THE AUSTRALIAN PHYSICIST

Institute Affairs ............................................. 81
The Uranium Debate ............................................ 82
Bureau of Mineral Resources ................................ 84
The Attitude of Physicists to Nuclear Energy ........ 85
Research School of Physical Sciences .................... 89
People and Institutions ...................................... 90
Physics in Australia .......................................... 91
Astec ........................................................... 92
Books .......................................................... 94

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COMMITTEE FOR LAW AND SOLAR ENERGY

The South Australian Government has requested the Law Reform Committee of South Australia to consider the legal problems which may arise out of the use of solar energy in South Australia.

During the next few months, the Committee will be considering a number of matters, including:

1. the identification of the legal problems referred to, and legislative incentives for the use of solar energy in domestic and industrial applications;
2. the definition of a right of access to solar radiation, and the feasibility of its implementation, whether generally or in particular areas, and whether by easement or as of right;
3. building and planning regulations, and standards, including those relating to design and insulation;
4. the protection of consumers purchasing solar energy appliances;
5. the control of the use of solar radiation and the supply, storage or transport of energy derived therefrom.

We are interested in obtaining information which will assist us in developing our approach to these problems.

Written submissions are therefore invited from any interested person or organization on any of these matters.

Such submissions should be directed to the Secretary, Law Reform Committee of South Australia (Solar Energy), 9th Floor, 33 Franklin Street, Adelaide 5000 – Phone 212 1177.

13 Pawsey Memorial Lecture

In honour of the late Dr J. L. Pawsey will be delivered by Professor G. R. A. Ellis Department of Physics, University of Tasmania on Exploration of the Solar System Thursday 21st of July 1977 8 p.m. Laby Theatre, School of Physics, University of Melbourne
President's Column

One of the innovatory moves made by the Institute in the last year was the Solid State Conference in February in Wagga Wagga. This was an outstanding success and the executive would like to encourage more meetings of its type in all areas of physics.

The initial suggestions came from a group of members of the Institute who saw the need for a meeting on topics in this field. It was proposed to Council, who supported it directly by underwriting expenses and supplying working funds. A real contribution to the success of the meeting was a zero registration fee.

The 30th Council Meeting of the Institute is September 15-16. The executive invites any group of members who think a meeting in their field would be of value, and who are willing to do the organisational work, to submit a proposal to Council either through their State Chairman or directly.

The Honorary Registrar, Dr. J. G. Collins, will supply details of the Wagga Wagga Conference on request.

Institute Affairs

The Freeze

The new arrangements for the AIP office have brought about a reduction in administrative effort and further improvements in efficiency are being planned. The Executive of the Institute are hoping that the financial results for this financial year will make it possible to budget for 1977/78 without a rise in subscriptions. We are also hoping that unfinancial members who are reading their "free" copy of *The Australian Physicist* will send us their cheque by return mail.

The Action

In contrast to the political scene, the freeze in AIP costs is not being associated with a freeze in services. On the contrary many ideas for new services to members are being considered. In fact, on 9th May, 1977, the Executive appointed D. Ellyard as Hon. Assistant Secretary to help investigate and initiate new activities. There would be little point in listing the dozens of ideas that are being canvassed but you might like to let us know what you think of one possibility—a group tour to Europe, North America or China. Such tours usually cost about $2,000 and if there is enough interest it may be possible to make the appropriate arrangements.

Meetings

For a quite different reason the President of the AIP would like to hear from any member who is planning to attend the First Annual Conference of the Institute of Physics in New Zealand (to be held at the University of Waikato on 17-19 August, 1977). The occasion warrants fraternal greetings from the AIP.

The next meeting of the AIP Council has been set for 15th and 16th September, 1977 and planning for the meeting will commence in June. Any suggestions for topics that should be discussed should be brought to the attention of Branch Committees or the Executive. The most valuable suggestions, of course, are those accompanied by offers to help in expanding the membership and activities of the Institute.

Science Policy

The note on uranium in the March issue of *The Australian Physicist* generated considerable response and the extent of the concern by physicists on this topic has been very evident in recent months. Another topic which is making the news is solar energy R & D in Australia. The AIP Executive feel that there should be a follow-up to the proposal published in *The Australian Physicist* in October 1976. Contributions are welcome whether they be through *The Australian Physicist* or through Committees.

Information

Information on physics-related events in Australia is being collated and circulated to Hon. Secretaries of AIP Committees in order to help avoid clashes. We would appreciate early notice of plans of lectures and conferences, even before arrangements are finalized, so that plans can be developed taking into account other events.

—J. R. Bird,
Honorary Secretary
The Committee has prepared a draft set of questions and answers on the Uranium issue which it is proposed, if approved by members and Council, to issue to the public. Many of the questions do not directly involve expertise in physical sciences but are included to make the document reasonably self contained. It is the opinion of the Science Policy Committee that the Institute has a responsibility to make a contribution to the public debate that has been called for on this issue. The Uranium Committee has endeavoured to provide factual material and avoid taking sides or to be seen as taking sides, even by jaundiced eyes. The questions and content of the answers have been obtained from several members who were kind enough to respond to the Committee’s requests for assistance. Please send any comments to the Convenor, Professor D. Haneman, School of Physics, University of New South Wales, PO Box 1, Kensington 2033.

Questions and Answers

Question 1. Will Australia build nuclear power stations?
Answer. (There is no answer based on physical science). There are no definite plans present for construction of a nuclear power station in Australia and hence there will be no operating stations, at least until 1985 or 1990. Projections of rising energy demand in Australia are made by a number of organisations, along with postulates about the sharing of that demand among various sources including nuclear power stations. The results of these speculations depend on the ‘ground rules’ that are used and these are essentially expressions of the basic philosophy of the person(s) making the projections.
Information on Australian projections, as provided to the OECD, has changed since the early 1970s when plans for a power station at Jervis Bay were at first supported and then dropped.

<table>
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<tr>
<th>Year</th>
<th>1980</th>
<th>1990</th>
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<tr>
<td>OECD 1973</td>
<td>1</td>
<td>6</td>
<td>GW (electrical) installed</td>
</tr>
<tr>
<td>OECD 1976</td>
<td>-</td>
<td>1</td>
<td>6 capacity</td>
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A typical power station would have an installed capacity of 0.6 to 1.2 GW(e). (1 GW = 1000 MW).

Question 2. What percentage of the world’s uranium supplies does Australia possess?
Answer. Australia has a number of major deposits with more than 0.1% of U\textsubscript{3}O\textsubscript{8} and which fall into the category usually described as ‘recoverable at up to US$15 per pound U\textsubscript{3}O\textsubscript{8}’. The latest review is that contained in the First Report of the Ranger Uranium Environmental Inquiry, which quotes Australia’s ‘reasonably assured resources’ as 3.12 million tonnes of uranium — being 27% of the western world’s resources. The full extent of uranium ores in Australia is not yet established, but on present indications, they may well exceed 10% of those available to the western world.

Question 3. If Australia stops mining, will this reduce world nuclear power installations?
Answer. (There is no answer which depends on physical science). Because of the extent of Australia’s uranium resources and the fact that they are not yet committed in contracts to particular countries, it is possible that Australia’s policies concerning mining and export can influence overseas nuclear power programs — particularly through the price of uranium. However, the Ranger Uranium Environmental Inquiry Report considers that a decision by Australia not to mine uranium would have minimal impact on power programs before 1990. By that time, the success of exploration activities in other countries, the rate of growth in energy demand and the success in developing alternative energy sources, may all have changed the picture significantly, either towards or away from demand for Australia’s uranium.

Question 4. What gross income will Australia receive from uranium export?
Answer. (This is not a question involving physical science). Ranger proposals to mine 3000 tonnes or 6000 tonnes of U\textsubscript{3}O\textsubscript{8} per annum are estimated to be earning $100 M or $200 M (in 1976) dollars by 1985 and continuing until about 1995 or 2010. There are at least three other companies interested in mining deposits in the Northern Territory and Western Australia, and the Ranger Uranium Environmental Inquiry estimate that the maximum rate of exploitation could be 30 000 tonnes per annum, worth $100 M per annum in 1976 dollars. Actual earnings will depend not only on inflation of the 1976 dollar, but also on any change in price for uranium (assumed to be US$20 per pound of U\textsubscript{3}O\textsubscript{8}) which can only become known as successive contracts are written, either for Australian or overseas uranium.

