. Some of the equipment shown in the film was on display.

A Scientific Trade Exhibition was held in conjunction with the meeting and some of the latest instrumentation used in medicine and biology was displayed. Great interest was shown in two radioisotope body scanners which plotted out in coloured ink or on photographic film a gamma map of the distribution of radioactivity in a patient. In addition a film was shown of a gamma scintillation camera giving similar information, but in a much shorter time on a C.R.O. screen thus allowing dynamic studies of the passage of radioactive material through organs by "sequential stop-motion scintigraphy".

The trade exhibition was held in the Architecture School of the University of Melbourne which also houses the University's I.B.M. 7044 Computer. The Cancer Institute's Radiation Isdose Plotting programme on the Computer was demonstrated several times during the exhibition.

By courtesy of Professor Brian Lewis (Professor of Architecture) delegates were invited to visit the Japanese Garden and Japanese Room in the School of Architecture. These were designed by Shigeru Yura, a former member of Architecture School’s staff. A Japanese garden, in symbolic manner, is a Japanese landscape painting in the

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ground. The Japanese Room, fabricated in Japan, is based on the simple Sho-in-Zukuri domestic design of the seventeenth century. This room is a remarkable example of fine art and craftsmanship.

No scientific meeting really achieves its full potential without an informal and social side and this aspect was both adequately and delightfully covered. Apart from informal counter lunches etc., the more formal items included a buffet lunch at the Trade Exhibition and the Annual Dinner at the Royal Automobile Club of Victoria.

The meeting did not pass unnoticed by the general public. Apart from several references in the daily Press Dr. J. W. G. Wignall's weekly science article in the Melbourne Age was devoted to an account of the meeting under the title "The Biophysics Revolution".

This was the most successful of all our meetings to date and not only because of the record attendance and the great enthusiasm of the delegates. The much broader range of topics dealt with, the increased outside interest in the meeting and the vastly improved standard of the content and presentation of the subjects all demonstrate that Physics in Medicine and Biology has come of age in Australia.

Physics Department, R. J. de Groot Cancer Institute, Melbourne.

The Physics Instrument Exhibition 1967

The Victorian Branch will be holding an exhibition of scientific instruments in the Storey Hall, Royal Melbourne Institute of Technology during August 29-31, 1967.

The aim of the exhibition is to present not only the most up-to-date commercially available equipment, but to encourage exhibits of prototype instruments at present under development by private companies, scientific institutions and universities.

Persons interested should contact the Convenor Mr. J. L. William, (P.O. Box 61, Oakleigh, Victoria, 56-4397) or the Secretary, Dr. A. J. Dyer (C.S.I.R.O., Division of Meteorological Physics, Aspendale, Victoria, 90-3331). Mr. A. K. Connor of the Royal Melbourne Institute of Technology is to be the Exhibition Manager.

International Symposium on Fibrous Proteins

A Symposium on Fibrous Proteins, sponsored by the Australian Academy of Science, will be held in Canberra from 14th-18th August, 1967.

The program will consist of a series of discussions addressed by invited speakers on various aspects of the chemistry and molecular architecture of the proteins of skin, muscle, wool, hair and silk. The topics to be discussed include: electron microscope, X-ray and infrared studies of molecular structure; mechanical properties of fibrous proteins; solution studies of fibrous proteins; chemical structure and reactivity of fibrous proteins; synthetic peptides and polymers as models of protein structure. About forty invited speakers will contribute of which half will be from outside Australia.

Further information may be obtained from the Symposium Secretary, Division of Protein Chemistry, C.S.I.R.O., 343 Royal Parade, Parkville N.2, Victoria, Australia.

Congress on Acoustics, Tokyo, 1968

The Sixth International Congress on Acoustics will be held in Tokyo, Japan, from August 21 to 28, 1968. The Congress is sponsored by the International Commission on Acoustics. The Acoustical Society of Japan will be in charge of the arrangements. Chairman of the Congress will be Professor J. Saneyoshi.

