The Australian Institute of Physics

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A NEW PUBLICATION
"URANIUM — Energy source of the future?"
THE CASE FOR E. W. Titterton
THE CASE AGAINST F. P. Robotham
Price $4.95
ISBN 0 17 005579 8

This book was commissioned by the Australian Institute of International Affairs and is published in their Abacus series by Thomas Nelson Australia Pty. Ltd., 19-39 Jeffcott Street, West Melbourne, Victoria 3003, Australia, 1979.

The book is the first member of a new "Discussion Series" of books commissioned by the Australian Institute of International Affairs intended, within the covers of a single book, to examine the pros and cons of controversial international issues. In this case both sides of the uranium argument are presented so that (with the aid of the index) the reader can examine them and form his own judgement on the issue.

The Institute believes this will be of considerable help to understanding the complexities of an important modern problem. Professor Titterton (the Australian National University) presents material pointing to the need for nuclear power while F. P. Robotham (Radiation Protection Officer at the University of Melbourne) outlines the case against nuclear power.

The book may be ordered in single copies from—
The Director
The Australian Institute of International Affairs
Box E181, PO,
Canberra, ACT 2600, Australia.

The price is—Australia A$4.95, postage and packing 50c; New Zealand NZ$6.50, postage 65c; United States of America US$5.60, postage; United Kingdom stg £2.50, postage 30p.

The statements made and the opinions expressed in The Australian Physicist do not necessarily reflect the views of the Australian Institute of Physics, its Council or Committee.
PRESIDENT'S COLUMN

There has been a big increase of interest in the history of science in the last generation. In Australia this has been expressed in various ways and many persons will have followed a similar path to me and have enjoyed reading Ann Mozley Moyal's recent book, "Scientists in Nineteenth Century Australia" (1976). The Academy of Science has been publishing the "Records of the Australian Academy of Science" since 1966 and there have now been many good historical articles. I draw attention to those that I found important and appealing. There are the two long linked articles by John McNeil on H. J. Grayson and the development of the ruling of diffraction gratings in Australia (Records, Vol. 2 (1972) Number 3, p. 18, Vol. 3 (1974) Number 1, p. 30), and that by Len Huxley and Fred White on the history of Radio Research in Australia 1927-1939 (Records, Vol. 3 (1974) Number 1, p. 7).

It seems to me that the members of the Institute should be aware of this activity in historical writing because there are many things that we can do to assist. Firstly, there is the act of writing historical scientific articles ourselves; there is a great need for more of them. Secondly, it may not be widely known that the Basser Library of the Academy has as one of its aims to act as a collector of archival material for the history of science in Australia. The AIP has sent its early records, especially those of the Association with the British IOP, to this Library. The first archival collections were recorded by Ann Mozley in her earlier book "A Guide to the Manuscript Records of Australian Science" (1966) and continuing editions are noted in the "Records". With the passage of time opportunities will come the way of most of us to contribute to these archives, for instance as laboratories expand or move to new sites, or as individuals retire or have to act as scientific executors.

Of course, old scientific equipment has great archival and display value and there are collections in most museums. The new site for the Museum in Sydney and the projected site for the Science Museum in Melbourne will allow displays which are going to be very much better than any available at the moment, except perhaps, in my mind, for the Museum for the History of Medicine in Melbourne University. This, though small, has a splendid display and is a tribute to the collecting power and enthusiasm of Emeritus Professor Ken Russell.

H C Bolton

OBITUARY———Gordon Hay Godfrey, 1892—1979

Gordon Hay Godfrey, a Foundation Fellow of the Institute, died on 16th September, 1979. Born on November 14th 1892, he was educated at Fort Street High School and taught in a number of High Schools in New South Wales and Queensland. He obtained degrees in Arts and Science at Sydney University, followed by an M.A. with University Medal in 1919 for a thesis on the Special Theory of Relativity. From 1921, Godfrey was associated with Sydney Technical College, first as Head Teacher of Physics and later as Lecturer-in-Charge of Physics and Optometry. In 1951 he was made Associate Professor of Applied Physics at the University, and for a time was acting Head of School. His services to Optometry were recognized by his election to Honorary Life Membership of the Australian Optometrical Association (NSW Division).

During World War II Godfrey worked at the National Standards Laboratory on optical problems, principally on refractometry. He maintained his interest in research until shortly before his death, working on the optical properties of multilayer coatings.

About seven years ago he re-examined his M.A. Thesis and started to follow up some ideas he had then put forward which now appeared relevant to deeper understanding of Wave Mechanics. These ideas were sent to Louis de Broglie, famous for his theory on Particle Waves which now bear his name, who replied at some length, commending Godfrey's insight into what was then an infant concept.

His colleagues extend their sympathy to Mrs. Mabel Godfrey.

Professor J. F. McConnell, UNSW.
-32nd. AIP COUNCIL MEETING

The AIP Council met in Sydney on 20, 21 September 1979 to review the work of the Institute during the 1978/79 financial year and to approve plans and budget for 1979/80. Reports from Branches, Groups and Committees showed a lot of activity in the past year and this will provide the basis for the Annual Report now being prepared. An equally vigorous programme was adopted for 1979/80.

CONFERENCES AND MEETINGS

Conferences supported or co-sponsored by the Australian Institute of Physics during the coming year include:

- International Magnetospheric Study, La Trobe University, 27 Nov-Dec. 1979
- Australian Conference on Molecular Physics and Quantum Chemistry, Science Centre, Sydney, 17-20 Feb. 1980
- Gascoyne Electronics Meeting, Sydney University, 21-22 Feb. 1980
- 4th AIP National Congress, Melbourne University, 25-29 August 1980
- 5th International Ion Beam Analysis Conference, University of NSW, Feb 1981

Following the success of the Applied Physics Conference held in Rockhampton in July, Planning has commenced for a second such conference and it is hoped that these will become a regular, major AIP event, alternating with the National Congresses.

It is planned to hold the 1980 Pawsey Lecture — an AIP prestige event — in Western Australia and Council also initiated consideration of financing an AIP Lecturer to visit nearby developing countries.

GENERAL ACTIVITIES

The Editor of The Australian Physicist reported on the work of the Editorial Committee which, although only a voluntary Committee, sustains one of the Institute’s most difficult and important activities. A greater supply of contributions — particularly news items — is needed to ensure the continued success of the Institute’s journal.

Following a discussion of the role of the Australian Journal of Physics, Council expressed its strong support for this journal as a necessary part of a mature physics programme in Australia which should not be completely dependent on publication in overseas journals. Council also expressed its willingness to consider any requests for assistance from the AIP Advisory Committee.

Council supported proposals for:

- Preparation of a pamphlet on Careers in Physics.
- Preparation of short films for use at the 4th AIP National Congress.
- Preparation of an Heiostat Exhibit for display at The Questacon, a centre for participatory science exhibits being set up in Canberra.

Additional AIP activities include an Archive for historical material and the introduction of a collection of scientific equipment of historical value. Arrangements for these collections involve the Basser Library, Canberra and the Victorian Science Museum respectively.

REPRESENTATIVES ON OTHER ORGANISATIONS

AIP representatives provided reports to Council which will also form part of the AIP Annual Report. However, after consideration of the recent activities of the Conference of Allied Societies, Council resolved to withdraw from this organisation.

COUNCIL COMMITTEES

Branches are active in a variety of ways in education but it has been very difficult to establish national activities on this topic. Accepting the advice of most of those interested members who had commented on this situation, Council decided to discontinue the Education Committee.

The Science Policy Committee reported a year of vigorous activity in which more than ten topics received attention — most of which have already been reported in The Australian Physicist. As part of a continuing consideration of freedom of scientific activities, Council resolved to write to the Australian Academy of Science noting and welcoming the resumption of scientific exchange with the USSR and the hope that Science will not be used in future to apply diplomatic pressure on other countries.

The Employment Committee reported that a paper on the results of the Remuneration Survey should be available for publication before the end of the year. Plans are underway to survey information on graduate employment.

MEMBERSHIP

The Membership Committee reported a small increase in membership for the first time in four years. However, Corporate membership of the Institute is still static and further efforts are needed in recruitment. For this purpose an Information Kit has been prepared for display at important meetings and a revised General Information Booklet will be issued in the near future. It is also hoped that individual members will publicise the broad scope of Institute activities and the value of membership as a means of supporting and participating in these activities.

In accordance with the advice of the Membership Committee and other experienced members of the Institute, Council adopted two important changes to the requirements for membership grades. These are:

- Fellows shall have achieved a high level of attainment or responsibility and to have made a substantial contribution to physics, or to the profession of physicist or to the teaching or application of physics.
- The appropriate steps are to be taken to allow admission of Graduate members upon satisfactory completion of a recognized degree or diploma or equivalent training without having to subsequently gain one year of experience in the practice or teaching of physics or its applications.

COMPANY SUBSCRIBERS

It was unanimously resolved that Dr W. Beaz and Sir Alan Walsh be elected as Honorary Fellows of the Australian Institute of Physics.

COMPANY SUBSCRIBERS

The Industrial Liaison Committee of the W.A. Branch submitted a report containing sixteen recommendations aimed at increasing Company Subscriber membership of the AIP. These cover many possibilities for two-way exchange of information between the AIP and interested companies on job opportunities, conferences, physics developments, availability of expertise, special training and other activities. The Editor of The Australian Physicist and the AIP executive are to investigate possible action on these recommendations.
FINANCE
Having held membership fees constant for three successive years Council decided that it would be preferable to begin making small increases rather than risk the need for a much larger rise in future years. It was therefore resolved that membership fees be increased by approximately 8% to the following: Fellow — $57; Member — $39; Graduate — $25; Associate — $15; Student — $56, Subscriber — $15, Company Subscriber — $85.

