THE UNIVERSITY OF
MELBOURNE

LECTURESHIP
in the
SCHOOL OF
PHYSICS

Applications are invited for this position.

QUALIFICATIONS: Ph.D. with postdoctoral experience.

DUTIES: Supervision of research students together with undergraduate lecturing or laboratory classes. Experimental physics research is being carried out in high energy physics, diffraction physics and low energy nuclear physics. Further details of research opportunities are available on request. Preference will be given to applicants with interests in experimental high energy physics.

Applicants should have experience in one or more of the following areas: electronic instrumentation, small computers, computing.

SALARY: $8,698 - $11,982 per annum.

Considerations will be given to applications for appointment with or without tenure.

Further information is available from the Registrar. All correspondence should be addressed to the Registrar (position 640011), The University of Melbourne, Parkville, Victoria, 3052, Australia.

Applications close on 21st March 1974.
A PLACE IN THE SUN

Australia and Australian science are moving hesitantly towards new interests in energy studies. Overseas events and local voices point to the importance of such studies but the strength of the message is sapped by the concept of the lucky country.

The energy crisis, solar energy and similar topics are favourites for meetings of all kinds and reports and recommendations also abound. The Australian Academy of Science Report Number 17 suggests that a target of $2 \times 10^{18}$ joules per annum be set for the solar contribution to low grade heat and transportation needs by the year 2000. This target is comparable to the present total energy usage in Australia.

There is even some action. In November, the Minister for Science (Mr W.L. Morrison) announced the establishment of a Solar Energy Studies Unit within the CSIRO. With R.N. Morse as Director, this Unit will conduct feasibility studies and advise the CSIRO Executive. This move gives further recognition to the success of nearly twenty years of research and development by the CSIRO Division of Mechanical Engineering — particularly in water and air heating for home and factory.

The solar water heaters currently produced in Australia use selective absorbers and are not surpassed in quality anywhere else in the world. They can provide 60 — 90 per cent of the energy required in a year for hot water systems — the rest being made up with electric or fuelled boosters.

Other establishments are also working on solar energy problems or are planning such activities. Flinders University has recently created an Institute for Electrochemical and Solar Energy conversion to serve as a focus for their interests in these fields. It is interesting to note however, that few of the projects receiving ARGC grants for 1974 are for topics such as those recommended by the AAS report.

With the Ministers for Science, Conservation and the Environment, and Minerals and Energy all expressing interests in solar energy, perhaps something like a national policy can emerge to override the otherwise inevitable clashes of interests and personalities.

A Few Facts

The average annual insolation at Alice Springs is only about 40 per cent greater than at Melbourne.

The daily total energy gain varies from 100 Wm$^{-2}$ in Melbourne in winter to 260 Wm$^{-2}$ over most of Australia in summe.

Australia is not greatly better off than any other country between 50°N and 50°S. For example, the mean solar input to the USA is only about 10 per cent less than to Australia.

Parabolic reflectors are only advantageous for achieving high temperatures. Their loss due to scattering is 20 — 40 per cent and this represents a serious reduction in efficiency for low temperature applications.

Typical averaged growth rates for vegetation in temperate climates are 4 — 8 g.m$^{-2}$ per day and at this rate one-third of the total Australian crop area could provide the present total energy needs. The current wheat straw production is equivalent to 10 per cent of the present energy needs of Australia.
SOLAR ENERGY RESEARCH IN AUSTRALIA

A committee consisting of C.N. Watson-Munro (Sydney University, Plasma Physics), N.K. Boardman (CSIRO Plant Industry), S.T. Butler (Sydney University, Theoretical Physics), L.W. Davies (AWA), O.T. Dennean (CSIRO, Environmental Mechanics), D.W. George (Sydney University, Mechanical Engineering), R.G. Giovannelli (CSIRO, Physics), R.E. Luxton (Sydney University, Mechanical Engineering), L.E. Lyons (Queensland University, Physical Chemistry), R.N. Morse, (CSIRO, Mechanical Engineering), G.W. Paltridge (CSIRO, Atmospheric Physics) and J.A. Roberts (CSIRO, Radiophysics) reported recently to the Australian Academy of Science on the advisability of extending solar energy research in Australia and in the way in which this might develop. The Committee's report is available from the AAS at $1.80.

Some of the recommendations of the Committee include:

- upgrading the present network of radiation measurements;
- studies of absorber and collector systems for water heaters, steam generation, heating and cooling of buildings, drying and dehydration, and desalination;
- research into the optimisation of the performance of absorbers, particularly in relation to the interaction of operating temperature, plate absorptivity and emittance, convection and radiation losses;
- studies of methods of storage and extraction of heat;
- research into the economic production of liquid and gaseous fuels such as methane, alcohol and hydrogen from cellulose and other suitable plant material;
- research into the breeding, selection and growing of plants and trees for fuels, with particular attention to the recycling of phosphate and other non-renewable fertilizers;
- an integrated systems approach to the production of food, timber and fuel from agricultural and forest products;
- development of selective absorbers with high absorbance over the range of 0.2 - 2 μm and high reflectivity over the range 2 - 20 μm;
- development of optical collectors to focus solar energy on the solar absorber - including the study of optical design, solar tracking systems and the development of mirror or lens systems that resist degradation by dust and other environmental factors;
- heat transfer studies;
- basic studies of the physics and technology of silicon, inorganic compound and Schottky-barrier junctions, aimed at increasing our understanding of the devices and improving their potential cost effectiveness. Particular areas for study would include - a detailed understanding of current-voltage-illumination characteristics, formation techniques and properties of polycrystalline junctions, and new techniques for the growth of monocrystals;
- research into increasing the efficiency of organic photovoltaic cells;
- research into the direct conversion of solar energy to chemical energy;
- research into the molecular structure of the photosystems of plants;
- search for new and improved configurations of materials in thermoelectric elements;
- studies of the hydrogen cycle and fuel cells;
- research into various forms of storage batteries.