The program will cover the field of acoustics including the following topics: Speech Analysis, Physiological and Psychological Acoustics, Molecular Acoustics, Ultrasonics, Noise Control, Room Acoustics, Electroacoustics, Physical Acoustics, Mechanical Vibrations and Musical Acoustics.

Unpublished papers in these or related fields will be acceptable. The technical sessions are expected to be held at National Education Centre. The exhibition of acoustical equipments, technical visits, ladies' program and sightseeing trips will be arranged in connection with the Congress. Official languages for the Congress will be English, French and German.

Further information will be announced by June, 1967. Anyone in Australia interested in the Congress and desiring all further information, should send his name and mailing address to the following address by 31st March, 1967, for relay to the Acoustical Society of Japan: Mr. P. Dubout, Hon. Secretary, Australian Acoustical Society (Vic.), c/o Division of Building Research, C.S.I.R.O., Graham Road, Hightett, S.21., Victoria.

“Science Week” for Melbourne

An exhibition, "Science in the Development of Australia", will be held in Melbourne's Exhibition Buildings between June 26 and July 1, 1967. It is designed to make science intelligible and accessible to as many people as possible, and to make it a more useful tool intellectually and practically. It is being presented by the Science Teachers' Association of Victoria, with the Governor-General, His Excellency, The Right Honorable Lord Casey, as Patron.

Many organizations are already involved and the exhibition should give an opportunity for contact between them, the science teachers, the parents and the students themselves. For further information, please contact Exhibition Promotions Pty. Ltd., 415 Bourke Street, Melbourne (67-9721).
Moscow in September

The 1966 European conference season for physicists closed recently with a gathering in Russia of nearly 1000 delegates to the 10th International Conference on Low Temperature Physics (LT 10). The conference, one of a biennial series, was sponsored jointly by the International Union of Pure and Applied Physics and the Academy of Sciences of the U.S.S.R., and was organized by a committee of the Academy under the chairmanship of Academician P. L. Kapitza. Scientific meetings were held at the Sovietskaya Hotel in Moscow between August 31 and September 6, 1966.

The size of the conference indicates both the intense activity in solid state physics at low temperatures and the equally intense desire of physicists to visit Russia. About 190 participants came from the United States, 78 from the United Kingdom, and 43 from France; a further 153 were assorted foreigners, and the remaining 500 physicists were from the U.S.S.R. itself. Approximately one-quarter of the Western physicists were accompanied by wives and a hardly few by their children also.

Accommodation ranged from *de luxe* suites with radio, television and piano at Rubls 31.50 per person per day* to rooms in "Category B" with bathrooms somewhere in the building at Rubls 7.65 per person per day. Most foreigners were absorbed into the huge Ukraina Hotel, an extremely comfortable but grandiose building of 29 ever-decreasing storeys in a perpendicular, vending-cake style. Though all were eventually accommodated, many had doubts on arrival at Moscow international airport when by some master stroke of organization five jets were landed within 20 minutes. Any administrative system, let alone the rather inflexible Russian one, would be taxed by the ensuing, multilingual chaos, as for four hours happy conference formed and crashed queues for passport control, hotel allocation, customs control, baggage clearance, buses and hotel registration.

The conference lasted for one week and consisted of three plenary sessions and nine scientific sessions, the latter being run in four simultaneous sections. The first plenary session was opened by Dr. Kapitza with an address of welcome, after which

*At official exchange rates the ruble is exactly equal to the Australian dollar.

the Fritz London Award was presented to Professor C. J. Gorter, Director of the Kamerlingh Onnes Laboratory in Leiden. The award is for outstanding achievements in the field of low-temperature physics, and is unique in that the recipient is chosen by the informal, popular vote of his fellow low-temperature physicists throughout the world. At the final plenary session the Low Temperature Committee of IUPAP announced that they had once again considered the future of meetings of this size and had once again come to no decision. However, given no change in policy, it was decided to hold LT 11 in St. Andrews, Scotland, in August, 1968, and LT 12 in Japan in 1970.