Question 5. How many jobs are created by uranium mining and export?
Answer. (This is not a question involving physical science). Ranger proposals are for 600 or 1000 people to be employed for two years on construction work and for 250 or 400 to be then employed on production. Indirect increases in employment at the proposed Regional Centre and elsewhere will change these numbers substantially; a factor of 5 to 10 is commonly used to estimate the full effect of a mining project. Likewise, mining by other companies could increase the numbers, but not in direct proportion to the factor of 10 estimated by the Ranger Uranium Environmental Inquiry to be the maximum rate of exploitation. Vigorous exploitation of uranium could therefore provide employment for 5000 to 10 000 people at least until the end of the century.

Question 6. Is uranium mining hazardous?
Answer. Uranium mining in the Northern Territory will involve those hazards normally associated with open-cut mining operations, plus the risk of exposure to direct beta and gamma radiation, as well as the inhalation
of radon or radioactive particulate matter. Ore processing involves similar hazards, plus problems of the release of pollutants such as sulphur dioxide, metals (e.g. copper, lead and zinc) as well as radioactive materials. Suitable technology is known for the direct protection of miners and any other persons in the surrounding area. However, full protection has not always been provided in the past and some miners have been at risk from radiation, even up to 1970 or thereabouts. For example, a study of underground miners in Colorado showed, in 1969, an incidence of lung cancer which was six times higher than for non-mining populations. Environmental studies have been carried out to assess the quite high natural levels of radioactivity in areas of the Northern Territory adjacent to uranium ores and the possible effects of mining on these levels. The results have been used by Ranger in the planning of mining operations and the precautions they propose to adopt are set out in the Ranger Environmental Impact Statement. However, much remains to be learnt about these topics. Continuing studies are therefore important as well as independent monitoring and supervision of any mining operations.

**Question 7.** Will there be radioactive waste as a result of Australian mining operations?

**Answer.** Occasional pockets of almost pure oxide occur in Australian ores, but the economic deposits usually contain 0.1 - 1% U₃O₈. Ore processing therefore leaves as tailings most of the original material, including the radioactive daughter products. Ranger propose to retain the tailings in an engineered dam. After mining is finished, the tailings would be covered by a layer of soil or other material. Once again, the possible effects of seepage from the tailings dam have been assessed on the basis of data at present available, but continuing studies of long term processes are necessary.

**Question 8.** Can reactors produce their own fuel?

**Answer.** Breeder reactors using uranium-238 as well as U-235 or Plutonium-239 fuel produce additional plutonium, whereas the use of thorium-232 would produce uranium-233. The latter offers some possible advantages for a reactor fuel cycle, but breeder reactors using thorium have not yet been developed. Breeder reactors have been tested in the USSR, France, UK and USA, and prototypes are under construction or operational. Fuel doubling times are of the order of 20 years.

**Question 9.** Could this make our supplies obsolete?

**Answer.** The impact of breeder reactors on uranium demand depends on the fuel doubling time that is achieved in final commercial designs as well as the timing and rate of their introduction for power generation. The doubling time may well be less than 20 years (corresponding to a growth rate in fissile content of 3½% per annum or more). However, political and economic factors, which are not a matter of physical science, are having an important impact on the development and use of breeders. Witnesses at the Ranger Uranium Environmental Inquiry presented estimates that the introduction of commercial fast breeders after 1990 would cause a significant reduction in demand for uranium at times varying from the year 2000 to never.

**Question 10.** What percentage of nuclear power plants is out of action at present?

**Answer.** In March 1977, 4398 MW or 5.1% of installed nuclear generating capacity was out of action for one reason or another. Detailed analyses are published of the causes of shutdown, the majority being due to problems with conventional power station equipment.

**Question 11.** How does one shut down a reactor quickly in emergency?

**Answer.** Reactor control and shutdown are achieved by movement of neutron absorbers (boron, cadmium, etc.) in and out of the reactor core. For emergency shutdown, safety rods are released and inserted by stored energy, e.g. spring loading plus gravity. It takes 0.1 to 0.2 seconds for movement to commence and a small movement (10% of safety rod travel) to make a sufficient change in reactivity to terminate the chain reaction within about half a second. From 2 to 3 seconds are required to fully insert the safety rods for complete shutdown.

**Question 12.** How much uranium is dispersed by coal fired power stations?

**Answer.** Most coal contains a few parts per million of uranium and somewhat more thorium. Therefore a coal fired power station burning 1 million tonnes of coal per annum (500 MW(e)) will produce wastes containing 10 - 20 tonnes of uranium and thorium and their daughters. To produce the same power, a nuclear power station would use 50 - 80 tonne of natural uranium. Most of the uranium and thorium in coal would be retained in the ash, including fly ash trapped by electrostatic precipitators. A small percentage, as well as any radon gas trapped in the coal would be released to the atmosphere.

**Question 13.** What are the problems of storage and security of (i) radioactive wastes and (ii) plutonium?

**Answer.** (i) These questions refer to countries with nuclear reactors and do not concern Australia directly at present. Numerous proposals have been put forward for waste disposal. They range from firing waste-filled rockets into the sun, through burial in the Antarctic ice cap to the now most favoured, solidification and burial in stable geological formations. However, in the words of the Foxy Inquiry, “There is at present no generally accepted means by which high-level waste can be permanently isolated from the environment and remain safe for long periods.” Waste disposal research is being pursued. Wastes are now stored in tanks with concrete surrounds.

(ii) A few kilograms of plutonium is used for an atomic bomb. Plutonium is not naturally occurring but is produced in an atomic reactor. It is extremely radioactive, and shielded in heavy containers. Security arrangements are the responsibility of nations that possess the reactors.
A Review of the Bureau of
Mineral Resources

The Minister of National Resources, the Rt Hon J. D. Anthony announced on 23 March that a Departmental review would be undertaken of BMR, the Bureau of Mineral Resources, Geology and Geophysics. The review group comprising the Department's Deputy Secretary, R. N. Townsend, BMR's Director, L. C. Noakes, an officer of the Public Service Board, Graham Moffatt and the former Director of the South Australian Department of Mines and Australian Mineral Foundation, Lee Parkin, will call on outside advice and assistance from representatives of industry and others associated with geoscience. It will encourage the submission of written papers. However, there will be no public invitation for submissions, although the review group would welcome views as to the objectives of the BMR and the priorities which should attach to them. These views should be addressed to the Chairman, BMR Review, PO Box 378, Canberra City, ACT 2601. He convened the group's first meeting early in May.

It may be foreseen that the review will follow two stages, examining first the role, activities and objectives of BMR and then the facilities in staff, equipment, and finance and their suitability to the role.

BMR was established in 1946 when the Australian mineral industry was in crisis and has undergone continual growth and change since then. The review group was asked to consider the work of BMR in the light of the needs of the future mineral industry. The work of BMR is described in the following notes and the Table 1 below shows the relationship between the objectives of BMR and its various programs. The Table 1 shows that BMR has a wide range of programs and that some are major contributions to the objectives of BMR, while others are minor contributions. This list includes the various geophysical and geological surveys carried out by BMR and the other Bureau of Mineral Resources and its various programs.

The work of BMR is described in the following notes and the Table 1 below shows the relationship between the objectives of BMR and its various programs. The Table 1 shows that BMR has a wide range of programs and that some are major contributions to the objectives of BMR, while others are minor contributions. This list includes the various geophysical and geological surveys carried out by BMR and the other Bureau of Mineral Resources and its various programs.