LETTERS

Physics Action?

Sir:—With all the recent publicity on the world energy crisis I feel that it is high time we, the physicists of Australia urged the government to initiate some substantial research into widespread use of solar energy. We are very fortunate that we have millions of square miles of desert where the sun shines most of the time.

Solar power used to generate electricity, coupled with our hydroelectric power stations, would virtually eliminate the need for oil and coal power. Research would need to be done on many aspects such as the most efficient way of converting solar power to electricity; ways of getting the power from the desert to the big cities; and electric-powered cars and trucks.

Solar power is surely the answer to the energy crisis since the power source is virtually inexhaustible and is pollution free — unlike atomic power which creates insoluble problems with pollution. Surely we can get this research under way before the oil crisis becomes worse or before the supply dries up altogether.

I hope some of my fellow physicists feel the same way as I do about this matter and that we can use our Institute to promote this cause to the government and the general public.

— Judith Yeo
19 Tiverton Dr.
Mulgrave 3170.
ATOMIC ENERGY IN AUSTRALIA

THE 21st ANNUAL REPORT OF THE AUSTRALIAN ATOMIC ENERGY COMMISSION

The 21st Annual Report of the AAEC comes to light in a climate of uncertainty concerning the future of world oil supplies, and at a time when the environmental hazards of fission reactors are being more widely criticized than ever before. As in many other developments, Australia has had the advantage of coming late into the nuclear energy business; indeed there is still room for debate whether she need develop fission powered stations at all. This Report (1972–73) studiously avoids discussing the arguments for or against nuclear power in Australia, but sets forth the factual details of the Commission’s many and varied activities in fields related to nuclear fission, radioisotope production, uranium processing, public health and environmental studies. There is also a thorough review of world developments in nuclear power, wherein it may be noted that 132 nuclear power stations (total output 40 802 MW) are now in operation, with a further 144 stations under construction, throughout the world.

The long-term demand for uranium (as U₃O₈) is estimated to grow from 81 000 tons in 1973 to 4 million tons by the end of the century. Uranium exploration in Australia is increasing, and there are indications that Australia could become a major supplier of this mineral. The Report discusses the prospect of setting up uranium enrichment plants in Australia, and mentions research which is going on at Lucas Heights into various enrichment mechanisms.

A section of the Report outlines the specialized equipment and research projects operated by the Commission, and several instances are given of assistance to outside bodies, where facilities such as neutron activation analysis or fabrication of reactive materials, were brought to bear on special problems. A new phototching technique uses a photographic master treated with Californium 252. This radioisotope emits fission fragments which bombard any contacting surface, and produce a pattern which in suitable materials may be etched away, yielding a high-resolution replica of the original.

The sales of radioisotopes for diagnostic, industrial and research uses have increased substantially over the year. (Income for 1973 from this source was $621 000.)

The Commission continues to support research by Universities and other organisations in fields related to atomic energy; grants totalled $315 331 in 1973. In the international scene, Australia ratified the Treaty for the non-Proliferation of Nuclear Weapons in January 1973. AAEC personnel took part in discussions on this and other international matters.

There was a slight reduction in AAEC staff over the year. This no doubt reflects continuing uncertainty in the role of nuclear energy in Australia. The 21st Annual Report is a record of considerable achievements, and the Australian taxpayer may well conclude that $13.8 million has been well spent. It is, however, becoming clear that at least a fraction of this expenditure might be fruitfully applied to the development of alternative sources of energy, and that nuclear fission is not an acceptable long-term solution to the nation’s power supply problems. — J.C. Macfarlane.

TERM DATES 1974

ACT
ANU
Schools (incl. Darwin)
Canberra CAE

NSW
Univ. New England
Univ. Newcastle
Sydney Univ.
Schools
Macquarie Univ.
UNSW
NSWIT
Mitchell CAE
Hawkesbury Agr. Coll.
Riverina CAE
Wagga Agr. Coll.

4 Mar – 13 May
29 Jan – 2 May
4 Mar – 26 Apr
29 Feb – 7 Apr
25 Feb – 11 May
29 Jan – 2 May
4 Mar – 27 Apr
4 Mar – 20 May
18 Feb – 29 Jun
28 Feb – 3 May
25 Feb – 10 May
25 Feb – 3 May
4 Mar – 3 May

3 Jun – 24 Jun
2 May
6 May – 21 June
3 Jun – 20 Aug
10 Jun – 17 Aug
25 Feb – 11 May
20 May – 22 Jun
26 May – 16 Jun
28 Feb – 29 Jun
20 May – 12 Jul
20 May – 28 Jun
20 May – 3 May
20 May – 12 Jul

8 Jul – 12 Aug
21 May – 22 Aug
29 Jul – 20 Sep
22 Jul – 22 Aug
22 Jul – 26 Aug
26 May – 22 Jul
26 May – 26 Aug
29 Jul – 30 Aug
20 May – 12 Jul
20 May – 11 Jul
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20 May – 12 Jul

2 Sep – 27 Oct
31 Oct – 7 Dec
10 Sep – 11 Dec
30 Sep – 15 Nov
9 Sep – 8 Nov
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2 Sep – 2 Nov
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11 Nov – 7 Dec
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16 Sep – 13 Dec
9 Sep – 22 Nov
9 Sep – 6 Dec
9 Sep – 6 Dec

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* indicates tentative or assumed dates.