At the working sessions some 447 papers listed in the conference abstracts (and an unspecified number of late acceptances) were read in one or other of the sections: Helium (97 papers); Superconductivity A and B (177); Metals (96); and Antiferromagnetism (77). Most sessions began with an invited paper of 30 minutes and continued with 10-minute contributed papers. (As each contributor has been allowed five pages for his paper, the conference proceedings will exceed 2200 pages, and should rival "Physics for High School Students" in sheer hulk.)

The official conference languages were English and Russian, and each participant was provided with a portable radio receiver with which to listen-in to simultaneous translations which were broadcast on four separate frequencies. The translators did an admirable job with difficult specialist material, but occasionally a frantic thumping could be heard from the glass wall of the broadcasting box as the translator tried to slow down an excited speaker trying to cram 15 minutes of material into the allotted ten. One felt for the tired translator who, late one afternoon, broke off his commentary during a paper by a Polish physicist to groan: "Oh, this guy speaks dreadful Russian!" and then patiently returned to his task. On another occasion the curses of an exasperated Russian whose slides were put through all possible orientations by a flustered projectionist were faithfully translated, to the great joy of the English-speaking members of the audience.

It is difficult to summarize the main lines of interest at a conference with so many very short
and specialized papers. There was certainly much discussion of the progress and of the likely limiting temperature in the millidegree range of the He³-He⁴ refrigerators at present under construction by groups in the U.S.A., Britain and Russia. There are some divergent and vocal schools of thought here. In the Metals section a lot of time was devoted to magnetic resonances and to the consequences of magnetic breakdown of complicated bound structures in the presence of high magnetic fields. Thermal and magnetic measurements on dilute alloys in the 0.3-4.2 K range, and the effect of pressure on the properties of electrons in metals, were also discussed at length. Inevitably clashes and overlaps occurred between sections, particularly between Metals and Antiferromagnetism, and it became difficult as the day wore on to synchronize sessions. Here the radio link was useful in helping one to gauge progress in different sections.

Guided tours of the sights of Moscow and of the Kremlin were provided for delegates by "Intourist" as part of their package-deal accommodation service. Because of the crowded conference programme, these trips had to be fitted in during the less interesting sessions. Participants' wives and families were entertained by the Ladies' Committee with a variety of activities ranging from "a reception at the Institute for Physical Problems for Ladies" (sic) to visits to schools and kindergartens. An exceptionally fine banquet was held on the Saturday evening, but otherwise at night delegates were free to visit the circus (when performing), or the football, or the ballet (where one horrified delegate arrived to find his wife, who had been unable to get seats from official sources, doing a roaring trade on the footpath buying and selling tickets from Muscovite scalpers until she emerged triumphant with two in the centre of the front row), or the puppet theatre, or just to spend a few happy hours riding the "Metro" underground system and photographing the chandeliers which light the railway track. Another alternative was to have dinner, which could easily occupy the complete evening as the Russians do not believe in hurrying their meals.

**Helsinki in August**

The size and impersonal nature of the Moscow conference contrasted strongly with the 1966 Low Temperature Calorimetry Conference which was held in Helsinki during the preceding week, from August 25 to 30. The Physics Department of the Technical University of Helsinki, under the leadership of Professor Olli Lounasmaa, took the opportunity to waylay about 150 physicists on their way to Moscow and hold a small specialist conference at which the emphasis was as much on calorimetric techniques as on the physics revealed by calorimetry.

The conference was held in the new buildings of the Technical University at Otaniemi about five miles from the city. Delegates and their families were all accommodated in the Hotel Otaniemi, which is a residential hostel for students during the University term and a tourist hotel during the summer vacation.

The weather was warm and sunny, and the organization was superb. As a result a calm and unhurried atmosphere pervaded the whole conference. Contributed papers were each of 20 minutes, there were no parallel sessions, and the communal living provided plenty of opportunity to meet people and have informal discussions over coffee or beer.