Table 1

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<th>PETROLEUM RESOURCE STUDIES</th>
<th>EARTH STRUCTURE &amp; PHYSICAL PROPERTIES</th>
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PROGRAMS CONTRIBUTING TO OBJECTIVE: • MAJOR CONTRIBUTION ○ MINOR CONTRIBUTION

The Australian Physicist, June 1977
The Attitude of Physicists to Nuclear Energy

I.S. Falconer and D.C. Sams, School of Physics, University of Sydney, N.S.W.

The Ranger Uranium Environmental Inquiry, under the chairmanship of Mr. Justice R. W. Fox, presented its First Report (Fox et al., 1976) at the end of October last year, with a recommendation for "public consideration" and "debate" ("Final recommendation" p.186). In the September preceding the presentation of this report the United Kingdom Royal Commission on Environmental Pollution, under the chairmanship of Sir Brian Flowers, presented its report Nuclear Power and the Environment (Flowers et al., 1976). This report also stressed the necessity of encouraging a public understanding of the issues involved so as "to enable decisions on major questions of nuclear development to take place by explicit political process". (p.199).

A public debate on nuclear power has been carried out for some years now through the news and correspondence columns of the regular newspapers and scientific journals. The debate in Australia has been sharply polarized with the participants split into two hostile camps, with few contributors expressing a middle view. The Ranger Inquiry Report commented that (pp. 5 and 6)

"In considering the evidence we have found many wildly exaggerated statements are made about the risks and dangers of nuclear energy production by those opposed to it. What has surprised us more is the lack of objectivity in not a few of those in favour of it, including distinguished scientists. It seems that the subject is one very apt to arouse strong emotion both in opponents and proponents."

What should be the role of physicists in this debate? "A Statement of Concern by Members of the Australian Scientific Community" appeared in The National Times (January 3, 1977) opposing uranium mining and the development of nuclear power. A strong rejoinder by Dr Leslie G. Kemeny questioning firstly how many of the signatories were physicists, and secondly, "how many...have had any practical analysis, environmental impact study or operation of nuclear power plants..." was published with slight variations in both The National Times (January 17) and The Australian (January 12). Subsequent issues of The National Times contained a number of letters contesting the statement, as understood by the respondents, that the only people competent to decide on questions raised by nuclear power were physicists, and in particular those involved with nuclear engineering.

Although the Uranium Subcommittee of the AIP Science Policy Committee has sought the advice of members of the AIP (Australian Physicist (1976) 13, 47, 155) there has been no debate of the issue in The Australian Physicist. Nevertheless our experience at Sydney University, and discussion with colleagues from other universities indicates that the development of nuclear energy is widely (and sometimes heatedly) discussed within the academic community.

A group of about 30 staff and postgraduate students in the School of Physics, University of Sydney, have been meeting regularly to inform themselves about the scientific questions involved in the widespread use of nuclear power. The members of this group hold a wide range of opinions on the continued exploitation of nuclear energy, and see one of the roles of the group as providing a source of technical information to interested bodies, rather than espousing a particular policy. In this role members of the group have spoken to student and community groups, and will be presenting a series of lectures on "Uranium Power: Its Physical Basis" for the WEA. By this means the group hopes to stimulate informed public discussion of the kind envisaged by the Ranger Inquiry and Flower reports. The need for such informed discussion has recently been reiterated by Mr Justice Fox (1977). The group's initial experience indicates that people attending these meetings are looking for guidance from an expert but uncommitted source. Although none of the group is professionally concerned with nuclear energy, they are far better informed than most people, and believe they are playing a useful part in the nuclear energy debate. Speakers from the group have tried to avoid giving answers to social and moral questions, but rather to encourage the audience to answer these questions themselves.

These comments indicate that we believe that physicists are vitally concerned about the possible use of nuclear energy, and do have a role to play in the nuclear energy debate. We are concerned that, apart from a handful of people who take extreme stances, professional physicists are publicly taking little part in the nuclear energy debate, and are not attempting to reach a consensus on the issues involved -- if indeed it is possible to reach a consensus. Is this because our colleagues believe that they lack the knowledge required to contribute to the debate, that their expertise is not relevant to the issues involved, or that it is inappropriate for physicists to express anything but a personal opinion on these issues?

We have designed a questionnaire on the attitude of physicists to nuclear energy which is included in this issue of The Australian Physicist in an attempt to ascertain what physicists really think about the development of nuclear energy and alternative energy sources, and to stimulate discussion and action by the physics community. It is hoped the results of this questionnaire will be of general interest to the physics community, and assist the AIP in formulating a nuclear energy policy.

We would be grateful if you could find time to answer the questionnaire enclosed with your copy of The Australian Physicist and post your reply to:

Dr. J. G. Collins,
National Measurement Laboratory,
CSIRO,
University Grounds,
Chippendale, NSW. 2008

We ask you to give your name and address on the tear-off slip attached to the questionnaire. This infor-
information will be used only by Dr Collins to ensure that there is no sampling bias in the replies received. These slips will be removed before handing the questionnaire to the authors, to ensure the anonymity of the respondents. (Anonymous replies will not necessarily be rejected.) We believe that Dr Collins is sufficiently well-known that respondents can be assured that their anonymity will be retained, but that there will be a reliable check on the validity of the sample of responses received. Responses will not be restricted to members of the AIP. Further copies of the questionnaire are available from the authors.

Most of the questions require only a choice to be circled or a simple reply of "Yes", "No" or "Undecided" to the question. However, questions 9, 10 and 15 require several options to be ranked in order of preference, by placing numbers in boxes. We do not expect all the options to be ranked for these questions, and would consider only one or two numbers to be an acceptable response. Equal ranking of two or more options will be accepted. The employment classifications of question 5 are based on those used by the AIP Employment Survey Subcommittee (Cox and Sabine, 1973). We suggest you describe your subject area, question 7, according to the list given in Cox and Sabine.

The authors share with most others an aversion to questionnaires. The responses are designed to be coded for sorting by computer, and we have endeavoured to design all the questions so that they will reflect the opinions of all respondents. However, it is not the intention of the authors to limit the responses only to those suitable for coding. If any of the questions are framed so that it is not possible to accurately express your opinion, please omit or modify the question. In such a case the authors would greatly appreciate any explanatory comments you would like to make.

In addition to completing the questionnaire we would appreciate receiving any comments you would care to make on the individual questions, or the question of nuclear energy in general. A general comments section has been included at the end of the questionnaire and extra comments may be appended. Comments of sufficient interest will be published (anonymously) with our analysis of the results in a later issue of The Australian Physicist.

Finally, the authors would like to express their appreciation to those who participate in this questionnaire. A large representative sample is vital if the results of the questionnaire are to have any significance. Please encourage your colleagues to complete and return this questionnaire.

References

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**Questionnaire on Physicists’ Attitude to Nuclear Power**

This questionnaire is designed to gauge the opinion of physicists on the role of nuclear power in the provision of the world’s energy and their opinion on the public controversy surrounding nuclear power. The purposes of this questionnaire are further described in the article on page 85 of this issue of The Australian Physicist.

In general, we are seeking a clear expression of each respondent’s opinion. Thus if the form in the questionnaire is not suitable, then a clear indication of the reason would be appreciated. In constructing the questionnaire certain topics have been chosen for inclusion and others have been omitted. If this selection distorts the expression of your opinion, the authors would appreciate receiving your comments.

We hope that all readers of The Australian Physicist will complete and return this questionnaire. If you do not wish to complete the whole of this questionnaire, we would nevertheless greatly appreciate receiving your answers for questions 1 to 7.

[If you do not wish to remove the questionnaire from your journal you may use photocopies].
NAME: .................................................................

AIP MAILING ADDRESS: ..................................................

.................................................................

SIGNATURE .................................................................

(Circle your answers)

Question 1

Do you consider that the issues raised by the use of nuclear reactors for power production are sufficiently important to warrant your spending some time (several hours) to investigate and consider the arguments raised in the current debate? [Yes, No, Undecided]

AGE, QUALIFICATIONS and EMPLOYMENT

Question 2

What is your age? under 20, 20 - 29, 30 - 39, 40 - 49, 50 - 59, 60 and over.