**THE CALENDAR**

**FEBRUARY, 1974**

11-13 4th Australian Vacuum Conference, Canberra (AIP Vacuum Group)

11-13 5th AINSE Nuclear Physics Conference, Canberra.

18-20 *Measuring with the Microscope*, (Aust. Microsopic Society)

**MAY**

19-20 11th Annual General Meeting and 24th Council Meeting, Adelaide (AIP).


20-24 Fourth National Symposium of Solid State Division, RACI, Canberra.

SOLAR POWER

T.M. Sabine
NSW Institute of Technology

Introduction

Solar power has been talked about for generations as an ideal method for supplying the world's energy so it is worthwhile examining why it has suddenly become of great interest in the 70s. Even 5 years ago anyone who talked of growing trees to fuel power stations would have been regarded as crazy.

The basic reasons seem to be that society has realised that the supply of non-renewable fuels is limited and that the rate of usage is increasing. There are many arguments about just how fast this is occurring. Exponential growth leads to a factor of 8 times by the year 2000. A recent study at ORNL indicates that saturation in the use of domestic energy-consuming gadgets is occurring and the increase will be a factor of 2 by 2000. Domestic appliances are a major user of electric power. One of the disturbing problems of saturation is the structure of our utilities, for example, the standards for the intensity of electric light in dwellings are continually going up. Our eyes are not evolving or devolving at anything like the same rate. There will always be this type of pressure while greater consumption reduces unit costs.

The fact remains that there is no way in which all the world's population can enjoy the consuming rate of the affluent American citizen given the known fuel reserves. I am omitting nuclear power. I think the waste disposal problem will relegate nuclear power to a minor place in the scheme of things. There is no certain way of disposing of all nuclear waste and as this is composed of isotopes like strontium 90 with a half life of 30 years one is committing many future generations to dealing with the mess we make. Fusion may be the answer but its feasibility is not proven.

On the surface, solar power is very attractive because, as far as we know, it does not create environmental or pollution problems. However, nuclear research started in much the same way with the potential problems pushed under the carpet. A recent conference I attended in Paris was devoted to solar power. It was sponsored by UNESCO and I imagined was rather like the first Geneva conference in the 1950s on the peaceful uses of atomic energy. About 700 people attended including 13 from Australia.

Paris Conference

The conference was of scientifically low level with a marked absence of theoretical papers. The lack of these, which could establish a sound framework for discussions of technology was very noticeable. The general feeling was one of optimism in that the climate of public opinion and the development of modern technology were together at a stage where the investment of sufficient money to develop solar energy sources would be socially acceptable and could produce worthwhile results.

It is also becoming obvious that something should be done as soon as, with the present level of pollution, 14–16 per cent less direct sunlight falls on Washington DC than fell 54 years ago. UNESCO set up a working party to advise it of ways of proceeding in this field. This working party suggested activity at four levels:

Level 1 — A modest programme of education and dissemination of knowledge.

Level 2 — A programme of assistance in the promotion and execution of national, regional and global projects, under UNDP and other external auspices.


Level 4 — An International Solar Energy Decade.

These activities provided for a political means of international cooperation and the conference proceeded with a discussion of various aspects of solar power. There were three major concurrent sessions: Sun and Energy; Sun and Housing; Sun and Life.

The Sun and Energy Sessions were subdivided into two major topics.

1. Direct accumulation and utilisation of heat from the sun.
2. Direct conversion of solar radiation to electricity through photovoltaic devices.

US Evaluation

The National Science Foundation set up a solar energy panel to evaluate solar energy as a possible power source for the USA. They estimated that the total energy consumed for all purposes in 1970 was $71 \times 10^{15}$ joules. Solar energy arrives on the earth at a rate of $18 \times 10^6$ joules $\text{km}^2\text{day}^{-1}$. At an efficiency of 10 per cent this means that 1½ per cent of the land area of continental USA could potentially supply America's energy needs.

Note that this is the power required in 1970. Growth by a factor of 10 would make this figure unacceptably high. The areas considered to be important by the panel are: Heating and cooling of buildings; Production of clean renewable fuels; Generation of electric power.

Heating and Cooling

At present a reduction in cost by a factor of about 2 to 4 is necessary to make solar power competitive with other means of heating and cooling buildings. With
an investment of approximately $100,000,000 over the next 10 years in the development of collectors, thermal storage devices and air conditioners, solar heating and cooling of buildings could be incorporated into about 10 per cent. of buildings in the USA by 2000 and over 35 per cent. by 2020.

Production of Clean Fuels

Solar energy can be used to produce renewable clean fuels using photosynthetic processes, for example, an installation consisting of trees grown and then burnt to provide electric power requires about 1000 km²/1000 MW electrical. It is anticipated that with an expenditure of about $300,000,000 in research and development over a 15 year period that by the year 2000 1 per cent. of the solid fuel, 10 per cent. of the gaseous fuel and 1 per cent. of oil could be made. By 2020 these figures could be 10, 30 and 10 per cent. respectively.