Emphasis at the Calorimetry Conference was on instrumentation, on the mundane but important problems of thermometric calibration and the processing of calorimetric results, and on measurements of the heat capacities below 4.2 K of materials containing magnetic impurities. Once again it was clear that magnetic effects are the major current interest in a large number of low-temperature laboratories. Upon arrival each delegate was presented with a proof copy of the conference proceedings, which will appear as a separate issue of Annales Academiae Scientiarum Fennicae, and was given three days in which to submit corrections. The journal will be issued within a month or two of the conference, thanks to efficient editorial work by Professor Lounasmaa and his committee.

Highlights of the entertainment provided were an all-day sea trip through the archipelago to the old town of Porvoo, a first-class conference dinner which featured reindeer as the main course, and a seaside sauna party. The last, segregated in deference to the visitors, gave the world's leading calorimetrists probably their one and only chance of galloping out of an enclosure with a nominal ceiling temperature of 120°C and jumping stark naked into the moonlit Gulf of Finland at a mild 16°C. After four cycles the "Lady of the Bath" served hot Finnish sausage and cold Finnish beer to revive flagging constitutions.

**Sydney in October**

In retrospect the two conferences provided an extremely interesting contrast in contemporary scientific meetings. The one was too big, too impersonal, and often confusing, but at the same time exciting and indicative of the vast expenditure of money and human energy which is going into all branches of physics at low temperatures. The other was ideal: It was small and intimate, and it provided a relaxed setting in which to talk about details and the bread-and-butter problems of low-temperature physics. And yet, if it were not for the huge parent meeting which followed, it could never have been held.

Reviewed by Mr. J. C. Dooley, Bureau of Mineral Resources, Canberra.

The task of the reviewer of this book has been simplified, because the authors set out in a preface what they have attempted to do, and because, within their own terms of reference, they achieved their objectives admirably.

They state that they have aimed at two audiences—students and professionals, with preference for the students where their interests diverge. They aim at building the foundations of theory, and its relation to practice, and at filling a gap between existing text books and research journals. The book is not intended as a handbook and does not attempt to summarize current research. They have not attempted to list an exhaustive bibliography, partly to keep the size of the book "tolerable"—the references, listed at the end of each chapter, range from a single reference for "Electromagnetic Theory" to somewhat more than a page for "Plane seismic waves in layered media".

They deal for the most part with geophysical prospecting, but touch occasionally on deeper crustal or mantle problems. Engineering or groundwater applications are not mentioned specifically, though, of course, some of the theory is relevant.

The book is divided into three parts—Seismic Methods, Gravity and Magnetic Methods, and Electrical Conduction and Electromagnetic Induction Methods. Each section begins with an introductory chapter, which includes a discussion of the relation between the properties of rocks measured and their physical and chemical structure; Part II ends with a useful summary of rock magnetism. Each part develops the basic theory on which interpretation is based, leading up to chapters on quantitative interpretation. There is no attempt to describe field techniques or instruments, except for Chapter 15 on "Electromagnetic Induction Methods", written because "the literature in this area is scanty and consists mainly of descriptions of obsolete practices".

Considering the range of material available, the authors have naturally had to make some choice, and undoubtedly specialists in various fields will regret some omissions. For example, there is no discussion on the vast possibilities opened up by the use of magnetic recording and playback facilities in seismic reflection; the widely (if not always wisely) used second derivative in gravity and magnetic work is barely mentioned, and the induced polarization effect receives only a brief discussion.

On the other hand no one can fail to be surprised by the thoroughness and usefulness of the discussions of many of the topics included. There is an abundance of type curves and nomograms for direct interpretation of anomalies in terms of simple geometric shapes, many of which have not previously appeared in the literature. The first part includes discussion of imperfectly elastic media, transversely isotropic media, inhomogeneous media, and the effect of these properties on seismic recordings, and concludes with an erudite chapter on refraction and reflection of spherical waves. The treatment of electromagnetic induction is very comprehensive.

A sound knowledge of mathematics is required to follow most of the book—probably at about the level of second year honours or third year pass as taught in Australian universities. This is a timely reminder of the need for mathematics and physics (mostly classical physics) in the training of geophysicists, when geophysics—where it is taught as a separate discipline in Australian universities—is invariably handled by geology schools.