Question 3

What is your highest academic qualification? DSc, PhD, MSc, Hon. Deg., Pass Deg., Non-graduate, Other (please specify).

Question 4

What is your grade of AIP membership? Fellow, Member, Graduate, Student, Subscriber, Non-member.

Question 5

Which best describes your place of work? CSIRO, Commonwealth Government, School, Hospital, State Government, University, CAE, Industry, Other (please specify).

Question 6

Which best describes your form of employment? Management and Administration, Research and teaching, Teaching, Research, Development, Research and development, Other (please specify).

Question 7

Describe the subject area in which you do most of your current research work? (List below, e.g. Solid state physics, medical physics, optical astronomy, computing)

EXPERTISE and THE NUCLEAR POWER DEBATE

Question 8

Have you at any stage in your career worked for a significant period of time in
(a) low energy nuclear physics [yes, no]
(b) reactor engineering/physics? [yes, no]

Question 9

Where have you gained your knowledge of the benefits and risks of nuclear power? (please rank in order of importance)

Newspapers, radio and television  [ ]
Popular books  [ ]
The popular scientific press (Sc. Am, New Scientist, Physics Today, Nature, Science)  [ ]
Discussions with your colleagues  [ ]
Seminars and conferences  [ ]
Reports of judicial Inquiries (Fox Report, Flowers Report)  [ ]
Technical literature and reports  [ ]
From your own work (past or present)  [ ]
Other (please specify)  [ ]

Question 10

Whose opinion should governments give the most consideration in deciding the future of nuclear power? (please rank)

An informed public  [ ]
The scientifically educated community  [ ]
Physicists  [ ]
Nuclear physicists and engineers  [ ]
An Atomic Energy Commission  [ ]
A Judicial Inquiry  [ ]
A government energy department  [ ]
Other (please specify)  [ ]

Comments: .................................................................

Question 11

What role do you think physicists should play in the public debate over the use of uranium? (please specify)

.................................................................

ATTITUDE TO NUCLEAR POWER and ITS ROLE

Question 12

Which of the following paths would you like to see the world follow in the development of nuclear power? (Choose one)

- A halt to the development of nuclear reactors and a gradual decommissioning of the presently operating reactors.
- The operation of current reactors to the end of their design lifetime with a halt to the construction of more reactors.
- The development and installation of a few more reactors to the maximum feasible capacity but without the introduction of breeder reactors.
- The development and installation of further uranium reactors and the introduction of fast breeder reactors.

Comments: .................................................................

Question 13

Do you consider that the benefits of commercial nuclear power generation outweigh the hazards? (circle one) [Yes, No, Undecided]

What do you consider are the principal benefits or hazards which determine your answer.

1. .................................................................
2. .................................................................
3. .................................................................
4. .................................................................

Comments: .................................................................

Question 14

Do you consider that the energy needs of the world to the year 2050 could be satisfactorily met without the use of

(a) thermal nuclear reactors, [Yes, No, Undecided]
(b) fast breeder reactors? [Yes, No, Undecided]

The Australian Physicist, June 1977  87
Question 15
What would you prefer to see the world using as its principal sources of energy (a) around the year 2000, (b) after the year 2050? (Tick up to three)

- Fossil fuels
- Thermal nuclear reactors
- Fast breeder reactors
- Solar power
- Fusion power
- Geothermal, wind, tidal and/or hydroelectric

Comments:

Which of the above do you see the world using as its principal source of energy? (please specify)

(a) around 2000
(b) after 2050
Comments:

AUSTRALIAN RESOURCES

Question 16
What would you prefer to see Australia do with its uranium? (choose one)

- Leave it in the ground
- Reserve if for possible future use in Australia
- Sell it overseas with safeguards and the return of spent fuel rods to Australia for reprocessing
- Sell it overseas with a minimum of restriction

Comments:

Question 17
Should Australia develop a uranium enrichment facility?

[Yes, No, Undecided]

Question 18
Do you consider that Australia is conducting enough research into the development of: (Yes, no, undecided for each)

- Fossil fuels and their utilisation
- Nuclear power
- Solar power
- Fusion power
- Geothermal, Wind, Tidal and/or Hydroelectric
- Energy Conservation

Do you consider that any of the above are particularly underfinanced or overfinanced. (list below)

Underfinanced:

Overfinanced:

Comments:

GENERAL COMMENTS Use Separate Sheet

AUSTRALIAN ATOMIC ENERGY COMMISSION RESEARCH ESTABLISHMENT, LUCAS HEIGHTS—NEAR SYDNEY

CHIEF, PHYSICS DIVISION

Applications are invited for the position of Chief, Physics Division (and in the Commission's Nuclear Science and Technology Branch which operates the Research Establishment at Lucas Heights about 30 km southwest of Sydney.

The research program of Physics Division, which currently has a staff of 53, including 41 professionals, has been primarily in the fields of reactor and nuclear physics and currently includes theoretical and experimental investigation of the fission process, measurement and analysis of neutron cross section data, neutron transport, shielding and theoretical studies of reactor transients and loss of coolant accidents. Some broadening of the program recently involves modeling studies in support of the uranium fuel cycle research program; involvement in plasma experiment and theory is being increased, and these trends to diversification are expected to continue. Facilities include a low powered (100 kW) reactor (MOATA), 3 MeV van de Graaff accelerator, split-table critical facility. Theoretical Physics Section has direct access to the central IBM 360/65 computer to which are coupled local computing and interactive facilities.

The Division Chief is responsible to the Branch Head for the management of the Division and for the development of the Divisional program in consultation with Program Managers and other senior staff. He will be expected to give advice within his area of experience and competence on matters of Commission policy.

Applicants should hold high scientific qualifications with experience in reactor and nuclear physics and have a proven record of research and research management.

Salary will be at the level of Chief of Division, Level 1, currently $28,468.

Application forms may be obtained by phoning the Recruitment Officer on 531-0111 or writing to the Recruitment Officer, A.A.E.C., Research Establishment, Private Mail Bag, Sutherland, N.S.W. 2232, no later than July 15 1977.
Research School of Physical Sciences

Two major structural changes in the Research School of Physical Sciences (RSPhysS) are suggested in guidelines for resource allocation prepared by the School's Director, Professor Robert Street.

The guidelines, contained in a document entitled 'Guidelines for advising on and the determination of resource allocation within RSPhysS for the period 1977-79', were prepared following a review, by an external committee, of future directions of research activity in the School.

The results of the review and the details of a paper - 'Evaluation of Research Activities: a Statement of Policy by the Faculty Board' - based on the review and adopted by the RSPhysS Faculty Board in October last year, are regarded as internal School matters. However, Professor Street, summarised some of the ramifications of the review and guidelines for the University Council at its meeting on 11 March.

Professor Street said that during its work, the Review Committee had realised that the University, in common with others, had entered a period of financial stringency which could continue for several years. 'As a result, the task to which the Committee initially believed it was addressing itself, namely, the identification of areas for future development partly through growth, is now perceived as an exercise in maintaining and improving viability by the encouragement of scientific merit through reorganisation and redistribution of resources'.

'Two major structural changes are contained in the guidelines', Professor Street told Council. 'The first of these relates to changes which are to be made in the activities of the Department of Engineering Physics. The Faculty Board has recognised an opportunity for the School to commit itself to a development of Plasma Physics which provides basic information for the possible utilisation of fusion processes as clean energy sources. An autonomous Plasma Physics group is to be created by agreed partition of the present Department of Engineering Physics.

'It is considered at the present time that the homopolar generator (HPG) has an important part to play in the development of plasma physics and its use will now be dedicated almost totally to the needs of the experimentalists in the Plasma Physics group.

Thus, the control of the HPG and its operating team will be assumed by the leader of the Plasma Physics Group. Very recently, the Faculty Board reaffirmed its opinion that the Plasma Physics initiative as detailed in the Guidelines should be taken and in accordance with established procedures has requested the Electoral Committee to proceed to an appointment of a Professorial Fellow in this field', Professor Street said.