From a discussion of insurance cover for members attending Committee Meetings or Scientific Meetings of the AIP it appeared that some members are already covered by existing policies but some may not be covered. It was therefore decided to recommend that Committee members and others should each check the situation applying to their own case.

R. Bird, Hon. Sec.

VICTORIAN BRANCH NEWS

At the September meeting of the Victorian Branch, a large audience attended the talk entitled “The Bionic Ear — Implanted Hearing Aids” by Dr David Dewhurst. Dr Dewhurst presented a fascinating description of progress with a hearing aid being developed by the Electrical Engineering Department at Melbourne University in conjunction with the Eye & Ear Hospital, for sufferers of nerve deafness. About 0.5% of Australia’s population suffers from nerve deafness, in which the hair cells of nerves in the cochlea are damaged. To provide the sensation of hearing, a box of electronics is implanted in a socket in the mastoid bone, and connected by leads passing through the ear drum and middle ear to a linear array of electrodes in the spiral cochlea. Although further work is needed to miniaturize the implanted electronics, particularly for use in children, the major progress still to be made is in the external unit which drives the implant.

Sound frequencies are not related in a simple way to the position of nerve cells stimulated in a normal ear. Therefore a computer must be programmed to translate each sound into the appropriate series of digital signals to the electrodes. The result is transmitted by inductive coupling from external coils in the wing of spectacles to the implant under the skin.

Implants have so far been inserted in two patients who are now painstakingly participating in tests to improve the external unit. However, it will be some time before this unit is ready to be reduced from its present size, that of a small suitcase, to the more practical size of a cigarette packet.

Following the announcement of the award of the Nobel Prize in Physics to S. L. Glashow, S. Weinberg and A. Salam for their contributions towards the unification of the theory of weak and electromagnetic interactions, the October meeting was devoted to providing some insight into this difficult area of physics with Professor Geoff Opat, University of Melbourne, presenting “Gauge Field Theory and the Unification of Weak and Electromagnetic Interactions”.

After some biographical details of the Laureates, enlivened by personal reminiscences, Professor Opat introduced the concept of the four categories for fundamental forces: strong, gravitational, electromagnetic and weak. The unification of the latter two represents a step towards the formulation of a totally unified theory.

In introducing the mysteries of electromagnetism and weak interactions and the concept of neutral current interactions, the uninitiated could take heart from Professor Opat’s opening remark that one should approach the theory like viewing an Aztec rock carving: it does not have to be understood to enjoy it. Drawing analogies with a local radio station, Professor Opat proceeded to illustrate the distinction between electromagnetic, or photon mediated, interactions such as electron-electron scattering and weak interactions such as beta decay and neutrino scattering.

Despite the apparent fundamental difference between these two types of interaction their unification was proposed independently by Weinberg and Salam in the late 60s with the introduction of so-called neutral currents. In the analogy of the radio station these currents represent direct induction and do not involve the emission of electromagnetic radiation. The extension of this unifying field theory and its mathematical similarity to those used to describe strong interactions have led to the belief that gauge theories may eventually provide a basis for the unification of the theories for all forces.

The talk then concluded with survey of the experimental results which have confirmed the theoretical predictions.

The Branch annual dinner was held in University House, Melbourne University on November 2. Although the attendance was rather disappointing, those members who came had an enjoyable evening and were amply entertained by Mr Bob Crowder’s after-dinner talk on “Weather Forecasting”. A one-time TV personality as weather announcer for Channels 2 and 7, and now Assistant Director of the Bureau of Meteorology in Melbourne, Bob Crowder provided a delightful mix of scientific insight and amusing anecdotes on the art of foretelling the weather.

The Branch Annual General Meeting held on November 22, concluded what has been a very successful and active year for the Victorian Branch.

J. Pollard
T. F. Smith

COMMONWEALTH DEPARTMENT OF HEALTH
AUSTRALIAN RADIATION LABORATORY

CHANGE OF ADDRESS

The laboratory has moved premises. It is now located at:
LOWER PLENTY ROAD,
YALLAMBIE, VICTORIA 3085

The new telephone number is 433 2211 (area code 03).
The Telex address is 433 2211 (area code code 03), with the answer back code “ARLAB” as before.

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SCIENCE INDICATORS AND THEIR ROLE IN AUSTRALIAN SCIENCE POLICY

In June 1979, Professor Ron Johnston of the University of Wollongong wrote a Report for the Australian Science and Technology Council (ASTEC) with the above title. A few copies were sent to the AIP and were to have been discussed at a meeting of our Science Policy Committee (SPC). There was not enough time to arrange a full discussion and it was left to a few members of the SPC to make individual comments on the Report as they thought fit. These comments of mine have been sent to ASTEC as an individual contribution. I append the Abstract of the Report to my comments; it summarizes the 81-page Report extremely well.

There are many discussions of Science Policy matters in all science organizations nowadays as witness the numerous science policy committees or their equivalents. These discussions reflect an increasing awareness in our society that we need to control the way in which some aspects of Science and Technology are used and the directions in which they are moving. For instance, current debates on energy are in front of each of us and comments on "nuclear versus solar", coal-oil conversion, conservation of petroleum, etc., are mentioned almost daily in the newspapers. It will have been noticed by many that in contrast to some problems, which are going to be around for generations, much of the debate springs up on short-term issues and fades away or disappears into emotional or factional arguments. In AIP SPC meetings it has more than once been stated that if only we knew what next year's crisis was going to be, then we would have a chance of preparing ourselves for its debate instead of trying to respond in a hurry. It is hard to have clear, relevant and well-arranged information to use as a basis in the debates. This very impression is an irritation to practising physicists who are not prepared to admit the essential variability of human judgements.

The term "science indicators" was first used by the U.S. physicist, Harvey Brooks, in 1971, when he was reporting on science policy to the National Science Board of the USA. We may perhaps liken the situation to the measurement of temperature by a thermometer. After the invention of the clinical thermometer, diagnosis was made much easier. Repeated measurements of temperature form a time series, from which information may be deduced, especially after experience. As the Report says, science indicators form time series but not all time series are science indicators; we need a lot of thought and experience to construct the effective indicators. As another example of the use of such time series, we now have long runs of global temperatures, and we can now interpret them in terms of climatic changes.

The Report is long and scholarly; there are 81 pages and 97 references. The record of persons who have attempted to construct science indicators is long; we start with Charles Babbage who, in 1830, assembled qualitative information to demonstrate the need for change in the support for science. Succeeding attempts were the reports of the Devonshire Royal Commission in Scientific Instruction and the Advancement of Science in the 1870's, Frederick Rose's "Report on Chemical Instruction in Germany and the Growth of Present Conditions in the German Chemical Industry" in 1901, J. D. Bernal's studies in "The Social Function of Science" in 1939, and Vannevar Bush's "Science: the Endless Frontier" in 1945.

Defining the indicators will not be easy, but there is already a body of evidence about them. The USA seems to have done most of any individual country, and the Organization of Economic Cooperation and Development (OECD) has done a lot for its member nations. Professor Johnston, as can be seen in the Abstract, considers that science indicators have three policy roles to play, which he defines as intelligence, policy and public. Following the fascinating revelations of R. V. Jones in his recent book, Most Secret War, we need, as physicists, no further proof of the way in which indicators of a scientific enterprise can be monitored from outside. The political role has an appeal in that an "objective" basis is offered for political decisions.

In Australia we have had collections for several years of research and development (R&D) statistics in Project Score (Surveys and Comparisons of Research Expenditure), now run by the Department of Science and the Environment. Statistics by themselves are not immediately indicators but, as Professor Johnston points out, need to have that essential aspect of being connected to the relationship between input and output of the whole structure of society.

I think that this Report makes a strong case for science indicators in Australia and I urge ASTEC to take up the problems of recommending them to the Federal Government. The Report says that there is no need for a large personnel structure. Every step that removes some of our ignorance about our society and teaches us how science and technology can be applied more effectively must be welcomed.

The address for comments on this Report on Science Indicators is: The Secretary, ASTEC, PO Box 52, Canberra, ACT 2600.

H. C. Bolton

Extract from: "Science Indicators and Their Role in Australian Science Policy Report to the Australian Science and Technology Council (ASTEC), Professor Ron Johnston, June 1977".

ABSTRACT

Science indicators are measures of changes in aspects of science and technology, distinct from research and development (R&D) statistics in that they are designed to meet the interests of a particular audience, usually government policy-makers (Chapter 2). They are different from economic and social indicators in that these are disciplinary-based whereas science indicators form a distinct class only by their focus on application. It is the central role of science in the economic and cultural state of society that justifies the notion of a science indicator (Chapter 3).

A detailed study of overseas indicator programs and of the wide literature relating to indicators has led to the conclusion that the preparation of a science indicator report could be of considerable value in the development of Australian science policy.

The policy roles of science indicators are of three types:

- a technical or intelligence role, whereby measures of the most significant characteristics and changes in science and technology provide the capability for assessing the state of scientific and technological enterprises, for detecting major changes in its organization and balance, and for evaluating the effects of policy initiatives.
a political role in providing a basis for a better informed scientific community in developing recognition among politicians of science and technology as dynamic systems which can be adversely affected by apparently unrelated decisions, and in providing an 'objective' basis for political decisions and a common language for the expression of countervailing interests and goals; and

a public role in increasing public awareness of science and technology and enhancing understanding of the role of research in shaping the nation's future (Chapter 5).