In spite of the mathematical nature of the theory, however, the authors keep the reader's feet firmly on the ground, as frequent references are made to the necessity of relating the calculations based on physical and mathematical laws to the reality of geological structure. Timely warnings are given about the dangers of oversimplification, and the need for experience and the "feel" for a realistic interpretation, which, though largely beyond the scope of this work, is essential in the geophysicist's make-up.

This book will facilitate greatly the proper training of geophysicists and must be regarded as an essential addition to the library of any practising geophysicist or geophysical institution concerned with interpretation of surveys. Those working in the more basic aspects of geophysics will also find it invaluable as a theoretical reference.


Reviewed by Dr. C. K. Coogan, C.S.I.R.O. Division of Chemical Physics, Clayton, Vic.

This book is a good sample of the new wave of physics text books, pitched at the level of the postgraduate student, which presents physics as an enclave of the mathematics department. Typically the book is all mathematics and little or no physics. The author himself sums the situation up in his preface: "A sufficiently naive reader might get the impression that no experiment on solids have ever

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been done; stubbornly refusing to read between the lines he might even conclude that there is no need to do any, since whatever is of importance can be predicted a priori."

There is no author index in this text. Nor is there need of any, as no authors nor their writings are mentioned in the book! A diligent search of its pages unturned no reference which slipped through by mistake—the sole allusion is to Seitz and Turnbull, eds., Solid State Physics in the preface.

The result is an ex cathedra presentation of the Relevations of Theory, as it came to the author, which tends to gloss over the assumptions implicit in the Theory and its attendant Models, to present one treatment rather than variants with sometimes conflicting or at least different results and, in short, to shield the student from any whisper of controversy. To me the presentation smacks of "Don't argue, this theory is right." It is in the text book, it must be true.

Bowing to convention, the author has dutifully placed several problems at the end of each chapter (one wonders whether a physics text book would sell in America nowadays without those problems?) Nor can he resist the temptation to "josh" in this region of the book—for example page 48 sets out: "Corollary 2. For a given $F(R)$, the set $A_f$ is unique. The proof is in Problem 4". Problem 4, page 49 reads: "4. Prove Corollary 2 on page 48." One wonders whether thought and learning processes of graduate students have changed so much in these last ten years.

Lest you get entirely the wrong impression of the book from this rather dyspeptic review, I hasten to add that it does seem to me to be a valuable book—but probably not for the audience intended. Those who would derive most benefit from it, in my opinion, are those who have worked over the subject matter of the book before, in other texts more closely related to the physics of the laboratory and experimental discoveries, and who know the "ifs" and "butts" which must be applied here and there. The strong point of the book is its emphasis on the mathematical properties of solids resulting from the spatial regularities of a crystal. It is very attractively laid out and printed. The chapter headings are: The Geometrical Symmetry of Crystal Structures (the nature of a crystal lattice and its various symmetry properties), Waves in Lattices, Vibration Spectrum of a Lattice, Quantization of Lattice Vibrations and Calculation of Specific Heat, Interaction with Electromagnetic Radiation, General Features of Electron Energy Levels, Statistics (the statistical mechanics of crystals, with and without defects), The Wannier Representation, Effective Mass Theory.

This is undoubtedly a good supplementary book on solid state theory which should certainly gain a place in most institutional libraries.

SUBMARINE GEOLOGY AND GEOPHYSICS.
Reviewed by Mr. L. V. Hawkins, Department of Applied Geology, University of New South Wales.
In the field of submarine geology and geophysics, the accumulation of new data and the extension of knowledge has been extremely rapid; it includes contributions from many scientists working on complex and varied problems throughout the seas and oceans of the world. In such a branch of science, there is a real need for the frequent presentation, analysis and review of the data and for the exchange of ideas at international symposia.