'The second change which is foreshadowed relates to the expansion of our interests, again including the encouragement of conscious collaborative ventures (possibly involving the Departments of Engineering Physics, Theoretical Physics, Nuclear Physics and Applied Mathematics), in Solid State Physics.

'There is to be a close relationship between the present Department of Solid State Physics and the Director's Unit which is not to continue as a long term independent Unit.

'It is envisaged that the sharing of resources of equipment and accommodation will permit the development of an integrated effort covering a broader range than that currently being pursued. The recruitment and appointment of a Professorial Fellow to participate in and provide additional impetus for this program is being pursued actively', Professor Street told Council.

Speaking of the overall effects of the review and ensuing guidelines, Professor Street said it was clear that necessary and desirable changes would entail a redistribution of resources generally within RSPhysS. 'It is recognised that there are difficulties in making rapid changes in research programs especially involving tenured staff and large-scale experimental installations. However, there is agreement that progress towards stated ends should not be unduly or artificially delayed. The expectation is that many of the recommendations implicit in the Guidelines should be implemented within three years'. ANU Reporter, 26 May 1977.

Department of Science

European Space Agency Tracking Station proposed for Australia

The Minister for Science, Senator Webster, announced on the 19th May that the Government is considering a request from the European Space Agency to establish a space-tracking station in Australia.

A delegation from the ESA has visited Australia for discussions with officials of the Department of Science and other government departments and inspected potential sites near Carnarvon in Western Australia.

The proposed station would track, transmit commands and receive data from ESA spacecraft and if a decision were made to proceed, the station would probably begin operation late next year.

OECD Review of Science and Technology in Australia

The full published report by the Organization for Economic Cooperation and Development of its review of Science and Technology in Australia was released in May.

The review was one of a series conducted by the OECD to assist member countries to assess the adequacy of their scientific and technological effort and policies, taking into account each country's broad national goals.

The final report contains the Background Report, the Examiners' Report and an account of the Paris confrontation meeting. Although much of this material has been published previously, the final report draws together in convenient form material of great interest to those concerned with the future of science and technology in Australia.

Copies of the report will be available soon through the Australian sales agents for OECD publications.

The Australian Physicist, June 1977 89
People and Institutions

1978 Post-Graduate Scholarships in Electronics offered by Philips

The Philips company enjoys a worldwide reputation for excellence in the field of electronics and for its research and design orientation. Naturally Philips want to promote a high level of learning and skill in this field. Each year Philips offer a number of scholarships to graduates of electrical engineering, physics or other related subjects, to study for a Master of Electronics Engineering at the Philips International Institute of Technological Studies in the Netherlands.

The scholarships are for a period of one year beginning in January at a Philips manufacturing centre or research laboratory in Eindhoven. Course work involves lectures and experimental or design work in electronics and affiliated techniques. Financial assistance is offered and airfares to and from will be paid by Philips. Applicants are drawn from all over the world but must be able to speak English and are normally under the age of 30. This is in line with Philips belief in assisting the younger talent to develop.

Applicants must possess a university degree or equivalent relevant to electronics engineering and illustrating a high level of achievement as only the very best will be chosen for this course.

The course will allow students to extend their talents in the field of electronics while providing a situation where exchange of ideas and experiences with students of other countries can take place.

Applications close on September 1, 1977 and further information and application forms are available from Philips Research Manager in Australia, Dr G. de V. Gipps at Philips Industries Holdings Limited, PO Box 1138, North Sydney, NSW 2060.

New Optics Journal

The Optical Society of America will produce a new monthly journal from July 1977. "Optics Letters" will publish short papers (2000 words) within approximately three months of submission. Papers may be submitted to the editor, Dr R. W. Terhune, Research Laboratories, Ford Motor Company, PO Box 2053, Dearborn, Michigan 48121, USA, or through P. E. Ciddor, National Measurement Laboratory, Chippendale 2008, who is a member of the Editorial Advisory Panel.

NDT Centre at Harwell

Pioneering Work

The Centre owes its existence to the pioneering work done in the development of inspection techniques for the nuclear industry. Although it is only indirectly involved in support work for Britain's nuclear power programme, a useful cross fertilisation of ideas still takes place between the Centre and the UKAEA on NDT matters.

It has established itself as a national data store for the collection and dissemination of information on the science and technology of quality assurance. It maintains a large collection of up to date publications (more than 15,000 items), on subjects of NDT and quality assurance. These are indexed into a computerised retrieval system. Ready access by industry to the data store is encouraged and a subscriber scheme is operated for overseas users.

The laboratory equipment covers the full range of accepted NDT techniques and much of it is technically in advance of available commercial equipment. The Centre also has its own especially designed modular series electronic systems for NDT applications. These enable special purpose prototype test systems to be constructed with the minimum delay and with maximum technical flexibility, incorporating the latest developments in signal processing and data display techniques.

The NDT Centre has built up considerable expertise in a number of the problem areas which industry frequently encounters. These include: Defect location and sizing, inspection of welds, measurement of bond efficiency, dimensional measurements, analysis and characterisation of materials, automatic inspection procedures, process control (including automatic data analysis), testing concrete and other composite materials.

In many of these areas the Centre has already developed hardware and systems which can help solve such problems, often in 'on-line' applications. Industry is encouraged to bring to the Centre problems that are beyond the scope of conventional techniques; those needing skills and expertise not yet commercially available and those which anticipate inspection needs associated with new materials or new fabricating procedures.

Harwell has proven expertise in, and considerable experience of, a wide range of inspection techniques. This powerful armory includes: Ultrasonic holography, ultrasonic defect sizing, ultrasonic onimetry, ultrasonic thickness measurements, ultrasonic scatter analysis, ultrasonic phase measurement, acoustic emission, acoustic impulse testing, high definition radiography, magnetic flux analysis, data analysis by computer, automatic radiograph or picture data processing, microwave gamma radiography, neutron radiography, proton radiography, dynamic radiography, thermography, infrared testing of coatings, defect scanning systems for B-scan and C-scan, bulk compressibility testing, ultrasonic transducer evaluation, image analysis techniques, positron annihilation for fatigue monitoring.

Initial discussions held are without obligation. The Centre encourages a continuing dialogue with industry. Where an existing commercial instrument or service is known to be available and suitable to the client's needs the Centre will normally recommend its use. If the problem is novel or of limited application the Centre will submit a written proposal outlining its suggestions and detailing the likely costs. Acceptance of this proposal forms the basis of a contract. The work is then carried out in separate stages, after any of which the client can terminate the contract.

The Centre's commercial arrangements are flexible and tailored to meet the needs of a client.

The Centre can also arrange specialised training or appreciation course for client's staff to meet needs not provided for by teaching or training organisations.
Physics in Australia

Ultra High Purity Gases Produced in Australia. The first range of ultra high purity gases to be produced in Australia is now available from The Commonwealth Industrial Gases Limited. The range includes oxygen, nitrogen, hydrogen, helium and argon and the gases, except for oxygen which carries a purity guarantee of 99.995 per cent, are guaranteed to 99.999 per cent with maximum impurities of 10 parts per million. Previously such gases had to be imported from the U.S.A.

Further information is available from CIG Public Relations Department, 46 Kippax Street, Surry Hills, N.S.W., 2010.

Tracing Ancient Rivers
A study conducted by two geologists from the University of N.S.W., Drs. Albani and Rickwood with two members of Macquarie University’s School of Earth Sciences, Dr. Johnson and Mr. Tayson, has traced the ancient river systems of the Botany Bay area. Throughout 1975, the bedrock of Botany Bay was investigated using a continuous seismic profiling system called a “sparkler” which generated sparks of short duration in seawater. The sparks cause water vapour bubbles to form and as the bubbles implode they generate sound waves. The reflected waves are detected by an array of hydrophones and fed to a chart recorder. Both the sparking unit and hydrophones are towed behind a research vessel. The particular frequency used is able to penetrate the sediment so that the charts trace both the bottom and bedrock.

The studies are being conducted by Unisearch on behalf of the Sutherland Shire Council who are worried about the Cronulla beaches. An overall scientific study of the area is intended. *Unken*, No. 5, 25 April, 1977.