The last two roles are often not recognized, though they may be the most significant effect of a science indicators program.

In view of the present immaturity state of the knowledge of the science system, input-output analysis provides the most fruitful path for the development of science indicators, though they would need to be revised in the light of theoretical advances. Indeed, the development of science indicators needs to be recognized as a research process itself, rather than a question of acceptance or rejection of a pre-formed policy tool (Chapter 4).

Data are readily available for the construction of input indicators i.e. measures of resources, both capital and manpower, to R&D and innovation; output indicators, reflecting the products or consequences of science and technology are far more difficult to measure. Immediate measures of output in the form of the number of publications or refinements of this using citation analysis can be constructed, but their validity has been seriously challenged.

Measures of ultimate output such as patent statistics, level and kind of inventive activity and productivity are available but there are so many intervening factors it is very difficult to attribute some portion of enhanced productivity to research, let alone infrastructural services (Chapter 4). Nevertheless, some progress is being made in the construction of output indicators. The Organisation for Economic Co-operation and Development (OECD) is developing four on an international basis — productivity indices, balances of technological payments, trade balances and patent balances (Chapter 6).

Most OECD nations have, or are actively developing, a science indicator program, though not always under that name. The general purpose is to obtain greater assistance in the formulation and evaluation of science and technology policies. The National Science Board (NSB) in the USA has been publishing a biennial science indicators report since 1972 and the evidence is that it has been highly effective in intelligence, political and public roles. Overseas experience indicates a wide acceptance of indicators as having an important part to play in the formation and evaluation of science policy. In most countries, science indicators reports are produced or being developed with quite modest resources, relying largely on existing data (Chapter 6).

Science and technology statistics are already used to a significant extent in science policy debate, formation and evaluation in Australia. However, there is a need and opportunity for a centralised collection of appropriate science indicators to expand this role. Four case studies of the actual or potential intelligence policy role reveal how science indicators could be used in evaluation of stated science policies, in the establishment of priorities for research, in assessing the 'employment coefficient' of technologies, and in determining the changing fine structure of the research system (Chapter 7).

An illustrative practical list of science indicators has been constructed, largely from available data. A wide range of data sources have been found to be available, including not only Project SCORE but also the annual and other reports of all research funding and performing bodies, the publicly available documents from the wide range of organisations concerned with some features of the scientific and technological infrastructure, including particularly manpower and training and international data collections.

On this basis it is concluded that a science indicators report would not only be highly valuable but also practicable, requiring only relatively small resources. It is suggested that it might be published biennially and that responsibility for its production should rest with the Department of Science and the Environment, in view of its experience with Project SCORE and its responsibilities in the area of scientific information. Considerable emphasis is placed on the need for a science indicator report to be presented in a clear, compelling and easily comprehensible format, with analysis of the major developments and diagrammatic presentation suitable for a wide lay audience.
PHYSICS ROUNDBOUGHT

ASTEC Acts on AST

Finding of astronomical research instruments is a costly business and ASTEC has reported on two proposals – The Australian Synthesis Telescope (AST) to be built at Parkes and a three-metre Optical telescope developed by ANU for installation at Siding Springs. The ASTEC report firmly favours AST at a cost of $12.5 milliam. The AST is a synthesis telescope in which a number of radio antennae are used in combination to give better resolution and sensitivity than is possible with a single dish. It is recommended that it be built and operated by CSIRO under contract to a Board and that it should be regarded as a national facility available to all Australian astronomers.

A New Journal

The European Physical Society has agreed to the publication in 1980 of a new quarterly journal by the Institute of Physics under the editorship of Professor G. W. Series. It will deal with both education and scholarly studies in physics, providing a forum for scholars and teachers of physics in universities and other educational institutions.

Flat Lapping/Optical Polishing Machine

A twin-wheel flat lapping/optical polishing/honing machine from Precision Lap Ltd, Camberley, Surrey puts a variety of surface finishes on flat or cylindrical components made from a wide range of materials.

The Precision lap 2/800 yields a flatness and parallelism which is difficult to achieve by other means. Also, the unit's high power motor, fully-floating upper lap plate and controlled carrier rotation ensure high rates of stock removal.

The twin-wheel arrangement, enabling both surfaces of a component to be lapped simultaneously, results in an epicyclic action, eliminating plate tracking. Because the whole surface of both plates is used, plate life is prolonged and accuracy maintained. [Gilbert Lodge & Co. Ltd., 13 Paramatta Road, Lidcombe NSW]

The Acoustics of Stringed Musical Instruments

A fourday Cooperative Workshop on "The Acoustics of Stringed Musical Instruments" will be held at the University of Wollongong, Physics Department, starting on Saturday 5th July and concluding on Tuesday 8th July, 1980.

The Workshop is being arranged under the joint auspices of the Caquac Acoustical Society and the Physics Department at the University of Wollongong and is timed to occur immediately before the Tenth International Congress on Acoustics in Sydney starting on Wednesday 10th July, 1980.

There is a growing interest in the physics of musical instruments, and it is hoped that the Wollongong Conference will enable Australians who are interested in aspects of this subject, to meet with some of the leading workers from overseas.

Further details, including a copy of the FIRST CIRCULAR may be obtained from A. I. Segal, Department of Physics, The University of Wollongong, Wollongong, NSW 2500.

Astronomy Advisory Committee

The appointment of an Astronomy Advisory Committee was announced on 5 November, 1979 by the Minister for Science and the Environment, Senator Webster.

The panel of distinguished astronomers will advise the Minister on all proposals for major new observing facilities requiring Commonwealth funds.

The Chairman is Professor K. C. Westfold, Professor of Astronomy, Department of Mathematics, Monash University.

Other members are: Mr. J. G. Bolton, F.R.S., CSIRO Division of Radiophysics; Professor R. H. Brown, F.R.S., F.A.A., F.R.A.S., School of Physics, University of Sydney; Dr W. G. Elford, Department of Physics, University of Adelaide; Professor S. C. B. Gascoigne, F.A.A., Mt Stromlo and Siding Spring Observatories, Australian National University; Professor V. D. Hopper, Department of Physics, University of Melbourne; Professor D. S. Mathewson, Director, Mt Stromlo and Siding Spring Observatories, Australian National University; Professor B. Y. Mills, F.R.S., F.A.A., F.R.A.S., Department of Physics, University of Sydney; Mr H. C. Minnett, O.B.E., F.A.A. CSIRO Division of Radiophysics; Dr D. C. Morton, Director, Anglo-Australian Observatory; and Dr M. D. Waterworth, Department of Physics, University of Tasmania.

The Minister said the new Committee would improve the advice available to the Government on astronomy and thereby help to maintain the excellence of research at astronomical facilities in Australia.

In the case of the more costly proposals for new astronomical facilities, the Government would also obtain advice from the Australian Science and Technological Council.

Scientific Highlights from the Anglo-Australian Telescope —1978—1979 Report

Some of the scientific highlights from research programmes conducted during the year are briefly described below. Additional details for some items are reported in the section on research.

- The distribution of iron ionised thirteen times has been mapped for the first time in the remnants of a supernova in the Large Magellanic Cloud. The pictures obtained give the spatial distribution of gas at a temperature of one million degrees.

- Observations made with both AAT and the UK Schmidt Telescope have been used to identify all objects brighter than the 20th magnitude in a small part of the sky away from the disc of the Milky Way. At this faint level, stars are still ten times more numerous than galaxies and 5% of them are located more than 13 000 light years below the plane of our galaxy.
The extraordinary star-like object SS433 in our galaxy has recently aroused considerable interest throughout the world. Wavelength shifts in hydrogen spectral lines observed over a 160-day period have indicated velocity changes of 50,000 km/s (about one-sixth the speed of light). It was a spectrum obtained with the AAT on 29 June 1978 that established the identity of SS433 with a radio source detected by the Molonglo telescope and an X-ray source found by the Ariel-5 satellite. This brought the object to the attention of the Californian astronomers who discovered the line shifts.

- The AAO's new infrared photometer-spectrometer has been used to study the 3.1 µm absorption of water ice apparently associated with several stars embedded in dust clouds. The absorption characteristic of ice was found in the spectra of some stars, as anticipated from other observations, but unexpectedly was absent in three stars in the dark cloud near α Ophiuchi. Here the dust grains must be coated with metallic oxides rather than ice.

- A programme to detect supernovae which have not reached maximum energy output has been undertaken jointly with astronomers of the U.S. Schmidt Telescope Unit. The first was found in a spiral galaxy in September 1978. Subsequent spectra obtained with the AAT showed that this stellar explosion belonged to the more luminous (type I) class and that the galaxy has a redshift of z=0.07. This redshift indicates that the supernova is one of the most distant yet observed spectroscopically.

A New Kind of Radioactivity

Three kinds of radioactivity are known in the breakup of natural nuclei -- alpha decay, beta decay and spontaneous fission. However, for the ground states of exotic, highly unstable nuclei, additional kinds of radioactivity involving the release of one or two protons have been postulated, but not yet observed.

Another possibility is for particles to be emitted from excited states of unstable nuclei formed, for example, in beta decay. These emitted particles are said to be beta-delayed. Protons, alphas and neutrons have been seen to be emitted in this way. It was Luis Alvarez who first pointed out the important distinction between radioactivity and the emission of these beta-delayed particles.

The search for new kinds of radioactivity is not new. The search for proton emission, for example, began as early as 1914, when even the idea of the proton itself was still in its infancy. It was Rutherford who first showed that the protons which came off when nuclei were bombarded with alpha particles were the result of nuclear reactions, and were not due to the decay of the target nuclei.