The Colston Papers No. 17, "Submarine Geology and Geophysics" is the collection of papers presented at an important international symposium, together with the resulting discussion. As such, it is a valuable addition to the literature on this subject and makes rewarding reading.

A total of twenty-three papers are presented, of which three have only the abstract and discussion; two of the papers are in French. The subjects treated range from the geophysics, geology and structure of the continental shelves, continental margins, oceanic ridges and the sea floor to coral reefs, marine sediments, sedimentation processes and environments, palaeontology and mineral exploration. Only one of the papers, "Mid-Oceanic Ridges and Tectonics of the Sea Floor" by H. H. Hess, is frankly speculative in character; most papers present very interesting data. In view of the magnitude and complexity of many geological problems, it is not surprising that some of the conclusions and discussions reflect the controversial nature of some intriguing geological theories.

A paper of particular geophysical interest is "Deep Structure of the Coastal Margins and Mid-Oceanic Ridges" by J. Larmar Worsel, and of general geological interest "Geology of the Continental Margin off Eastern United States" by K. O. Emery. Several interesting papers deal with sediments and sedimentary basins in the Mediterranean Sea, including a paper by D. Ninkovich and B. C. Heezen on the "Santorini Tephra" which has not only geological but also general, historical and archaeological interest. There are other interesting papers on recent sediments, including a paper by Ph. H. Kuenen on experiments with turbidity currents on the structure and geology of different areas, and a short paper by F. P. Shepard on the exploration of submarine canyons by Cousteau's diving saucer.
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Reviewed by Dr. W. I. B. Smith, School of Physics, University of Sydney.

Professor Lengyel's book can be unreservedly recommended as a comprehensive introduction to the physics of lasers. It is an excellent combination of the basic theoretical and experimental aspects of laser physics and technology. The emphasis is on lasers themselves. Five of the eight chapters discuss in turn lasers in general, solid, liquid and gaseous state lasers, including semiconductor lasers and pulsation and giant pulse techniques and theory. The other three chapters deal with electromagnetic radiation and the coherence of light, non-linear phenomena including frequency conversion, Raman effect and multiple photon processes, with the final chapter on laser applications being but 14 pages long. A most valuable feature is the excellent lists of references which are attached to each section of each chapter.

As stated in the preface, the material in the book reflects the state of laser art as it appeared in the literature published before the Northern fall of 1964, and in some cases advances published in early 1965 are also included. What may appear to be omissions or shortcomings of the book, such as no mention of holography, can almost always be put down to extremely rapid advances in a field in the state of roaring adolescence. Professor Lengyel has not only made useful contributions to the field himself (he was a member of the Hughes Research Laboratory when the first laser was built there by Maiman in 1960), but also he was attracted early to the task of organizing and recording the expansion of this field of knowledge. As this book proves, he has accomplished this task in a most commendable and useful manner to those interested in or working on or with lasers.


Reviewed by Mr. R. W. Harris, School of Physics, University of New South Wales.

It has now become impossible for the scientist to remain ignorant of the subject of electronics, and this has stimulated people to put pen to paper to cater for both the undergraduate and graduate scientist wishing to increase their knowledge of electronics. The type of book required is one which will survey all the important branches of electronics so that the reader can gain a working knowledge of the subject without having to go into the detail that an electronic engineer would require. One book which has met this challenge is "Electronics for Scientists" by Malmstadt, Enke and Toren, which also has an integrated course for experimental work. The above book, however, has two main disadvantages: (i) its cost, (ii) a limited coverage of topics (noise, tunnel diode and the SCR are not discussed, to mention just a few).

The book by Phillips, although not having an integrated course of experimental work, is inexpensive and does discuss most of the important topics. There is an excellent chapter at the end on the practical aspects of electronic construction and many proven circuits are given. The chapters cover: Simple Network Theory, The Properties of Vacuum Tubes, Transistors and other Semiconductor Devices, Tubes and Transistors as Amplifiers, Multistage Amplifiers, Rectifiers and Detectors, Feedback, Limits to Amplification: Bandwidth and Noise, Oscillators and Switching Circuits, Electronic Instrumentation, with appendices on Elementary Matrix Algebra, Transistor Hybrid Parameters, Symbols and Abbreviations, Circuit Symbols.