Australian Gravity Map
Australia is the first continent whose gravity field has been determined completely on a regional scale. A 1 : 5 000 000 gravity map of Australia was released last year by the Bureau of Mineral Resources. The latest issue of BMR Journal of Australian Geology and Geophysics (Vol. 1, No. 4) is largely devoted to papers on the interpretation of gravity observations as a guide to sub-surface geology, and includes 1 : 25 000 000 versions of the free-air and Bougeur maps, a history of gravity surveying in Australia, and a selected bibliography. *Search*, Vol. 8, No. 4, 1977.

ANZAAS 1979. It is hoped that the 49th ANZAAS Congress will be held in New Zealand in 1979 in association with a number of specialist meetings. The Congress would thus consist of a number of specialist meetings with a number of more sharply focussed inter-disciplinary issues grafted on. Two possible themes have been suggested for such issues. Either, The Direction of Science and its Future Development in the Australasian scene, or, a meeting devoted to the question of the desirability of Nuclear Power Generation in Australia and New Zealand.

Any comments on these suggestions, together with other suggestions may be sent to John Buckingham, Physics and Engineering Laboratory, DSIR, Private Bag, Lower Hutt, N.Z.

48th ANZAAS Congress – 29th August - 2nd September 1977
The University of Melbourne is host for this year’s ANZAAS Congress for which the theme is “Science for Society”. Section 1 (Physics) has arranged 12 Sessions with 38 Speakers including the Minister for National Resources, Mr J. D. Anthony speaking on “Energy Policy”. President of the Section is Professor L. W. Davies of AWA Research Laboratories and University of New South Wales who has entitled his address “The Physics of Communication”.

The Congress Circular may be obtained from the Congress Office, PO Box 29, Parkville, 3052.

Saudi Arabians Study Bureau of Meteorology
Senator Webster, announced that a Saudi Arabian delegation has spent two weeks in Australia studying the operations of the Bureau of Meteorology.

The five-man delegation from the Saudi Arabian National Meteorological Service met the Minister for Science in Melbourne.

The delegation was led by the Director-General of the Saudi Arabian service, Sheik Romah Mansour Al Romaih. Saudi Arabia is planning a major development of its weather service.

UNIVERSITY OF CANTERBURY
CHRISTCHURCH, NEW ZEALAND

UNIVERSITY POST-DOCTORAL FELLOWSHIP IN PHYSICS

Applications are invited for the above position. Applicants should possess a Ph.D. or an equivalent degree, preferably followed by some research experience. The appointee may be asked to undertake a limited amount of teaching in addition to contributing to the current research programme in their particular field. The emolument will be $NZ8000 per annum. Fellowships are tenable normally for one year, but with the possibility of extension. Applications close on 31 July 1977 with the undersigned from whom further particulars can be obtained. Apply — Registrar, University of Canterbury, Christchurch, New Zealand.
I seek leave to make a statement concerning the Government's arrangements for receiving independent advice on science and technology.

Science and technology have played an important part in Australia's development, and if properly encouraged, they may be expected to be even more important for Australia's future. They are basic to our capacity to meet the challenges presented by issues such as energy and resource availability, industrial productivity and competitiveness, urbanisation, and the management of the environment.

To ensure that our valuable but limited scientific and technological resources are applied most effectively to Australia's problems, an integrated effort is needed. Advisory machinery of the highest quality is essential if the Government is to make the right decisions. The Government must be able to draw on the best available advice if it is to formulate clear objectives, establish the most effective and appropriate institutional means for achieving them, and assign priorities on a rational and considered basis.

Mr Speaker, science policy advisory machinery was first established by a Liberal Country Party Government in Australia. In April 1972, the then Prime Minister, the Right Honourable the Member for Lowe, announced the formation of the Advisory Committee on Science and Technology. This reflected the importance the Coalition Parties attached to having expert and co-ordinated advice on policies for science and technology. As Honourable Members may recall, I was the responsible Minister when this original Advisory Committee was established in 1972.

The Committee was disbanded in February 1973. It was not replaced for some years - not until mid-1975 when an Interim Australian Science and Technology Council was set up pending the passage of legislation.

Soon after the 1975 election, a small and highly qualified Advisory Group was formed to advise on the role of a permanent science and technology council. Having considered the Advisory Group's report, I announced that the Interim Australian Science and Technology Council would continue, but with some changed membership and functions.

As the Advisory Group recommended, the reconstituted Interim Council was asked to report to the Government on long term arrangements for an independent science and technology advisory body.

The Interim Council consulted widely and considered a large number of submissions which substantially represented scientific and technological opinion in Australia. The Council's Report, presented in November 1976, indicated that there was widespread support for the creation of a permanent and independent science and technology council.

The Government has accepted the Interim Council's recommendation that the Australian Science and Technology Council be established as a permanent and independent body. As it is of great importance that ASTEC not only be independent, but that it be seen to be independent, the Government intends to establish ASTEC as a statutory body.

The establishment of an independent science and technology policy advisory council on a permanent basis is a significant advance. The history of science bodies in Australia has been chequered, and making ASTEC a statutory body will give the council the status, permanence and stability which it requires.

The functions of ASTEC are to advise the Government on science and technology, including:

- the advancement of scientific knowledge and the development and application of science and technology in relation to the national well being;
- the adequacy, effectiveness and overall balance of the national effort in science and technology in Government, industry, education and other sectors of the community;
- the assessment of gaps and overlaps in science and technology in Australia;
- the identification and support of new ideas of science and technology likely to be of national importance;
- the practical development and application of research discoveries and the fostering of technological innovations in industry; and
- the means of improving efficiency in the use of resources related to science and technology.

The Council will have a strategic role in assisting the Government to encourage Australian science and technology to meet the nation's needs and objectives. It will have no executive responsibilities but will be able to advise on operational arrangements.

ASTEC's knowledge and analysis of science and technology will be valuable to many arms of Government. And the Government expects the Council to inform itself and be informed of relevant Government policies and to take into consideration economic and budgetary implications in discharging its functions.

ASTEC will draw on existing Departments and Agencies for the expertise, knowledge and assistance necessary to enable these functions to be discharged effectively. But this will in no way compromise the independence of ASTEC.

Pending the passage of appropriate legislation, ASTEC has been established by executive action and is now continuing its important work. As the Council Report recommended, ASTEC will report to me, and its secretariat, which will be small in number, will be attached to my Department.

The Government has agreed that ASTEC should prepare a report on the present state of science and technology in Australia as recommended by the Interim Council. ASTEC will prepare this report in parallel with conducting investigations and providing advice on matters either referred to it by the Government or which arise from its own initiatives.

Since the Government will be making decisions on matters upon which ASTEC will be reporting, the timing of the release of ASTEC's reports will be for the Minister to decide. The Government intends that ASTEC's
reports shall be made public unless there are overwhelming reasons — in the national interest — for not doing so.

ASTEC will have a part-time Chairman and Deputy Chairman, and up to thirteen other part-time members. The Council's membership will have experience and knowledge across the spectrum of science and technology and its impact on the community. Members will be selected for their individual qualities and on the basis of their ability to contribute to the work of the Council, not as representatives of particular interest groups.

I am pleased to announce that Professor Geoffrey Badger has accepted the position of Chairman of ASTEC. Professor Badger has had a distinguished career as a scientist. After several years as a Professor of Organic Chemistry, at the University of Adelaide, he served for a short time as a member of the Executive of CSIRO. He has just completed a ten-year term as Vice-Chancellor of the University of Adelaide and is now a Research Professor in that University. He is the President of the Australian Academy of Science and the Chairman of its Science and Industry Forum.

Professor Badger has played a significant part in developing and presenting the case for an independent advisory council, on science and technology. In 1967, he chaired a working party, established by the Science and Industry Forum of the Academy of Science, to examine the need for science policy machinery in Australia. I recall that as Minister for Education and Science I took part in the discussion of his report at a subsequent meeting of the Forum. Professor Badger again stressed the need for an independent science advisory council in a Presidential Paper published by the Academy in 1975.