Now in an experiment at the CERN synchro-cyclotron (SC), beta-delayed emission of the two neutrons has been seen in the decay of the isotope lithium-11 to beryllium-11.

In the experiment, the lithium isotope was formed by bombarding a uranium carbide target, heated to 2000°C, with 1.6 µA 600 MeV protons from the SC. The atoms were mass separated in the ISOLDE isotope separator, and a beam of some 15 atoms per second was obtained.

Preliminary studies of single beta-delayed neutron emission revealed peaks corresponding to emission from well-known beryllium-11 levels, but in addition a broad distribution was seen. This was suspected to be due to two-neutron emission, but confirmation was needed.

In a second experiment, the lithium-11 beam was directed to the centre of a 60 cm paraffin block, equipped with eight helium-3 proportional counters. The neutrons stayed an appreciable time (about 100 microseconds) in the paraffin before they were detected by a helium-3 counter. This enabled the experimenters to connect their detectors together and look for time-correlated neutron events.

Correlated pairs of neutrons were seen, and the effectiveness of the method was checked by looking at multiple neutron emission in the spontaneous fission of uranium-238.

The two-neutron energy spectrum from lithium-11 is expected to show signs of final state interactions, so that further studies could reveal important information on the neutron-neutron interaction. [Corn Courier, Nov. 1979]

Australian Radiation Laboratory

In September the Australian Radiation Laboratory of the Commonwealth Department of Health completed the started occupancy of its new premises at Yallambie, Victoria. It is perhaps appropriate that this move to new premises should have occurred during the fifty-first year of the Laboratory's existence.

The new building, named the Don Stevens Building in honour of its immediate past Director, Mr D. J. Stevens, was erected by the Department of Housing and Construction at a cost of approximately seven million dollars.

The total (gross) area of the building is approximately 8,800 square metres divided into scientific and administrative support wings which are joined to enclose a garden court. The environs are being developed to form a natural bushland of native trees and shrubs.

The Australian Radiation Laboratory (Don Stevens Building) was officially opened by the Commonwealth Minister for State for Health, the Hon. Ralph J. Hunt, M.P., on Friday, 5 October. The official guests were then taken on conducted tours of the Laboratory and afterwards entertained at afternoon tea in the large staff room.

The current functions of the Laboratory include:

- on-going research and development mostly in radiation physics and chemistry on topics relating to radiation health
- development of radiation protection standards and codes of practice for the safe and effective use of radiation
- maintenance of national standards of radiation exposure and of radioactivity
- conducting quality evaluation programs for radioactive materials used in medical diagnosis and treatment.

Melbourne Branch of New CSIRO Division

The CSIRO Division of Applied Physics (formerly the National Measurement Laboratory) has established a Melbourne branch.

For the next few years, the branch will be located in a Central Science Block at Monash University, Clayton; in a well-equipped laboratory which was formerly used as a senior teaching laboratory.

The establishment of the branch laboratory of the Division will extend the calibration facilities available in the Melbourne area to industry and other sections of the community.

The staff of the laboratory will be available for consultation on problems involving physical measurement or the application of physics so that the resources of the Division of Applied Physics, whether located in Melbourne, Sydney, or Adelaide may contribute to the needs of industry and the community in Melbourne.

The Branch Laboratory will initially have facilities for calibration and research in the areas of engineering metrology, physical metrology and electric measurements. [CoResearch July/Sept. 1979]
EMPLOYMENT SURVEY 1979
AIP EMPLOYMENT COMMITTEE

INTRODUCTION
This article reports the results of the third employment survey undertaken by the Institute, and the second undertaken by the Employment Committee. (Refs. 1, 7). Together with these earlier surveys, the results reported here provide information that is broadly comparable with similar surveys conducted by other professional institutes in Australia and overseas (Refs. 2-4). As is done by these other institutes, the Committee plans to repeat the employment survey regularly, probably biennially, so as to monitor changes in employment patterns.

The particular aim of this survey was to obtain, for the first time, an indication of the salary structure pertaining to members of the Institute. This will enable future surveys to identify movements and trends for physicists in Australia, and to draw comparisons with other professional groups and with income trends in general.

Recent articles in this journal have reported numbers of physics students (Ref. 5) and their employment prospects (Ref. 6). It is intended that a future paper will draw on these and the Committee's studies to provide a statement on the job market for physicists in Australia.

METHOD
Survey questionnaires (see Appendix A) were included in subscription advice letters mailed to all members of the Institute in November 1978. All members were asked to reply to the questionnaire, and were invited to return completed questionnaire with their subscriptions. Responses were received from 887 members, representing a response which was marginally higher than that of the previous survey, and about 50% of membership. Response rates of this magnitude should provide a reasonable basis for drawing conclusions about employment of members of the Institute as a whole. However, the possibility of bias in surveys of this nature can never be ruled out; for example, unemployed members may be less inclined to respond than employed members.

Apart from Question 10, members were asked not to cross more than one box in each question. In addition, retired and unemployed members were requested to answer only certain sections of the questionnaire. Returns were edited to ensure that they conformed to these requests. As an example, responses indicating Present Occupation as both Full Time Study and Part Time Employment were coded to the former.

It was also decided during editing to discard most responses to Question 7-12 from full-time students. Only responses to these questions from full-time students on paid leave from an employer were included. This procedure avoids potential bias to employment patterns which might be caused by students indicating the University of CAE as their employer. It excludes students' incomes from stipends and part-time teaching from calculations of mean salary.

The data were keyed to tape and passed through a table generating routine. Copies of the data and of unpublished tables are available from the authors.

RESULTS
General
Of the 887 responses received, 765 (86%) were from members in full-time employment, and 13 in part-time employment. There were 64 full-time students, 29 retired members, and 15 unemployed, of whom 11 were seeking employment. Forty-one respondents (4.6%) were female.

As might be expected in the space of only one year, some of the tables obtained in the present survey are not significantly different from those included in the report of the survey (Ref. 1). These tables have not been included in this report, but are available from the authors.

The distribution by qualification of the respondents is, however, different from the 1978 survey, as shown in Table 1. It has not been possible to compare this distribution with the qualification distribution of Institute membership as a whole. However, Table 2 compares the responses received with the total membership in terms of grade of membership. This table suggests that the survey results should, in general, be a true reflection of the total AIP membership. The low response from student members is to be expected considering the nature of this survey.

As indicated previously, 11 respondents were unemployed and seeking employment, giving an unemployment rate of 1.4% among respondents holding or seeking employment. The authors rate that, although female responses was less than 5% of the total, three of the eleven unemployed and seeking employment were female.

Job function (type of work) categories were varied slightly from those of the 1978 survey, as were the categories of employer. The distribution of job functions obtained in the

<p>| TABLE 1 |
| DISTRIBUTION BY QUALIFICATIONS |</p>
<table>
<thead>
<tr>
<th>BSc or Diploma</th>
<th>Masters</th>
<th>Doctorate</th>
<th>Higher Doctorate</th>
<th>Other (or not indicated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1979 Survey (%)</td>
<td>39</td>
<td>15.1</td>
<td>40.6</td>
<td>4</td>
</tr>
<tr>
<td>1978 Survey (%)</td>
<td>30</td>
<td>19</td>
<td>47</td>
<td>4</td>
</tr>
<tr>
<td>1972 Survey (%)</td>
<td>49.7</td>
<td>15</td>
<td>32</td>
<td>3.3</td>
</tr>
</tbody>
</table>

<p>| TABLE 2 |
| GRADE OF MEMBERSHIP |
|---------------------|------------------|----------------|-----------------|-----------------|</p>
<table>
<thead>
<tr>
<th></th>
<th>Fellows</th>
<th>Members</th>
<th>Graduates</th>
<th>Associates</th>
<th>Students</th>
<th>Not Indicated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey - No. . . .</td>
<td>163</td>
<td>347</td>
<td>31.1</td>
<td>43</td>
<td>19</td>
<td>4</td>
</tr>
<tr>
<td>Respondents - % . .</td>
<td>18.4</td>
<td>39.1</td>
<td>35.1</td>
<td>4.8</td>
<td>2.1</td>
<td>0.5</td>
</tr>
<tr>
<td>Total Membership - %</td>
<td>17.0</td>
<td>37.5</td>
<td>36.1</td>
<td>4</td>
<td>5.4</td>
<td></td>
</tr>
</tbody>
</table>

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present survey is at Table 3, and that of employers at Table 4. Comparisons with the 1978 survey are of doubtful validity, but it is perhaps worth noting that respondents employed in universities represented 28.8% of the total, down from 33% in 1978, and 10.4% of respondents were employed in schools compared with 8% in secondary schools in the 1978 survey. In the job function categories, the percentage of respondents indicating ‘Administration and Management’ increased from 9% in 1978 to 13.7% in 1979, and in ‘Technical Support’ from 5% in 1978 to 4.9% in 1979. Substantial variations occurred in the percentages responding in the categories ‘Research Only’, ‘Teaching Only’ and ‘Research and Teaching’, but these variations are considered to be due to a clarification of the category definitions; if the three categories are taken together, the same percentage is given in 1979 as in 1978.

Finally, the authors contend that it is more reasonable to use ‘Years of Experience Since First Physics Qualification’, rather than age, as a baseline against which other parameters should be measured. Because both the age and years of experience were obtained in this survey, it was possible to check this hypothesis. In fact, there is essentially no difference in the results obtained if one equated the years of experience to age less 21 years. ‘Years of Experience’ has been used in the subsequent tables.