Generation of Electric Energy

A distinction can be made between internal collection of solar energy and technological collection. Internal collection occurs in the atmosphere and in the sea. The energy is stored as wind, and as thermal gradients in the sea. It is calculated that the power potential in winds over the USA is about $10^{11}$ kW electrical. In the ocean the surface is about 10 to 15°C hotter than the depths.

A heat engine using this small difference would operate at about 2 per cent efficiency. Environmentally it is estimated that use of this method of power generation will lower the temperature of the tropics by 1°C and raise the temperature of the temperate zones by the same amount.

Technological Collection of Solar Energy

One method of collecting heat directly is based on the use of absorbers which will absorb visible light but will not re-emit it in the infrared region of the spectrum.

There are two types of these absorbers. The first are interference filters. These take advantage of the fact that optical properties in a material are an oscillating function of the depth of penetration of the electromagnetic wave. If one lays down fine layers of suitable material one can tailor the surfaces to the desired properties. They should have the following characteristics:

1. High absorption in the visible (a)
2. Low emissivity in the infrared (e).
3. Resistance to corrosion.
4. Resistance to thermal cycling between 10°C and 500°C for times of the order of 40 years.
5. Low diffusion rates in the temperature range chosen in this application. Their performance depends on maintaining the layer thicknesses at a precise fraction of the wave length of light. Diffusion will destroy the boundaries and hence the selective nature of the absorption.

6. A production cost of less than about $20/m².

Absorbers stacks used at present consist of layers like: Mo + CeO₂, Mo + MgF₂, Ni + ZnS + MgF₂ or Ni + CeO₂ + SiO₂. These are fairly rare materials with not very suitable high temperature properties.

We are working on the use of ceramic materials which have high melting points, thus low diffusion at moderate temperatures. They do not corrode and they have an enormous range of electrical properties which can be changed by alloying.

At present the good absorbers give an a/e ratio of 15–20. This is not quite high enough for use without optical concentration. At a/e = 20, 50 per cent of the incident energy can be extracted at 550°C while at a/e = 30, 50 per cent will be extracted at 400°C.

Materials whose selectivity does not depend on interference effects offer a simpler way of obtaining selective absorption. Many semiconductors have a band gap of energy comparable with the solar photon energy. They will be transparent to the infrared photon of much lower energy. One would use a base layer of a high reflectivity metal with a semiconducting layer on top.

The semiconducting layer would absorb the visible radiation and since highly reflective surfaces have low emissivity the infrared loss would be small. The material in common use for this purpose is copper oxide which is used in CSIRO water heaters. It has a = 0.9 and e = 0.15.

We are at present experimenting with a chromium oxide coating on a copper substrate. Our measurements show that for this a = 0.5 and e = 0.04. We are continuing experiments to obtain a higher value of a since the collector area is governed by that parameter.

The Photovoltaic Effect

Photovoltaic devices produce current directly through interaction of the photon with the crystal lattice. When the proper combination of semiconducting materials is used each photon will produce electron-hole pairs. If this pair has a sufficient lifetime a current will be produced in an applied field. Silicon photovoltaic devices are well known in spacecraft applications, however, the requirement on carrier lifetime means that ultra pure single crystal silicon must be used. The cost is of the order of $2000 per watt, in contrast with domestic power which costs roughly 20 c per watt. Some progress is being made in producing cadmium sulphide photovoltaic devices.

For reasons which are not clear polycrystalline cadmium sulphide will produce a photo-current, for reasons which are also unknown they deteriorate after about six months use. The cost of production of these is $9 per watt and economics of scale could reduce this to a price comparable with present generators.

Conclusion

While the technology of solar power is in its infancy it appears that with sufficient, but not impossible, financial backing it can make a very significant contribution to man's energy requirements by the beginning of the next century.
CAREER IN NUCLEAR RESEARCH

Reprinted from ANU Reporter, 28 September 1973

The career of Professor Sir Ernest Titterton, 57, as a physicist has coincided with, and aided, the birth and development of nuclear physics including the development of nuclear power and the detonation of the first nuclear bomb. And he would be the last person to regret it.

For Sir Ernest, the retiring Director of the Research School of Physical Sciences, believes that, setting politics aside, the spin-off from nuclear research has been enormous and beneficial to the general public in many directions.

"The first major achievement of nuclear physics", he told the Reporter, "was in solving the source of power generation in the stars. This turns out to be nuclear in origin and the discovery aided developments in astronomy.

"The second achievement was to harness nuclear fission for atomic energy. This is the basis of operation of a large number of power stations already in operation and being built around the world in rapidly increasing number in many countries, including Britain, the USA, France, the USSR, Spain, India and Pakistan and so on.

"The third achievement has provided the possibility of a virtually inexhaustible power source. This will be gained by using nuclear fusion reactions on earth similar to the nuclear reactions which go on in the stars. This thermonuclear power source uses two heavy isotopes of hydrogen, one of which is plentiful in nature, being in all water on land and sea.

"Another benefit has been in medicine in the form of radioactive tracers and treatments for many types of cancer, as well as specialised uses in industry.

"Another benefit, often overlooked, is that the need in nuclear physics for complicated calculations and very sophisticated electronics provided the techniques and the demand for the beginnings of today's computer industry".