Another eminent scientist, Professor Sir Rutherford Robertson, Fellow of the Royal Society of London and Past President of the Australian Academy of Science, has accepted the position of Deputy Chairman of the Council. Sir Rutherford is Director of the Research School of Biological Sciences at the Australian National University.

The other members of the council are—

- Professor B. D. O. Anderson, FAA, Professor of Electrical Engineering, University of Newcastle;
- Mr S. W. G. Burston, OBE, Chairman, Australian Woolgrowers and Graziers Council;
- Dr L. W. Davies, FAA, FTS, Chief Scientist, AWA Research Laboratory;
- Mr A. W. Hamer,
- Managing Director, ICI Australia Limited;
- Professor B. E. Hobbs, Professor Geology, Department of Earth Sciences, Monash University;
- Mr B. T. Loton, Executive General Manager, Steel Division, Broken Hill Proprietary Co Limited;
- Sir Louis Matheson, KBE, CMG, FTS.;
- Professor Sir Gustav Nossal, CBE, FAA, Director, The Walter and Eliza Hall Institute of Medical Research;
- Mr A. H. Parbo, Managing Director, Western Mining Corporation;
- Mr L. G.Pages, Reader in Political Science, University of Melbourne;
- Mr K. C. Stone, Secretary, Victorian Trades Hall Council;
- Professor R. Street, FAA, Director, Research School of Physical Sciences, Australian National University;
- Mr J. G. Wilson, CBE, Managing Director, Australian Paper Manufacturers Limited.

I would like to thank the organisations to which the members of ASTEC are affiliated for releasing their services to take up the task of this important advisory body.

I should also like to place on record the Government's appreciation of the work which the Interim Council, chaired by Sir Louis Matheson, has undertaken in preparing its report. Sir Louis and the members of the Interim Council have contributed considerable time and effort. Their advice has greatly assisted the Government to make decisions on long-term arrangements for obtaining independent policy advice on science and technology in Australia.

For the information of Honourable Members, I present the report of the Interim Australian Science and Technology Council entitled: "Future Arrangements for an Australian Science and Technology Council".

### Onassis Energy Research Foundation Competition

The Onassis Foundation was established in 1975 to conduct and promote research in various fields of the physical and marine sciences. It is at present sponsoring an international competition open to all senior students, researchers and teaching staff of any college or university.

The entrant is required to submit a piece of work on original research or a short thesis on either of the following topics: energy storage cells, hydrogen energy or solar energy. The closing date is 31st December, 1977.

The prize is a round-the-world-all-expenses-paid trip, $5000 US cash and the possibility of a job offer from the Foundation. Entries to:

International Competition, TOER Foundation, Administrative Office, PO Box 348, Kowloon Central, Hong Kong.
Book Reviews

PROBLEMS IN QUANTUM MECHANICS, edited by D. ter Haar, Pion Limited, London 1975. vi + 468 pp. $20.85

The third edition of this very useful collection of quantum mechanics problems contains two new chapters, one dealing with relativistic wave equations, the other with many body problems and density matrices. Extra problems have also been included in the existing chapters. As in previous editions, detailed and quite readable solutions are provided for most of the problems, making the book suitable for self-guided study.


Based on lectures given at the Niels Bohr Institute and NORDITA between 1971 and 1974, this book is a compendium of the present theoretical techniques associated with describing the interaction between two free nucleons in terms of one-boson exchange and two-pion exchange according to quantum field theory. The material is covered at an advanced level. Only brief introductions are given of the necessary background material of such as scattering theory and relativistic scattering equations.


Reviewed by T. T. Blackbum, School of Electrical Engineering, University of New South Wales.

This book is one of the first to be devoted entirely to the field of laser anemometry which, since its introduction in 1964, has developed rapidly and is now used for velocity measurement in fields as diverse as blood flow and high temperature plasma jets and for velocities in the range from millimetres per second to kilometres per second.

The authors, over the last six years, have made a substantial contribution to the field both in development of technique and in application and the book is a distillation of the experience gained by them in that time. The contents cover all aspects of laser anemometry from Mess scattering theory to economic considerations in the design of a system. For the user, or potential user, of the technique there is detailed discussion of optical systems and components, signal processing methods and, perhaps most useful, of scattering particles and their generation. A very comprehensive reference list is an added feature.

On the debit side, the authors tend to try and cover too much ground with a resulting lack of clarity in parts. In particular, Chapter 2, entitled 'Principles of Optics', could well have been omitted and the reader referred to other texts. Allied with this is a tendency to set down complex equations without defining terms in the text and although there is a nomenclature list, it is not complete.

Notwithstanding these criticisms, the book is a valuable addition to the literature of the field and is necessary reading for any intending (and established) worker in laser anemometry.


Reviewed by D. B. McCulloch, AAEc Research Establishment, Lucas Heights, NSW.

To attempt "a complete up-to-date treatment of neutronics experiments in moderators, subcritical and critical assemblies and reactors, together with the necessary techniques of radiation measurements" in only some 800 pages is a formidable challenge. Further, it could reasonably be said that little more than half the book is directly devoted to this aim, with the remainder comprising an historical introduction, followed by chapters generally reviewing solutions of problems by fission theory, nuclear reactions and the interactions of radiation with bulk matter, neutron source devices, radiation detectors, and nuclear instrumentation electronics. An appendix makes a very cursory foray into laboratory radiation safety.

The rest of the book assigns two chapters to a general account of radiation measurements, and the important methods of measuring neutron fluxes and energy spectra, with only four chapters left to cover, in varying degrees of detail, almost all the "standard" types of neutronics and reactor physics measurements usually made under both static and dynamic conditions in source-driven, subcritical, unfuelled and fuelled assemblies, and in critical reactors.

The scope is comprehensive, and the presentation is readable and informative, with a minimum of mathematics to break the continuity of the text. The compression of material produces some inconsistencies in the depth at which different topics are treated and, on occasions, may even obscure a concept to someone not already familiar with the field. References for further study are copious, but by no means exhaustive.

Despite the reservations expressed, the author's first aim of a book to accompany a graduate level course in nuclear radiation measurements and reactor physics, is met. Almost any topic which a student in such a course might conceivably encounter is at least touched upon. The second aim, to provide a reference work for the professional in the field, is, in this reviewer's opinion, not even closely approached.

LASER DOPPLER MEASUREMENTS, B. M. Wiatralsiewicz and M. J. Rudd, Butterworths, London 1976. vii + 160 pp. $18.00


Over the course of the last twelve years laser Doppler techniques have been developed as an important means for measuring flow velocities in fluids. This book sets out to provide a basic introduction for those who are new to the field as well as details of theory and applications for people already working in it.

The first chapter provides an historical review of laser Doppler velocimetry with outlines of some of the different techniques which have been used and a simple introduction to the theory. There follows a quite useful section providing a background understanding of areas with which a worker in this field is sure to get involved such as lasers, photo-detectors, optical mixing and the theory of Doppler shift. Other sections of the book progress more deeply and rigorously into the theory of laser Doppler measurements with an emphasis on optimisation of measurement conditions and obtaining the best signal to noise ratio. A few examples are given of practical applications of the technique to measure velocities in pipes, wind tunnels and the atmosphere with an emphasis on turbulent flow conditions. Finally, the book contains a fairly exhaustive set of references covering publications in this field up to about August 1974.

If there is a criticism to be made of the book it would be that, as an introduction to the field of laser Doppler, it does not go far enough into the practical details of real systems and the reader is left to sift these from the original articles. Nevertheless it serves its purpose well and would be a worthwhile purchase for any person interested in the subject of laser Doppler velocity measurement.


Reviewed by A. G. Little, Physics Dept. University of Sydney

A book on the techniques of Radio Astronomy is not novel but the subject changes constantly and so the recent publication of Volume 12, Part B of Methods of Experimental Physics brings to us the latest ideas in this field.