**TABLE 3**

<table>
<thead>
<tr>
<th>Type of Work</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration and Management</td>
<td>106</td>
<td>13.7</td>
</tr>
<tr>
<td>Design and Development</td>
<td>55</td>
<td>7.1</td>
</tr>
<tr>
<td>Services</td>
<td>56</td>
<td>7.2</td>
</tr>
<tr>
<td>Research only</td>
<td>172</td>
<td>22.3</td>
</tr>
<tr>
<td>Teaching only</td>
<td>130</td>
<td>16.8</td>
</tr>
<tr>
<td>Research and Teaching</td>
<td>210</td>
<td>27.2</td>
</tr>
<tr>
<td>Manufacturing and Production</td>
<td>1</td>
<td>0.1</td>
</tr>
<tr>
<td>Technical Support</td>
<td>38</td>
<td>4.9</td>
</tr>
<tr>
<td>Marketing</td>
<td>5</td>
<td>0.7</td>
</tr>
</tbody>
</table>

[Note: Based on 773 responses]

**TABLE 4**

<table>
<thead>
<tr>
<th>Employer</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>University</td>
<td>228</td>
<td>28.8</td>
</tr>
<tr>
<td>CAE</td>
<td>107</td>
<td>13.5</td>
</tr>
<tr>
<td>School</td>
<td>82</td>
<td>10.4</td>
</tr>
<tr>
<td>Commonwealth Authority</td>
<td>115</td>
<td>14.5</td>
</tr>
<tr>
<td>Commonwealth Public Service</td>
<td>131</td>
<td>16.6</td>
</tr>
<tr>
<td>State Authority</td>
<td>17</td>
<td>2.1</td>
</tr>
<tr>
<td>State Public Service</td>
<td>23</td>
<td>2.9</td>
</tr>
<tr>
<td>Local Government</td>
<td>24</td>
<td>3.0</td>
</tr>
<tr>
<td>Private Industry</td>
<td>51</td>
<td>6.4</td>
</tr>
<tr>
<td>Proprietors and Directors</td>
<td>8</td>
<td>1.0</td>
</tr>
<tr>
<td>Independent Organisation</td>
<td>6</td>
<td>0.8</td>
</tr>
</tbody>
</table>

[Note: Based on 792 responses]

**TABLE 5**

<table>
<thead>
<tr>
<th>Income Levels v. Grade of Membership</th>
<th>Fellow $</th>
<th>Member $</th>
<th>Graduate $</th>
<th>Associate* $</th>
<th>Overall $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median</td>
<td>25,030</td>
<td>20,160</td>
<td>16,580</td>
<td>12,000</td>
<td>19,570</td>
</tr>
<tr>
<td>Lower Quartile</td>
<td>22,670</td>
<td>18,370</td>
<td>14,170</td>
<td>10,910</td>
<td>16,370</td>
</tr>
<tr>
<td>Upper Quartile</td>
<td>30,280</td>
<td>23,550</td>
<td>19,330</td>
<td>18,000</td>
<td>21,820</td>
</tr>
<tr>
<td>Mean</td>
<td>26,600</td>
<td>21,100</td>
<td>16,900</td>
<td>14,300</td>
<td>20,300</td>
</tr>
</tbody>
</table>

**TABLE 6**

<table>
<thead>
<tr>
<th>Income Levels v. Qualifications</th>
<th>PhD+DSc</th>
<th>MSc</th>
<th>BSc(Hons)</th>
<th>BSc</th>
<th>Diploma*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median</td>
<td>21,260</td>
<td>20,000</td>
<td>16,290</td>
<td>17,380</td>
<td>17,600</td>
</tr>
<tr>
<td>Lower Quartile</td>
<td>18,610</td>
<td>18,060</td>
<td>13,250</td>
<td>13,780</td>
<td>15,000</td>
</tr>
<tr>
<td>Upper Quartile</td>
<td>25,730</td>
<td>23,760</td>
<td>19,870</td>
<td>19,470</td>
<td>19,000</td>
</tr>
<tr>
<td>Mean</td>
<td>22,500</td>
<td>20,700</td>
<td>17,500</td>
<td>17,400</td>
<td>16,600</td>
</tr>
</tbody>
</table>

* Number of respondents small.

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### TABLE 7

**INCOME LEVELS V. EMPLOYER**

<table>
<thead>
<tr>
<th>Employer</th>
<th>Median $</th>
<th>Lower Quartile $</th>
<th>Upper Quartile $</th>
<th>Mean $</th>
</tr>
</thead>
<tbody>
<tr>
<td>University</td>
<td>22,310</td>
<td>18,540</td>
<td>26,490</td>
<td>22,200</td>
</tr>
<tr>
<td>CAE</td>
<td>19,570</td>
<td>18,290</td>
<td>22,430</td>
<td>20,000</td>
</tr>
<tr>
<td>School</td>
<td>14,740</td>
<td>12,380</td>
<td>17,000</td>
<td>14,800</td>
</tr>
<tr>
<td>Commonwealth Authority</td>
<td>21,880</td>
<td>18,920</td>
<td>26,320</td>
<td>22,800</td>
</tr>
<tr>
<td>Commonwealth Public Service</td>
<td>19,370</td>
<td>17,310</td>
<td>22,840</td>
<td>20,000</td>
</tr>
<tr>
<td>State Government</td>
<td>16,400</td>
<td>13,710</td>
<td>20,570</td>
<td>17,600</td>
</tr>
<tr>
<td>Local Government*</td>
<td>18,800</td>
<td>15,500</td>
<td>20,000</td>
<td>19,500</td>
</tr>
<tr>
<td>Private Industry</td>
<td>18,000</td>
<td>15,670</td>
<td>19,730</td>
<td>19,000</td>
</tr>
</tbody>
</table>

### TABLE 8

**INCOME LEVELS V. TYPE OF WORK**

<table>
<thead>
<tr>
<th>Type of Work</th>
<th>Median $</th>
<th>Lower Quartile $</th>
<th>Upper Quartile $</th>
<th>Mean $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management and Administration</td>
<td>23,520</td>
<td>19,530</td>
<td>28,800</td>
<td>24,500</td>
</tr>
<tr>
<td>Research Only</td>
<td>20,100</td>
<td>17,880</td>
<td>24,170</td>
<td>21,100</td>
</tr>
<tr>
<td>Teaching Only</td>
<td>17,380</td>
<td>13,750</td>
<td>19,380</td>
<td>16,800</td>
</tr>
<tr>
<td>Research and Teaching</td>
<td>22,170</td>
<td>19,250</td>
<td>25,950</td>
<td>22,400</td>
</tr>
<tr>
<td>Design and Development</td>
<td>18,380</td>
<td>16,200</td>
<td>20,000</td>
<td>18,500</td>
</tr>
<tr>
<td>Services</td>
<td>17,230</td>
<td>15,000</td>
<td>19,140</td>
<td>17,100</td>
</tr>
<tr>
<td>Technical Support*</td>
<td>14,500</td>
<td>11,250</td>
<td>16,000</td>
<td>14,100</td>
</tr>
</tbody>
</table>

### TABLE 9

**INCOME LEVELS V. GEOGRAPHIC DISTRIBUTION**

<table>
<thead>
<tr>
<th>Location</th>
<th>Median $</th>
<th>Lower Quartile $</th>
<th>Upper Quartile $</th>
<th>Mean $</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACT</td>
<td>19,760</td>
<td>17,250</td>
<td>25,600</td>
<td>21,800</td>
</tr>
<tr>
<td>NSW</td>
<td>20,520</td>
<td>17,000</td>
<td>24,390</td>
<td>20,800</td>
</tr>
<tr>
<td>Queensland</td>
<td>19,380</td>
<td>15,330</td>
<td>23,500</td>
<td>20,100</td>
</tr>
<tr>
<td>South Australia</td>
<td>19,580</td>
<td>17,380</td>
<td>22,500</td>
<td>20,200</td>
</tr>
<tr>
<td>Tasmania*</td>
<td>19,600</td>
<td>18,000</td>
<td>24,000</td>
<td>20,800</td>
</tr>
<tr>
<td>Victoria</td>
<td>19,220</td>
<td>16,000</td>
<td>23,200</td>
<td>19,900</td>
</tr>
<tr>
<td>Western Australia</td>
<td>18,800</td>
<td>14,800</td>
<td>22,910</td>
<td>19,100</td>
</tr>
</tbody>
</table>

* Numbers of respondents small.

Table 1 reveals a lower percentage of doctorates and a higher percentage of first degrees than was the case in the 1978 survey, and Table 2 indicates that the 1979 percentages should be a fairly accurate reflection of the total membership. This alleviates some of the concern regarding the shift towards higher qualifications, expressed in the 1978 paper (Ref. 1), although it should be noted that the structure is still significantly different from that indicated by the 1972 survey. Tables 3 and 4 confirm the overwhelming tendency of physicists to stick to, or to be restricted to, the traditional employment areas. Only 6.4% of the respondents are employed in private industry, and less than 1% are in marketing, manufacturing and production. It is interesting to note that the RACI survey showed 48.3% of respondents employed in industry. While acknowledging that opportunities in industry are greater for chemists, one could certainly conjecture whether the level of employment for physicists in industry could be improved if there was a sincere desire to do so.

Table 5 reveals no surprises in the relativities for the various grades of membership. The overall median of $19,570 is similar to the RACI figure of $18,490, bearing in mind that the RACI survey was taken about 6 months prior to this survey. It is interesting to note, however, that the median salary for RACI Fellows was $27,800, compared with $25,030 for AIP Fellows. Fellows in the RACI constitute only 10.8% of the membership, whereas 17% of the AIP membership are Fellows; this might explain the differences.