Having listed the benefits so far in the forty-three year history of the discipline, Sir Ernest turned to the more tendentious aspect: atomic bombs. At age 28, he was a member of a British mission which was sent to the US in 1943 to design and produce nuclear weapons. He was in charge of the group which detonated the first device at Alamagordo, New Mexico, in July 1945 and the later Bikini experiments in the Marshall Islands.

"I have no regrets about that for I see it this way", he explained. "Nature made nuclear energy and nuclear bombs possible - not man. But men are greedy in their use of energy, wanting one man per car and even, sometimes in Canberra, one sees one to a bus. They wanted the development which led to nuclear energy, but the same fission processes also produce nuclear bombs. There is an emotional tendency to talk of these as if they were wholly evil. But at the time that our work led us to invent and detonate the first nuclear bomb at Alamagordo, Western Society was involved in World War II and was anxiously demanding the weapons essential to ensure survival.

"Many people have argued that it was nuclear bombs which brought about the end of that War. I think it was quite likely that the Hiroshima and Nagasaki explosions caused less loss of life in Japan than if the country had been invaded. And a great number of Australian lives were certainly saved. Many men would have been killed in such an invasion".

This leads to whether Professor Titterton minds being thought of as a "bomb-monger" by those who don't share his views. "I don't care what I'm labelled", he replied amiably. "The truth is that the development of the bomb had the support of the democratically elected governments of the UK, Canada and the US. I don't regret my part in it at all. I was just doing the war-time task assigned to me. I'm quite sure all of us would have regretted it if Hitler's scientists had discovered it first. That would surely have changed the course of history.

"Since then", he added, "we have seen many countries seeking nuclear energy, and that opens the possibility of many nations having nuclear weapons. This is a fact we have to learn to live with. The materials and the know-how are there; the clock cannot be put back.

"In spite of assertions in some quarters to the contrary, I have never recommended that we make nuclear weapons. What I have said is that as a nation we should not stick our neck in the sand and neglect the possibility of ever having them, when it is plain that many other countries are beginning to acquire them. We should keep our options open. After all, we don't neglect to obtain the latest warships, cannon and aircraft".

Professor Titterton speaks about physics - in all its branches - with such strong conviction that it suggests a life-long love affair with the discipline.

"It is true that physics has been my life. My interest was kindled in a small English secondary school by a great teacher, Mr William Summerhayes. He was a man who understood nature, loved life and had an inquiring mind. He so excited our interest that seven of his pupils, including me, have become professors of physics in universities around the world".

After gaining a BSc, MSc and PhD, all with distinction from Birmingham University, Professor Titterton worked with the British Admiralty from 1939-43. It was during this period that he made significant discoveries in radar which established his reputation, at a young age, as an eminent scientist. This led to a transfer into the new project for nuclear weapon construction.
'In radar we had had to generate very short pulses of energy. The first critical question on the bomb project was whether, in the fission process, the fast neutrons would be generated quickly enough to produce a fast chain reaction and release energy at unprecedented rates — a bomb. I used my radar knowledge and showed, in 1942 and early 1943, that nuclear weapons were possible'.

During the next three years he was transferred to the Los Alamos Laboratory in New Mexico and his work, which was carried out under secrecy regulations, included the detonation at Alamogordo of the first bomb ever tested and designing electronic equipment for the weapons tests at Bikini Atoll in 1946.

In 1947 he returned to Britain and led the emulsion and cloud chamber group at the newly formed Atomic Energy Research Establishment, Harwell.

ANU Council offered him the position of foundation Professor of Nuclear Physics within the Research School of Physical Sciences, in 1950, and for the last seven years he has been Head of the School.

'Sir Ernest in the Department of Nuclear Physics

'Apart from my own research, and making arrangements for the new nuclear facility, I have been directing a School of 420 staff spending over $5 million per annum and I can tell you the job is no sinecure.

'I have always believed that good scientific work requires a marriage of many skills. In the School we have experimentalists backed by theoreticians, supported by good instrument makers and technicians. Another important component is the secretarial staff who prepare and type research papers for presentation. These diverse skills need to be welded together into a well motivated group, if best results are to be achieved'.

Are scientists remiss for not taking more pains to explain their work to the public?

'Not at all', he replied, 'I believe public scientific understanding is increasing. However, the public still pays far more attention to politicians, because what they say affects the taxpayers' pockets.

'Personally, I have always taken up every sensible opportunity to speak on radio and television and have written numerous articles for newspapers and magazines. A scientist has a responsibility to make facts available and understood wherever he can'.

During his term as head of the School, Sir Ernest has been known as a 'workaholic', an indefatigable worker with very high standards, putting in long days in his office and laboratories as well as being there most weekends. In that time, he has taken no holidays or study leave. Although he has had, on average, two brief rounds the world trips each year of his term, they have involved consultations with equipment contractors, extensive lecture programs and attending international conferences. He is the author of nearly 200 research papers, has served on numerous government and university committees and is the author of three books including Facing the Atomic Future.

Having completed his term as School Director on 14 September Sir Ernest has returned to his professorship within the Department of Nuclear Physics and, in due course, will set up a small research unit.

'I'll probably be as busy as ever. Apart from my work in ANU, I am President of the Australian Institute for Nuclear Science and Engineering (AINSE) and a member of the editorial board of Nuclear Instruments and Methods produced in Amsterdam.

'Within my own field, I'll be looking into the long term possibility of using the new 14UD accelerator as an injector into yet another accelerator to enhance the research opportunities of the Department for heavy ion physics studies.