The book is eminently suited to the scientist wishing to acquire or brush-up his knowledge of electronics. The book has been chosen as a recommended text for Physics 3 at the University of New South Wales in 1967.

Reviewed by Dr. J. W. Blaney, Australian National University.

This book is well described by its title. It is a teaching text suitable for senior undergraduate students and presents the basic mathematical (vectorial) theory in a clear, carefully developed and selective manner, maintaining a strong emphasis on physical concepts. The author justifies the book as a presentation of a classical subject in physics in a style appropriate to students in the 1960's.

The theory is built up logically from the empirical laws of force between stationary and slowly moving charged particles, leading into force and energy fields as convenient mathematical and physical concepts. Emphasis is placed on the distinction between microscopic and macroscopic treatment and the similarities of electrostatic and magnetic theory.

The claim to contemporary atmosphere is based partly on this non-historical treatment, but mainly on the introduction of or reference to a number of topics of interest in modern physics. These include particle orbits, cyclotrons, superconductivity, plasma physics, magneto-hydrodynamics, time reversal and space inversion, atomic theory and some solid state physics. The treatment of these is, as the author acknowledges, very brief and beyond the scope of the book, and not at all suitable for study as they stand. However, the insertions are interesting and usually relevant. They perhaps are also intended to indicate that elementary electromagnetic theory falls short of adequate description and to open the student's mind to other branches of physics connected with electricity and magnetism. Although referring frequently to better treatment as being beyond the scope of the book, the author gives very few references for further reading. A number of errors in cross reference to earlier equations, etc., were also noted.

Four chapters are devoted to each of electrostatic, magnetic and electromagnetic fields in vacuum and material media, one to motion of charged particles in electromagnetic fields and one to electric and magnetic properties of matter.

The dust jacket hails the book as having "the best balance between mathematical rigor and sophisticated physics of any E. & M. book". The author, but not the student if he has heeded the oft-repeated warnings earlier in the book, falls from grace, with the concluding paragraph of a section on the Meissner effect, Chapter IX, which I quote in full.

"Another rather remarkable property of a superconducting ring is its self-inductance. The self-inductance of a circular loop composed of a wire of non-superconducting metal of zero cross-section is infinite, as may be seen by direct calculation from eq. 8.13. However, as the temperature of the metal is reduced below the critical temperature, the self-inductance becomes finite. This may be seen as follows. The loop is originally above the critical temperature carrying zero current but it is in an external field producing a flux $\phi_0$. The temperature is then reduced below the critical temperature and the source of the external field removed. Current $I$ will flow around the loop to produce the flux $\phi_0$. The self-inductance $L$ of the loop given by $L = \phi_0/I$ will consequently be well defined."

The physics, mathematics or both thereby thrown to the four winds might have been retrieved if a discussion of the fallacies, half-truths and truths had followed. Elsewhere it is stated baldly that though $B = 0$ inside a (thick) superconductor, $H = 0$. This is better regarded as an occasionally useful concept for external field description.

Rationalized MKS units are used and useful appendices on units, dimensions and mathematical relations are included. Problems are set on each chapter, and answers to some of these are given in an appendix.

The book is well produced and of undoubted benefit to a student reading it carefully. Most of the book is far better than this review seems to indicate—it just falls short of its stated objective.


Reviewed by Professor R. E. Aitchison, University of Sydney.

At first sight this book could be considered as a second edition of "Pulse and Digital Circuits" by the same authors, but so much new material is included that it can be considered as a new text.

Generally the book describes active and passive devices and circuit configurations used for the generation and processing of pulse, digital, and switching waveforms. These signals find extensive use in such fields as computers, control systems, counting and timing systems, digital instrumentation, etc.

Each chapter includes a thorough treatment of the subject, illustrative diagrams spread through the text, and numerical calculations or worked examples on the subject. Included in the Appendices is one giving Problems on the various chapters.