The issue concerns itself with many aspects of Radio Telescopes. The sixteen chapters are by different authors and the first six are devoted to the various antenna systems at present in use. The discussion on the types of astronomical antennas is very brief and serves mainly as a reference list, at least one of which (the one referring to the Molonglo telescope) is wrong. It is to be hoped that the others are more accurate. There is a good discussion of paraboloidal reflector systems with a lot of useful data referring to the modern approach to paraboloidal reflector systems and a chapter on antenna calibration which is a useful
practical guide. The section on practical problems of antenna arrays this reviewer found to be a bit elementary; more in keeping with an amateur radio handbook rather than current professional practice. For example, not putting a balun on a dipole is not good practice, particularly if polarization is important. The effect of mutual impedances on beam swinging one feels should have been discussed in greater detail.

The next five chapters deal with atmospheric and ionospheric effects relevant to Radio Astronomy. These chapters are well documented and provide a lot of useful information of direct practical use to the Radio Astronomer. The most important effects above 10 MHz are discussed at length and are of topical interest.

The remaining five chapters cover the back-end of the telescope -- the Radiometer. Here as in the rest of the book there is a lot of ground covered in only a few pages. The question of noise and temperature calibration systems is a serious omission -- particularly when referring to the very low noise parametric and maser amplifiers discussed in detail in the next two chapters.

The last two chapters on filter and correlation spectrometers give a good account of these systems but they could perhaps have been tied together a bit better so that a proper comparison of the two techniques could be made.

In general the book is a good source of references and is quite readable. It cannot be considered as a handbook to which one might go for design data, but it is a useful guide and should be considered as essential reading for all practising or budding Radio Astronomers.


Reviewed by G. A. Bell, National Measurement Laboratory, Chippendale, N.S.W.

This most welcome book comprises a number of contributions from a group of professional physicists and information experts which have been successfully integrated into a coherent whole by Herbert Cobblans.

Taking things out of order the last eight chapters of the book are each concerned with a particular branch of physics. In each chapter there are lists of the definitive books, the primary journals and the review journals. In those fields with which this reviewer is familiar this has been well done within the limits of the available space.

Chapters two to seven are written by people whose primary interest is in the classification and dissemination of information and deal with libraries, reference material and reviews, abstracting and indexing services. There is a good chapter on patent literature in which the author (T. Liebesny) directs attention to the very large volume of information which makes its first appearance in patent applications.

The introduction to this book is a gem from the pen of John Ziman. In the space of fourteen pages he tells us what the game is all about. This chapter should be compulsory reading for all budding professional physicists.

The book is well produced and is reasonably priced by today's standards. It merits a place on the shelf of any science library where it may also serve as a useful back up for library staff.

Articles of Interest in Journals


"Nuclear Fusion" -- The Energy Source for the Future" M. H. Bremann, Search, Vol. 8, No. 4, 1977


Conferences — and Courses

The Eleventh Meeting of Australian Crystallographers
The Eleventh Meeting of Australian Crystallographers will take place at Bendigo Teachers' College, (about 130 km north of Melbourne) from Sunday afternoon, January 29 to Wednesday afternoon, February 1, 1978. February 1978 has been chosen to avoid semester clashes in August 1977. — All interested persons are invited to participate.

Further information may be obtained from: L. A. Barsall, Physics, Univ. of Melbourne, Parkville, 3052; B. M. Gatehouse, Chemistry, Monash Univ., Clayton, 3168; I. E. Grey, CSIRO Div. Mineral Chemistry, PO Box 124, Port Melbourne, 3207 or D. J. Lloyd, State College of Victoria, Osborne St., Bendigo, 3550.

Undergraduate Physics Conference.
The 12th Annual Conference for undergraduate physicists in Canada was held recently in Ottawa. It was attended by nearly 200 students who travelled from all parts of Canada to take part.

The Conference is an annual event and is organized by the Canadian Undergraduate Physics Association. It is supported by the Canadian Association of Physicists, the Federal Government, host universities and industry. The conference budget reaches $20,000 and is obviously well-received both from the social and educational points of view.

The Conference occupied three full days, each being devoted to a particular theme. Those chosen were "Physics in Canada", "Trends in Physics" and "The Nuclear Question". Eminent speakers included Dr. Gerhard Herzberg of the National Research Council, Dr. Rene Racini of the University of Montreal, Dr. John A. Wheeler and Dr. Anderson from the USA and many others, Physics in Canada, Vol. 33, No. 1, 1977.

5th International Conference on Crystal Growth

International Conference on the Physics of Transition Metals
Toronto, Canada, August 15-19, 1977. Information from Professor E. Fawcett, Department of Physics, University of Toronto, Toronto, Ontario, Canada, MSS 1A7.

International Conference on Statistical Physics
Haifa, Israel, August 24-30, 1977. Information from Professor C. G. Kuper, Physics Department, Technion, Haifa, Israel.

International Symposium on Lepton and Photon Interactions at High Energies
Hamburg, August 25-31, 1977. Information from Dr. G. Sohngen, DESY, Notkestr 1, 2000 Hamburg 52, FRG.

International Conference on Lattice Dynamics
Paris, September 5-10, 1977. Information from Professor M. Balkanski, Laboratoire de Physique des Solides, Tour 13, 4 Place Jussieu, 75230 Paris Cedex 05, France.

CHANGE IN MEMBERSHIP FROM NOVEMBER 1976 UNTIL MAY 1977

FELLOW

New Election
D. J. H. Cockayne (NSW) P. Fisher (NSW)
R. Delbougeo (Tas) W. E. James (Vic)
D. G. Drummond (NSW) T. L. Tansley (NSW)

Transfers
I. G. Brown (Qld) L. Musumad-Davies (WA)
B. S. K. Chow (Vic) A. H. Opie (NSW)
R. E. Collins (NSW) R. J. O'Reilly (SA)
P. R. W. Hudson (Vic) C. A. Sholl (NSW)
M. J. Lynch (WA) R. D. Watson (Tas)
E. C. Mackenzie (SA)

MEMBER

New Election
W. A. Barton (NSW) S. L. Mair (Vic)
S. J. Campbell (ACT) R. D. Ryan (NSW)
D. H. Chaplin (ACT) A. W. Thomas (Qld)
J. C. P. Heggie (Vic) J. J. Todd (Tas)
R. E. Hendtlass (Vic) S. W. Wilkins (Vic)
P. L. Hewitt (Qld)

Transfers
L. Biggel (SA) B. J. Packham (Vic)
R. H. Brockman (NSW) G. W. Royston (Tas)
J. F. Drew (NSW) G. R. Small (ACT)
W. R. MacGillivray (Qld) G. B. Smith (NSW)
W. A. Miller (NSW)

Retirements
K. King (SA)

GRADUATE

New Election
R. A. Anderson (Vic) E. M. Gray (Vic)
R. A. Bradford (WA) T. M. Harders (WA)
D. J. Campbell (NSW) C. J. McCappin (WA)
K. Chakraborty (NSW) O. Moze (Vic)
W. J. Chang (Vic) P. J. Picone (Vic)
P. Gibbs (Vic) K. R. Taylor (WA)

Transfers
R. G. Ellis (Vic) P. Summerside (ACT)
S. D. James (Vic) E. V. E. Thulborn (Vic)
R. D. Loss (WA) D. A. Varel (NSW)
N. Mermelengas (WA) D. A. Williams (Vic)
A. W. Masparrat (NSW)

ASSOCIATE

A. E. S. Byrne (NSW) R. B. Huntley (Vic)
J. B. Cunningham (Qld) P. G. Lampard (WA)
C. Gunst (Vic) R. F. Rose (Vic)

STUDENT

J. F. Barker (Vic) L. Holterbach (WA)
S. L. Beway (NSW) D. A. Johnston (SA)
R. A. Braysher (Qld) R. A. Joseph (Qld)
S. P. Edwards (Qld) C. W. McLucas (Qld)
S. Elkan (WA) I. A. Papadopoulos (Vic)
R. G. Hammarstrand (WA) N. A. Raftery (Qld)

SUBSCRIBER

S. D. Tyrell (NSW)

—J. G. Collins
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