'I'll also take a holiday and some study leave but I enjoy physics and will always work at it. It comes naturally to me'.

Even his critics are unlikely to dispute that!'
METEOROLOGICAL PRIZES

C.H.B. Priestley – has been awarded the International Meteorological Organization Prize jointly with J.P. Sawyer (Director of Research, UK Meteorological Office). This is the first time that the highest award in meteorology has been awarded for the recipients’ contribution to science and to international meteorological organizations. Dr. Priestley, who is Chairman of CSIRO’s Environmental Physics Laboratories has pioneered studies of the large scale transport of atmospheric heat, moisture and momentum across the latitudes and the interaction between the atmosphere and the underlying land and sea surfaces.

G.W. Paltridge – will receive the WMO Research Prize for ‘The Encouragement of Young Scientists’. This prize is awarded for Paltridge’s paper ‘A Model of a Growing Pasture’ which was considered of outstanding merit and originality. It provides a method for predicting rates of plant growth from atmospheric data on solar radiation, temperature, humidity and wind, measured above a crop.

Dr. Paltridge, of the CSIRO Division of Atmospheric Physics has been engaged in studies of atmospheric electricity, the absorption and transmission properties of clouds and haze layers and other aspects of atmospheric radiation.

MATHEMATICAL MODEL OF A GROWING PASTURE

Paltridge’s model of a growing pasture sets out to calculate in a series of one hour: time steps the amount and form of pasture growth when the plant environment and various transfer processes are described in physical terms. The growth rate is based on a concept of limiting values. At any level in the plant canopy, the primary limit to photosynthesis, and hence growth rate, is set by one of three parameters.

(a) the radiation available to the leaf at that level,
(b) the CO₂ available to the leaf at that level,
(c) the capacity of the leaf to carry out the photosynthetic conversion of radiation and CO₂ to carbohydrate.

The best shape for plant growth when limited by available radiation.

At each time step in the growing model each of the three limits is assessed on the basis of the physical environment generated in the model, and the lowest limit is selected for a subsequent growth.

The model pasture is allowed to develop its own architecture by adopting the hypothesis that the pasture would position its new growth in such a manner as to maximise the total growth rate at any time. The pasture could grow upwards, downwards or increase the dry weight concentration of layers already occupied.

The best shape for plant growth when limited by the available CO₂ concentration.

Examples of physical parameters which are actually calculated within the model are (a) direct and diffuse radiation within the plant canopy, (b) total visible fraction of sky, (c) saturated vapour pressure in sub-stomatal cavity (d) boundary layer resistance, (e) bulk air temperature, (f) CO₂ concentration at different levels (g) vertical mass transfer coefficient.

The model has produced remarkably realistic simulation of plant growth. It provides a means of testing the influence on growth of various parameters, such as soil water, leaf shape, soil and leaf respiration, climate, and different “evolutionary” constraints.

Calculations with the model suggest that the ultimate limit to plant growth rate may be set more by CO₂ exchange with the atmosphere than by the available radiation. If this is the case then growth rates would depend on wind speed and could be increased by forced increases in CO₂ concentration. The model can thus be used to investigate many such aspects of the relation between plant growth and the environment.

References

The Australian Physicist, January 1974
ARGC GRANTS

The Australian Research Grants Committee has approved grants for 1974 totalling $6.5 million. The following list includes all projects in the physical sciences.

Physical Sciences

University of Sydney ($250,524)

T.M. Gagen
- Doubly Transitive Groups with a Solvable Stabilizer of a Point 8000

W.N. Christiansen,
B.Y. Mills,
R.H. Frater,
A. Watkinson and
A.G. Little
- Fleurs Compound Grating Telescope 80,427

R. Hanbury Brown
- An attempt to detect gamma-rays from extra-terrestrial sources by observing Cerenkov light pulses 16,603

C.B.A. McCusker,
M.M. Winn and
L.S. Peak
- A Study of Very Energetic Cosmic Radiation 43,871

B.Y. Mills
- Observations of Cosmic Radio Emission 48,545

B.Y. Mills and
A.G. Little
- High resolution observations of the southern sky near 1420 MHz Nil

R.R. Shobbrook
- Discovery, observation and period analysis of light and velocity variations in pulsating stars 1920

G.E. Wall and
J.J. Cannon
- Computational Problems in Algebra 11,262

C.N. Watson-Munro,
D.D. Millar and
L.C. Robinson
- E.M. Wave Propagation in Plasmas 32,341

P.R. Wilson and
C.J. Cannon
- Analysis and Interpretation of Inhomogeneities in Solar Atmosphere 7555

University of N.S.W. ($79,296)

H.J. Goldsmid
- Thin-film high-mobility semiconductors 3275

P. Mitchell
- The Excitation of Autoionized levels in Atoms by Electron Impact. 7835

K.N.R. Taylor
- Magnetic and E.S.R. Studies of Rare Earth Intermetallic Compounds. 3500

H.J. Goldsmid
- High-Field Thermomagnetic Effects in Semiconductors 4500

D. Haneman
- Study of Surface Bonds by Electron Paramagnetic Resonance. 2800

D. Haneman,
P.J. Jennings and
G.J. Russell
- Study of surfaces of semiconductors by low energy electron diffraction and Auger electron spectroscopy. 18,150

L.B. Harris
- Growth, Structure and Diffusion Properties of Grain Boundaries in Solids. 3680