Table 6 shows that members with an Honours BSc have a lower median income than BSc graduates and diplomates. A possible explanation for this is that some of the respondents are continuing studies, and indicated fellowships, scholarships and other forms of income. This is borne out by the fact that 9% of the BSc (Hons) respondents gave a salary of less than $10,000, compared with 5% for BSc respondents and none at all for diplomates.

Table 7 relates income levels to employer groups. The interpretation of differences in salaries paid by employers as differences in generosity needs to be undertaken with considerable caution. It is clear from Figure 1 (see below) that income is strongly correlated with experience. It is also true that there were substantial differences in the experience of respondent physicists as between different employers. Median experience of respondents since first physics qualification, by employer, is shown in Table 10. See also Table 5 of the report of the previous survey (Ref. 1). These differences in experience would appear to account...
reasonably satisfactorily for most of the differences in Table 7. Physicists in schools, however, even allowing for the fact that their experience is less than that of physicists with other employers, would appear to be receiving lower salaries than others.

### Table 10
**Median Years of Experience v. Employer**

<table>
<thead>
<tr>
<th>Employer</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>University</td>
<td>19.4</td>
</tr>
<tr>
<td>CAE</td>
<td>16.3</td>
</tr>
<tr>
<td>School</td>
<td>7.5</td>
</tr>
<tr>
<td>Commonwealth Authority</td>
<td>20.8</td>
</tr>
<tr>
<td>Commonwealth Public Service</td>
<td>17.0</td>
</tr>
<tr>
<td>State Government</td>
<td>9.5</td>
</tr>
<tr>
<td>Local Government</td>
<td>12.6</td>
</tr>
<tr>
<td>Private Industry</td>
<td>9.7</td>
</tr>
<tr>
<td>Overall</td>
<td>15.4</td>
</tr>
</tbody>
</table>

The remunerative advantage of moving into administrative positions is evident from Table 8. Table 9 indicates some surprising variations in income levels with geographic location. NSW has the highest median salary, although the ACT is well ahead for the upper quartile. Western Australia has the lowest median salary; Victoria is the next lowest, about $1,300 below the NSW median. It is also interesting that the ranking of median salaries in the five mainland states in this survey is the same as that in the RACI survey, apart from the exchange of South Australia and Queensland between second and third positions. In the present survey, the median salary was some $1,700 below that in NSW; in the RACI survey, the difference was $1,200. No immediate explanation occurs to the authors.

The data presented in Figure 1 shows the median, upper quartile and lower quartile incomes against years of experience (taken as years since first qualification in physics). Finally, it is interesting to note that the median salary for female members is $15,000, compared with $19,730 for male members; i.e. the median female salary is 76% of that for males; the equivalent figure obtained by the RACI survey was 79%

### References
2. RACI Emoluments Committee, Chemistry in Australia, 45, 419, 1978.

### Further Information
Requests for tables or other information concerning the survey should be directed to the Convener of the Employment Committee:

Dr R. M. Green,
Secretary,
Australian Science and Technology Council,
P.O. Box 52,
CANBERRA A.C.T. 2600.

---

### Australian Institute of Physics — Remuneration Survey, December 1978

**PLEASE X ONE SQUARE ONLY IN EACH QUESTION BELOW**

1. **AIP Membership**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

2. **Sex**

<table>
<thead>
<tr>
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<th>Diploma</th>
<th>BSc</th>
<th>BSc (Hons)</th>
<th>MSc</th>
<th>PhD</th>
<th>DSc</th>
<th>Other specify</th>
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<td>5</td>
<td>6</td>
<td>7</td>
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</tbody>
</table>

3. **Education Qualifications in Physics**
   (Indicate highest qualification only)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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<th></th>
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<tbody>
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<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
4. YEARS OF EXPERIENCE SINCE FIRST PHYSICS QUALIFICATION (Post Graduate Training in Physics is Experience)

<table>
<thead>
<tr>
<th>Years</th>
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<th>5-9</th>
<th>10-14</th>
<th>15-19</th>
<th>20-24</th>
<th>25-29</th>
<th>30-34</th>
<th>35-39</th>
<th>40</th>
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</thead>
<tbody>
<tr>
<td>4</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>

5. AGE

<table>
<thead>
<tr>
<th>Age Group</th>
<th>&lt;=21</th>
<th>21-24</th>
<th>25-29</th>
<th>30-34</th>
<th>35-39</th>
<th>40-44</th>
<th>45-49</th>
<th>50-54</th>
<th>55-59</th>
<th>60-64</th>
<th>Over 65</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>5 &amp; 6</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>

6. PRESENT OCCUPATION

If retired, please complete questions 1 to 6 only. If unemployed, please answer questions 1 to 6 and then complete questions 7, 11 & 12 as they apply to your last position; no other questions need be answered.

<table>
<thead>
<tr>
<th>Employed</th>
<th>Full Time</th>
<th>Part Time</th>
<th>Study Full Time</th>
<th>Retired</th>
<th>Unemployed</th>
<th>Seeking employment</th>
<th>Not seeking</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

and 6a. IF UNEMPLOYED, state for how long.

7. EMPLOYMENT – CROSS ONE SQUARE ONLY

PRIVATE INDUSTRY means a branch of manufacture or trade other than the one undertaken by a government or local authority. It includes bodies established by association of a number of private employers. PROPRIETOR owns wholly or substantially some undertaking including a consulting practice. DIRECTOR is a non-executive member of a board of directors. UNIVERSITY includes institutions connected therewith. SCHOOL includes technical and trade or other schools which do not train students for qualifications recognised by the Institute, even though the teachers may be Public Servants or Local Government employees. IT DOES include independent or denominational schools. GOVERNMENT does not include Universities, Colleges of Advanced Education or schools. GOVERNMENT AUTHORITY includes statutory bodies such as Electricity, Fuel or Road Commissions or Boards or CSRQ. GOVERNMENTAL LOCAL includes composite authorities such as water supply or sewerage boards for two or more local authorities. It also includes hospitals and public institutions. INDEPENDENT ORGANISATIONS means e.g., the Standards Association of Australia (SAA), the National Association of Testing Authorities (NATA), the Sugar Research Inst. of Australia. Independent or Denominational Schools are NOT to be included in this Category.

<table>
<thead>
<tr>
<th>PRIVATE INDUSTRY</th>
<th>EDUCATION</th>
<th>GOVERNMENT</th>
<th>Independent Organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employee Proprietor Director</td>
<td>University</td>
<td>CAE</td>
<td>School</td>
</tr>
<tr>
<td>5 &amp; 9</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

8. SALARY

(As at 1st November 1978) in $ Australian and should include any regular bonus or share in profits (other than dividends from investments) and a sum roughly equivalent to the value of any free quarters or allowances (other than expenses) that you may receive. Contributions to superannuation should not be deducted, nor contribution by employers added.

<table>
<thead>
<tr>
<th>Salary Range</th>
<th>5 Less than 10,000</th>
<th>10,000 to 11,999</th>
<th>12,000 to 13,999</th>
<th>14,000 to 15,999</th>
<th>16,000 to 17,999</th>
<th>18,000 to 19,999</th>
<th>20,000 to 23,999</th>
<th>24,000 to 27,999</th>
<th>28,000 to 31,999</th>
<th>32,000 to 35,999</th>
<th>36,000 to 39,999</th>
<th>40,000 and above</th>
</tr>
</thead>
<tbody>
<tr>
<td>$</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
</tr>
</tbody>
</table>

9. SUPERANNUATION

Non-transferable means any scheme under which the employer's contribution is lost to the employee (or payable only at the employer's discretion) on change of employment to a position involving a different type of superannuation.

<table>
<thead>
<tr>
<th>Transfer YES</th>
<th>Non-transfer NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

10. EMPLOYMENT-RELATED BENEFITS. (Place a cross X in EACH box where benefit is payable).

DAILY TRAVEL ALLOWANCE refers to the "per diem" type of allowance with flexibility of use. HOUSING ASSISTANCE includes access to housing finance of provision of long term housing. EDUCATION ALLOWANCE includes conference leave allowance. CONFERENCE EXPENSES PAID refers only to conferences at which attendance is not required by the employer. SUBSIDISED LIFE INSURANCE and SUBSIDISED MEDICAL INSURANCE means that premiums are paid by the employer. MEDICAL SERVICES refer to those provided by the employer. FLEXIBLE SALARY PACKAGE means that the employee is able to negotiate base salary plus car, type of superannuation etc. ZONE ALLOWANCE refers to an allowance extra to the normal tax allowance. CONSULTANCIES refers to the right to undertake and retain fees for consultancy work. STUDY LEAVE refers to paid leave during normal working hours for further study. SABBATICAL LEAVE refers to the automatic accumulation of extended periods of paid leave for work in other institutions.

<table>
<thead>
<tr>
<th>Leave Loading</th>
<th>Car</th>
<th>Car Allowance</th>
<th>Daily Travel Allowance</th>
<th>Telephone Allowance</th>
<th>Housing Assistance</th>
<th>Entertaining Allowance</th>
<th>Payment of Subscriptions</th>
<th>Education Allowance</th>
<th>Conference Expenses Paid</th>
<th>Superann. Index for Inflation</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>1</td>
<td>14</td>
<td>15</td>
<td>1</td>
<td>16</td>
<td>17</td>
<td>18</td>
<td>19</td>
<td>20</td>
<td>21</td>
</tr>
</tbody>
</table>

189 The Australian Physicist, December 1979
I wish to inform Honourable Members of a review of the Defence Science and Technology Organisation which I have initiated.

The Defence Science and Technology Organisation, which is part of the Department of Defence, employs some 4,900 staff and has a budget of about $90m. It is the second largest government science organisation in Australia.