The main emphasis throughout the text is on basic principles; most illustrations are for transistor circuits, with some reference to vacuum tube circuits where applicable.

There would be no point in considering the content of this book chapter by chapter—it is sufficient to say that it covers in considerable detail most aspects of the performance of switching circuits. In general the treatment is basic and emphasises principles, and is illustrated by worked examples. Perhaps some of the vacuum tube circuits could
be considered a little old-fashioned; also supplying problems without answers is of questionable value. However, apart from these points the major criticism of this book is its length. It would take a very determined student quite a long time to work through the text from start to finish.

A major topic associated with switching waveforms which is not treated in this book is the analysis and application of digital integrated circuits. There is no doubt that even now this subject is of major importance and it will become even more important in the future. In some respects, the problem of rapid growth of new subjects is one affecting all aspects of electronics, rather than this particular subject. Whatever the solution, there is no doubt that the book contains a good and thorough basic treatment of pulse digital and switching waveforms, and can be recommended highly for any student, engineer or scientist interested in the analysis of such circuits and their application in systems.


Reviewed by Dr. W. E. Smith, School of Mathematics, University of New South Wales.

With the revision and modernization of school mathematics syllabuses there has arisen a need for new books of two types. The first is for student text books for direct use by the students, and the second is for books for use by their teachers. The book under review is of the second kind although its usefulness is not entirely confined to this sphere. Its aims are to discuss material which is either new, or not completely familiar to many practising teachers, and to present illustrations for classroom use.

The book gives a logical and readable development of the ideas of set theory, relations and functions and basic group theory. Applications to various branches of mathematics including arithmetic and number systems, geometry and elementary topology are included. Matrices are introduced at an early stage. It makes no claims to rigour, being designed to interest teachers and not academically committed mathematicians. No special prior knowledge is necessary for the reader to be able to work through the text. There are numerous exercises of two kinds: one to be worked by the reader to clarify or extend the concepts in the text, and the other to provide ample illustrative examples for the teaching situation.

The authors are experienced in writing school texts for the United Kingdom education system and this book is intended for teachers there. The amount of material covered is a good deal more extensive than that required for adequate teaching of this section of the work in existing Australian school.

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mathematics courses. Nevertheless, teachers who graduated more than, say, ten years ago, would benefit from the broader background to be gained by working through this book.

Members of the Institute whose mathematical training was completed some time ago could also profit from reading this well-prepared book which would familiarize them with some essential concepts of modern mathematics.


Reviewed by Dr. N. S. Gill, Department of Chemistry, Australian National University.

This is a translation by N. N. Greenwood and H. P. Stadler of the original German text. They have written it in a clear, straightforward manner and at no time does one sense that it is a translation.

The author sets out to present, by the use of pictorial representations, a non-mathematical introduction to the modern theory of atomic structure and ionic, covalent and metallic bonding, including results that have been obtained by quantum mechanical calculations. On the whole, he has succeeded in presenting the concepts clearly, and many points are well made. In particular, the shapes and symmetry of orbitals and their use in bonding in a variety of situations are well illustrated. However, one cannot help feeling that, due to simplifications, some aspects tend to become vague, and this might confuse the student. For example, the discussion of valency states implies that the electronic structure of an atom in a valency state is necessarily different from that of the isolated atom, while the statement that "valency states are always singly occupied" is quite misleading without further elaboration. It is also unfortunate that the treatment of bonding in water and ammonia molecules is in terms of atomic $p$ orbitals, while it is in terms of hybrid orbitals in the case of methane. The translators have attempted to remedy this by a footnote but it might not overcome the impression that hybridization of atomic orbitals is not a general basis for describing covalent bonding.

An unusual feature for this type of text book is the sections on chemical reactivity and colour of compounds, although the treatment is not always the conventional one. This is partly the result of simplifications introduced earlier in the text and partly to the introduction of some of the author's own theories, which could stimulate some discussion.

This book could well serve as supplementary reading for students who are studying at an introductory level the various topics covered.

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