D.C. Hunt
- Group Theoretical Calculations. 1000

J.C. Kelly
- Study of ion implantation and interatomic forces by means of channeling 21,324

J.F. McConnell and
N.C. Stephenson
- Accurate Determination of Solid State Structures using an Automatic Four Circle X-ray Diffractometer. 2700

J. Oitmaa
- The Critical Behaviour of Some Parameter Dependent Ising Models. 500

H.F. Pollard
- Investigation by Acoustic Techniques of Irradiated Alkali Halide Crystals 2080

H.F. Pollard and
A.I. Segal
- Study of Evolutionary Sound Spectra. 500

I.H. Sloan
- Multiparticle scattering. 7452
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<th>Institution</th>
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<td></td>
<td>G.V.H. Wilson and D.H. Chaplin</td>
<td>Hyperfine Interactions in Magnetic Materials.</td>
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<td>University of New England ($25 757)</td>
<td>N.H. Fletcher</td>
<td>Studies in Musical Acoustics.</td>
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<td>N.H. Fletcher and J.M. Brettell</td>
<td>Physics of solids with disordered or statistical structures.</td>
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<td></td>
<td>Ronald Green</td>
<td>The development and use of optically pumped magnetometers for the direct measurement of the gradient and the total magnetic field over geological boundaries.</td>
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<td>S.C. Haydon and A.I. McIntosh</td>
<td>Ionization and Excitation in Electric and Crossed Electric and Magnetic Fields.</td>
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<td>University of Newcastle ($4900)</td>
<td>A.J. Gutmann</td>
<td>The Interpretation and Analysis of Theoretical and Experimental Data.</td>
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<td>N.S.W. Institute of Technology ($3964)</td>
<td>T.M. Sabine and G.H. Derrick</td>
<td>Joint Study of Selective Surfaces as Solar Energy Absorbers</td>
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<td>Melbourne University ($97 645)</td>
<td>I.A. Bourne</td>
<td>A High Power Acoustic Sounder.</td>
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<td>U. Radok</td>
<td>Meso-term Climatic Change in the Southern Hemisphere.</td>
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<td>Statistical Mechanics of Lattice Systems.</td>
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<td>K.A. Amos</td>
<td>Direct Reaction Inelastic Scattering from Nuclei.</td>
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<td>H.H. Bolotin</td>
<td>Nuclear Structure Studies Using Heavy-Ion Induced Coulomb Excitation.</td>
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<td>B.H.J. McKellar</td>
<td>Hadronic Weak Interactions.</td>
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<td>G.I. Opat and J.W.G. Wignall</td>
<td>Bubble Chamber Studies of Elementary Particle Reactions.</td>
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<td>B.M. Spicer and H.H. Bolotin</td>
<td>Studies in Nuclear Structure and Reaction Mechanisms.</td>
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<td>B.M. Spicer, E.G. Muirhead and M.N. Thompson</td>
<td>Investigations of Nuclear Structure in the Photomultipar Giant Resonance.</td>
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<td>J.A. Thomas</td>
<td>Infrared Astronomy.</td>
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<td>Monash University ($154 943)</td>
<td>J.N. Crossley</td>
<td>Recursive Equivalence and Combinatorial Functors.</td>
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<td>T.R. Finlayson</td>
<td>Superconductivity in Niobium-Zirconium Alloys.</td>
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<td>J.B. Miller</td>
<td>Partially Ordered Topological Structures.</td>
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<td>Magnetic Properties of Some Mictomagnetic Alloys and the Metamagnetic Compound Au₂Mn.</td>
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<td>B.R. Morton</td>
<td>Dynamics of Convective Clouds.</td>
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<td>R. Street, J.D. Cashion and J.A. Barclay</td>
<td>Studies of Solids at Low Temperatures in High Magnetic Fields.</td>
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<td>K. Thompson</td>
<td>Measurement of the Viscosity of liquid ³He and of liquid ³He-⁴He mixtures at temperatures below 0.05 Kelvin.</td>
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G.J. Troup and J.R. Filbrow — Electron Spin Resonance in ionic crystals, inorganic complexes, metals, low symmetry effects; nuclear magnetic resonance in simple compounds and crystals; antiferromagnetic resonance; temperature variations.  46 572

R. Van der Borght — Finite Amplitude Convection in Compressible Fluids and its Application to Astronomical Problems.  16 223

**La Trobe University ($5675)**

I.L. McLaughlin — Transport Properties of a Liquid of Polyatomic molecules.  500


R.C.G. Leckey, A.R. Lee and D.E. Davies — Electron co-incidence spectroscopy: solid state investigation.  1475

J.D. Riley — A study of the “Kondo Effect” in Yb: Au: Ag ternary alloys using Electron Spin Resonance.  2700

**University of Queensland ($9695)**


R.W. Parsons — Collision Broadening of Molecular Spectra — the study of line-shifuts at high microwave frequencies  4400

S.H. Hall — A conductivity bridge for the study of electrolysis in rocks.  600

C.F. Lee — Mathematical Solutions of Some Nonlinear Diffusion Systems.  200

D. Mugglestone — Astrophysics: Theoretical Investigation of Physical Processes Affecting the Formation of Strong Absorption Lines.  2500

**University of Adelaide ($86 653)**

E.H. Medlin and D.W. Field — The effect of Solid-State Interactions on Electronic Wave Functions; an X-ray Approach.  14 141