This review is one of a series that this government has initiated. Honourable Members will be aware that four other large science organisations have recently undergone reviews. These are The Australian Atomic Energy Commission, The Bureau of Meteorology, The Bureau of Mineral Resources and the CSIRO.

The Defence Science and Technology Organisation enjoys a fine international reputation. The review will help the Government obtain the greatest value from this talent and help to ensure that Australia makes the best use of modern technology in its Defence Force.

The review process will be in two parts. An External Review will concentrate on defence science and technology work as science, and an Internal Review will cover special defence aspects of the organisation including its objectives and interactions with the rest of defence.

The External Review will cover the quality and research content of the work of the Defence Science and Technology Organisation, its effectiveness in meeting program objectives and its relationships with industry and other science in Australia.

The Internal Review will examine the objectives of the Defence Science and Technology Organisation, its interaction with the services and other elements of the department, its management procedures and the value of its association with defence science overseas.

The External Review will be conducted by three distinguished scientists external to the Defence Department. Its Chairman will be Dr A. L. G. Rees, CBE, FAAA, formerly chief of the CSIRO Division of Chemical Physics.

The other members will be Professor A. R. Billings, FTS, Head of the Department of Electrical and Electronic Engineering, The University of Western Australia, and Dr K. T. H. Farrer, OBE FTS, Chief Scientist, Kraft Foods Ltd. Dr Farrer is Vice-President of The Australian Academy of Technological Sciences and is a former president of The Australian Industrial Research Group.

The Internal Review will have as its Chairman Professor P. T. Fink, CBE FTS. He is currently on a contract appointment as Chief Defence Scientist on loan from The University of NSW, where he was Dean of Engineering, he will be detached for full time duties as Chairman.

The other members will be Air Vice Marshal J. C. Jordan, AO (retired), formerly Assistant Chief of Defence Force Staff and Mr R. B. Finnegan, an Assistant Secretary in the Department of Defence.

The Reviews are to begin in the near future and will require about six months to complete. The Government will consider the reports of both reviews together.

While some of the review deliberations will be classified under security regulations, each review is to provide an unclassified version of its report for public release.
INDUSTRIAL RESEARCH AND DEVELOPMENT

"The worthy Merchant is the Heir of Adventure, whose hopes hang much upon the winds."
—Nicholas Brenton, 1545-1626

Industrial Research and Development in Australia bears little resemblance to the adventures of merchants in the times of the first Elizabeth, apart from the uncertainty accompanying the necessary investments. Also, it has always been easy for courtiers and countrymen to offer advice.

The Senate Standing Committee on Science and the Environment have just issued a 327 page report on IR & D whilst the Australian Science and Technology Council have published a 20 page discussion paper intended to provoke comment and debate on Industrial Innovation.

"If Australia is to develop as an industrial nation then a change is needed which will place a greater emphasis on supporting IR & D in its own right not in subvention to, or consequent upon, basic scientific research, but in parallel with it."

"Government research establishments need to adopt a much more aggressive, entrepreneurial attitude towards the eventual commercial contribution their work can make to national economic well being."

"The most striking example of unintended effects of Government policy is the influence of high levels of protection on Australian industry creativity."

"The needs and aims of society, including industry, require universities to become involved in interdisciplinary problem-oriented research, with university courses related to real rather than abstract problems."

"Low levels of IR & D incentive grants lead to a frittering away of public money without having any appreciable effect on the quality of the nation's technology."

These are a selection from the 61 main conclusions from the Senate Report and they should be sufficient to show how opinions rather than facts dominate the discussion. Let all science and education become an arm of industry seems to be the theme. And yet, in the body of the report we find "... the Committee is not convinced that more Government money by itself will solve the problem..." Tariff protection, financial risk, customer conservatism, industry fragmentation, unions, all require attention to a greater or lesser extent. It seems that in their extensive and no doubt expensive hearings, the Committee ran the gauntlet of all shades of political and economic opinion and yet in the end were able to publish 61 unanimous recommendations (in addition to the conclusions).

A clear, long-term national policy for innovation, rather than protection, plus Government purchasing and contracts going to Australian industry and with major involvement of tertiary institutions and CSIRO in industrially oriented R & D, courses, fellowships and committees are the recommended actions. Improvements in the Industrial R & D Incentive scheme are, of course, also recommended.

"He is the life of traffic and the Maintenance of Trade, the Sailor's Master and the Soldier's Friend...
In sum he is the pillar of a city, the Enricher of a Country, the furnisher of a Court, and a Worthy Servant of a King."

No doubt the "Worthy Merchant" also benefited in his endeavours from privileges and support bestowed by the King and our Senate Standing Committee are impressed by the need, in this new Elizabethan age, to return to similar practices. They might work.

After 62 public hearings and the consideration of hundreds of submissions, we might expect a definitive statement of needs and policies for IR & D. But no; ASTEC, at the time when the report was being produced, "is suggesting the need for a comprehensive review of..." the range of techniques available to government to stimulate Industrial Innovation. In a quick run through much of the same ground as covered by the Senate Committee, ASTEC aim to "provoke comment and debate" on this topic. Did they already know and dismiss the contents of the Senate Committee report — or did they assume that after three years of enquiry this was not going to appear?

Perhaps it is significant that neither ASTEC nor its members appear in the lists of witnesses and those who made written submissions to the Senate Standing Committee — and now they are giving notice of intention to "assimilate these reviews in one comprehensive examination". It is hard to believe that this will be fruitful when ASTEC's own discussion paper states:

"There is insufficient experience on which to base a detailed analysis. Government support for innovation is largely empirical and schemes that do not prove effective must be abandoned or modified."

—R. Bird

SCIENTISTS NEED NOT APPLY? ? ? ?

... HOSPITAL
MEDICAL TECHNICIAN/TECHNOLOGIST

We are seeking a qualified Medical Technologist or Technician to join the busy team in our Department of Biochemistry.
Scientists need not apply.
For further details 'phone..........

John Prescott found it.

182 The Australian Physicist, December 1979
An International Conference on the physics topics of Electromagnetic Interactions and Heavy Ion Reactions was held in Canberra last year. The two topics chosen reflected the major nuclear physics research interests of Melbourne University and of the Australian National University. One of the sponsors of the conference was the Australian Institute of Physics which provided a grant towards the running costs. Additional financial assistance was provided by the Nuclear and Particle Physics (NUPP) Group of the AIP. In return, one of the principal conference speakers was able to tour Australia for several weeks, talking at Institute branch meetings. Co-sponsors of the conference were the Australian Academy of Science and the International Union of Pure and Applied Physics. Sponsorship by the latter organization was important to our overseas visitors, in that it enabled them to apply for and receive financial support from sources in their own countries. The Academy of Science provided financial support, secretarial and managerial services as well as arranging for valuable commercial sponsorship by firms such as Qantas, Ansett and Avis.

A total of 133 participants attended the conference. Of these, 62 physicists were from overseas, representing 12 countries. The distribution by country is as follows: USA - 24; West Germany - 13; UK - 6; Japan - 4; New Zealand - 4; Sweden - 3; Canada - 2; France - 2; Denmark - 1; India - 1; South Africa - 1; Switzerland - 1. The distribution of participants from Australian institutions is as follows: Australian National University - 36; Melbourne University - 19; AAEC Lucas Heights - 6; University of New South Wales - 2; James Cook University - 1; University of Adelaide - 1; University of Western Australia - 1; Australian Government - 4. Of the above delegates, 24 were postgraduate students.

There were 30 invited speakers, of whom 23 were from outside Australia. In addition, 24 contributed papers were presented in two pairs of parallel sessions, each of six papers. The contributed papers were refereed and selected from a total of 113 contributions to the conference. The Conference proceedings have been published jointly by the Australian Academy of Science and Springer-Verlag as No 92, Nuclear Interactions, in the Lecture Notes in Physics series by the latter publisher.

The topic of Electromagnetic Interactions was covered by papers reporting the current state of the field, both experimental and theoretical, in electron scattering, electro-fission, photo-fission and other photo-nuclear reactions, isospin mixing studies, giant resonance investigations and sum rules for the electromagnetic decay of nuclear excited states. The basic properties of nuclei in their ground or excited states, such as lifetimes, magnetic moments and electric quadrupole moments, were also the subject of papers. These subjects have undergone a renaissance with the advent of heavy ion accelerators. For instance, the Doppler-shift methods of determining lifetimes are extended by the higher recoil velocities made available by heavy ion beams. The determination of electric quadrupole moments by Coulomb excitation often requires two experiments using projectiles of significantly different charges, one or both of which are therefore heavy ions. Multiple Coulomb excitations of target nuclei by heavy ion projectiles, leading to high spin states in these target nuclei (particularly those involving electric quadrupole excitation of collective motion of the nucleons) have also been studied and reported.

For the topic of Heavy Ion Reactions, the behaviour of the colliding nuclei may be conveniently classified by the energy and the impact parameter of the system. (The impact parameter is the distance between the centre of the target nucleus and the linear projection of the distant orbit of the centre of the projectile. Combined with the linear momentum, this defines the orbital angular momentum of the colliding system. Another combination defines the distance of closest approach.) For large impact parameters, the nuclei "miss" one another and we have a regime dominated by elastic scattering, inelastic scattering and Coulomb excitation for near misses. For smaller impact parameters and sufficient energy, we move into a regime where a few nucleons may be transferred between projectile and target (transfer reactions) either directly or via some apparent resonance mechanism. This regime is appropriate for glancing collisions.

With slightly greater inter-penetration of projectile and target, the process of deep inelastic collision, a new and active field of study, may become important. In this process, a large exchange of mass and charge occurs so that one cannot, with any certainty, relate the outgoing fragments to the target and projectile, as one can with elastic or inelastic scattering or transfer reactions. With still greater inter-penetration of projectile and target, the probability of fusion into a compound system possessing a large amount of angular momentum and excitation energy becomes appreciable. This is currently a very active field of study, aimed at elucidating the various ways in which a nucleus can handle large amounts of angular momentum and also the ways in which such a nucleus can get rid of this angular momentum. In the situation described above, the compound system may get rid of much of its excitation energy (but not angular momentum) by successive evaporation of several neutrons, and then rid itself of angular momentum and the rest of its excitation energy by cascades of gamma radiation. Often, preferred paths for the gamma ray cascades down the energy level system become apparent and these are studied in detail. In other studies only the gross features of the gamma ray cascade such as its intensity and multiplicity as a function of gamma ray energy can be determined. Alternatively, a fused nucleus may fission, again leading to fragments far removed in mass and charge from the initial particles. This gives the opportunity for study of collective motions of very heavy nuclei far removed from spherical in shape.

The large charge and mass transfers possible in heavy ion collisions mean that such collisions are a method of producing nuclei far from β-stability — the so-called "exotic" nuclei. This is by no means the only method, however, as thermal neutron-induced fission and high energy proton-induced spallation also lead to some exotic nuclei, often quite prolifically. The author of a paper on this subject pointed out that, over the last ten years or so years, about 300 new isotopes had been discovered — about 20% of the current total — leading him to claim that such nuclei are no longer considered exotic. It is true that they are difficult to study, being produced usually in very small numbers. Very often, only the mass of the rare nucleus in its (hopelessly) ground state is determined. But in some favoured cases, studies have been possible of further properties such as nuclear shapes and sizes measured over a considerable range of isotopes.

There were several papers at the conference on more fundamental subjects. The large electric charge resulting
from the collision of two heavy nuclei leads to some interesting zero-order effects on the vacuum — the physics of very strong electric fields — predicted some time ago by quantum electrodynamical theory. For a nuclear charge somewhat in excess of 1/z (where z is the fine structure constant 1/137) the lowest electron state in the K shell of such an atom is bound by more than the rest energy of an electron. Thus a new electron state is introduced into the Dirac sea of negative energy electrons, giving the possibility of observing the decays of the vacuum by spontaneous positron emission. Another phenomenon to be expected is the “shakeoff” of vacuum polarization in the form of electron-positron pairs when, during a collision, the dipole layer of vacuum polarization charge cannot adjust sufficiently rapidly as the collision proceeds. A third phenomenon is the enhanced K-vacancy production observed during heavy ion collisions because of a relativistic enhancement of the electron density inside the nuclei.

Other fundamental papers covered subjects from the behaviour of bulk nuclear matter (neutron stars) to a discussion of the basic interactions between nucleons. A couple of papers reported on developments in quark theory and one of these presented a very geometric picture of nuclei built up from quark lattice — a picture leading to a surprising amount of detailed agreement for shapes and sizes of quite complex nuclei, starting with parameters defining only the quark separation and the expected amplitude of quark vibrations within a nucleus.

In the summary paper, the speaker referred to the rate of growth of new knowledge in a field of current activity. With three major nuclear physics conferences per year, even 10% of new knowledge per conference builds up to a very significant growth over a short period of years. The speaker’s conclusion was that 90% of a summary paper can be prepared in advance! After commenting in detail on many of the papers presented, the summary speaker voiced the opinion that heavy ion atomic physics was an attractive but neglected field of research in which he hoped to stimulate interest in his post-conference tour of Australian universities and other physics institutions.

Mention should be made of the superb early spring weather arranged for the duration of the conference. That and an enjoyable social program contributed to the success of the conference, though the delegate arriving with only a Playboy Club tee-shirt and pair of pants, having been separated from his luggage somewhere in Asia, may have had more difficulty then most in enjoying the program. In spite of the breakdown of the Australian telephone network at this time, his luggage was recovered and the delegate departed much warmer and happier than he arrived. In conclusion, we had a worthwhile conference which achieved its aim of bringing distinguished overseas workers in the field of nuclear physics into contact with Australian physicists and students and also gave our visitors the opportunity of seeing at first hand the facilities available in our research institutions.

**International Conference on Nuclear Interactions.**

Editor’s note: The International Conference on Nuclear Interactions was held in Canberra from 18 August to 2 September, 1978. Dr. Hebbard intended that this summary would be ready soon after. However, preparation of the transactions for publication in *Nuclear Interactions* proved more onerous than was foreseen and necessarily took precedence over the summary. Its publication now should provide a valuable reminder of what was said then, not yet seriously depreciated by a year’s advancing knowledge.

---

**PHYSICS AND PHILIPS**

The Dutch part of international Philips Research is housed in the "Natuurkundig Laboratorium", which, literally, means: "Physics Laboratory". *Nomen est omen.*

Physics and physicists have, since the founding of Philips research in 1914 by the Leiden physicist Gilles Holst, played a crucial role in the growth and diversification of the Philips enterprise. Technical management contains many physicists and the top management of research has practically always been staffed by physicists.

As early as the first decade of this century, the brothers Gerard and Anton Philips had come to the conclusion that if the company was to compete with manufacturers of incandescent lamps in the USA, then trouble-shooting by engineers and chemists in the factory would not be enough; for a longer term policy they would need the support of scientific research. They took their time in finding the right man and in 1914 they found Dr. G. Holst willing to set up a team of promising scientists. The objective was, and still is, a fundamental understanding of the phenomena and materials that play a role in Philips products. Around a core of physicists Holst formed interdisciplinary teams that were problem-oriented, instead of product-oriented.

It should be emphasized that at this time it was quite unusual to employ physicists in private companies. In accordance with its objective, the research became organisationally separate from the Philips factories, reporting directly to top management. A further aspect of Philips research introduced by Holst was that of stimulating, checking and maintaining its scientific level.

Currently the research laboratories employ about 4000 people about 25% of whom are academic scientists. Roughly one third of them are physicists, the rest are mainly chemists, electrical and mechanical engineers and mathematicians. About the same number of physicists are employed in the development laboratories, in the factories and in various staff functions, many of them having started their careers in the research laboratories. The total number of physicists working for Philips amounts therefore to about 700, but many of them, in particular those not working in research, are fulfilling tasks not concerned with physics as such: the versatility that a physics training is put to good use. [*Physica News, Sept. 1979*]
Australian Journal of Physics

is the only international journal of general physics published in Australasia
has wide distribution (in 78 countries)
is edited by physicists for physicists
uses first-class international referees
gives you expert typesetting
gives 50 free reprints
has no page charges
publishes promptly

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AIP FOURTH CONGRESS
25th. — 29th. AUGUST, 1980
AT THE UNIVERSITY OF MELBOURNE
Secretary Dr. R. J. Fleming
Physics Department
Monash University

PROGRAM.
There will be seven half-day sessions of oral presentations as follows:-

**Session** | **Organiser**
---|---
Energy Resources | Dr. J. L. A. Francey, Department of Physics, Monash University.
Physics of Condensed Matter | Professor T. F. Smith, Department of Physics, Monash University.
Nuclear and Particle Physics | Professor B. H. J. McKellar, Department of Physics, University of Melbourne.
Applied Physics | Dr. M. Murray, CSIRO Division of Materials Science, Melbourne.
Radiophysics, Astrophysics and Gravitation | Professor G. I. Opat, Department of Physics, University of Melbourne.
Electron and Ion Spectroscopy | Dr. R. C. Leecy, Department of Physics, La Trobe University.
Atmospheric and Environmental Physics | Professor W. F. Budd, Department of Meteorology, University of Melbourne.

In addition, a Cosmic Ray Workshop, organized by Professor J. R. Prescott, Department of Physics, University of Adelaide, will be held on Tuesday 26 August. Poster displays will run concurrently with the above oral sessions. Further information is available from session organizers.

CALL FOR PAPERS.
The time-table is as follows:-

- Preliminary Abstract Deadline: 31 May, 1980
- Oral/Poster Presentation Notification: 30 June, 1980
- Final Abstract Deadline: 31 July, 1980

The programme of contributed oral presentations will be selected from the preliminary abstracts. All other contributions will be by poster presentation.

Both Congress and Workshop abstracts should be sent to the Congress Secretary. All contributed final abstracts will be published in the Congress Handbook. Full texts of the invited papers are to be published in a special issue of the Australian Journal of Physics.

REGISTRATION.
All participants must register, using a proforma which will be part of the Second Circular to be included in the May 1980 issue of The Australian Physicist or available directly from the Congress Secretary. Registration fees will be as follows:-

- AIP Members $30
- AIP Student Members $17
- Non-members $37

Student AIP members should contact their local Branch Secretary regarding availability of financial support to attend the Congress.

ACCOMMODATION.
Single room accommodation will be available at Ormond College in the University grounds, and can be booked only via the registration proforma. The expected costs are:-

- Bed and Breakfast — $16.50 per day
- Full Board — $23 per day

Motel accommodation will be the responsibility of individual participants, who are advised that such accommodation close to the University in August will require early booking. The Melbourne Town House in Swanston Street is adjacent to the University Grounds.

TRAVEL.
Ansett Airlines of Australia are official carriers for the Congress. Group discount concessions and car rental details will be advised in the Second Circular.

SOCIAL PROGRAMME.
A reception is planned for the evening of Monday 25 August, and the Congress Dinner will be held in Ormond College on the evening of Thursday 28 August.