E.S. Barnes — Convex Sets of positive quadratic forms.  5964

B.H. Briggs — Medium frequency ionospheric and meteor observations using a large antenna array.  10 306

B.H. Briggs and R.A. Vincent — Upper Atmospheric Winds.  6173

J.H. Carver, A.J. Blake and D.G. McCoy — Photodisintegration of Atmospheric Gases.  8 376

P.A. Dennison — Interplanetary Scintillation of Radio Sources.  11 744

W.G. Elford — Upper atmosphere winds from radio observations of meteors.  6550

C.A. Hurst and H.S. Green — Infinite-dimensional Lie algebras and physical applications.  13 347

S.W. Kennedy — Phase Interfaces in Solid State Reactions.  100

J.R. Prescott and A.G. Gregory — Studies of Cosmic Ray Air Showers.  9952

**Flinders University ($38 508)**

T.R. Afnan and R.T. Cahill — Nuclear and atomic reaction theory.  14 833

M.H. Brennan and I.R. Jones — The Properties of High Density Plasmas.  22 013

P. Schwerdtfeger — The Climatology of Adelaide.  7310

R.G. Storer — Quantum Statistical Mechanics.  1800
P.J.O. Teubner — Angular Distribution of Electrons Scattered from Atomic Hydrogen. 1200
E. Weigold and P.J.O. Teubner — The (e,2e) reaction in atomic systems. 11 352

University of Western Australia ($50 644)
D.G. Hudley and J. Imberger — Some boundary value problems in Geophysics. 8500
A.J.F. Boyle and B.M. Johnstone. — Some applications of the Mossbauer Effect 16 900
M.J. Buckingham and C. Edwards — The nature of the critical point. 1700
B.M. Hartley — Electron spin Polarization by magnetic scattering. 3040
W.C. Macklin — The physics of Hailstone Growth. 4720
E.N. Maslen — Accurate Crystal Structure Analysis. 4300
J.L. Robins — Nucleation and Growth of Thin Films. 1700
J.B. Swan — Atomic and Molecular Excitation by Ion Bombardment. 3750
H.H. Thies — Investigation of non-normal parity states in the light nuclei. 6034

University of Tasmania ($89 682)
P.A. Hamilton and M.D. Waterworth — Simultaneous Radio and Optical Astronomical Observations. 4300
M.D. Waterworth and R.D. Watson — Observations with 40" Telescope. 36 141
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G.R.A. Ellis — Radio Astronomy 2-22 MHz. 10 991
P.A. Hamilton and P.M. McCulloch — Investigations of Pulsars and the Interstellar Medium. 29 400
B.I.H. Scott and I.A. Newman — Biophysical Studies on Plants. 5200
M.D. Waterworth and R.D. Watson — Optical Astronomical Observations. 6000

Australian National University ($24 994)
R.J. Stalker and R.J. Sandeman — Laboratory Studies of Stellar Line Broadening Processes. 8308
R.J. MacDonald — Secondary Ion Emission from Single Crystal Surfaces and Ion Scattering from Single Crystal Surfaces. 9236

NOTES AND NEWS

Changes in Atomic Weights
The IUPAC Conference in August 1973 approved changes in the atomic weights of nickel (from 58.71 to .58.70) and phenium (from 186.2 to 186.207). A full report will be published in Pure Appl. Chem.

Senior Adviser on Science
Mr G.B. Gresford has been appointed Senior Adviser on Science, Technology and the Environment in the Department of Foreign Affairs. Mr Gresford, a former Secretary of CSIRO, has just returned from a seven-year term with the United Nations.

The Energy Crisis and the Future of our Cities
The Urban Land Institute of Australia will hold a conference on 1-3 March, 1974 at Lorne, Victoria. Information from the Secretary, U.L.I., 414 Lonsdale Street, Melbourne, Vic. 3000.

European Conference on Temperature Measurement
The IOP London has called for offers of papers (by 5 July 1974) for a conference on 9-11 April 1975 at NPL. Details are available from Mr T.P. Jones, National Standards Laboratory, Chippendale, NSW, 2008.

The Australian Physicist, January 1974
Oceanography – UNESCO Appointment

Dr G.F. Humphrey of the CSIRO Marine Biochemistry Unit, has been elected Chairman of the Intergovernmental Oceanographic Commission, for a term of two years.

Statistics in CSIRO

Dr J. Gani, Professor of Statistics at Manchester and Sheffield, will become Chief of the CSIRO Division of Mathematical Statistics late in 1974. The work of the Division is expected to extend into Applied Mathematics.

Centres and Units at the ANU

The November issue of ANU News carries a discussion of the growth and future of centres and units which cut across the departmental and even faculty boundaries, or cover highly specialized topics within a school. In other articles, seven groups are described in some detail, including the Office for Research in Academic Methods, which is devoted to improving the quality of teaching within the University, and to making efficient use of available resources.

CSIRO Scientist for Tasmanian Environment Control

Dr D. Martin, officer in charge of the CSIRO Tasmanian Regional Laboratory, has been appointed to the Tasmanian Environment Protection Council.

Ninth World Energy Conference

The 50th Anniversary Meeting of the World Energy Conference will be held in DETROIT, USA on 22-27 September 1974. The theme will be “The Economic and Environmental Challenges of Future Energy Requirements.” A variety of study tours will be available during and after the conference. Details are available from Mr A.H. Cadd, Secretary of the Australian National Committee, World Energy Conference, Box 1823, GPO, Melbourne, 3001.

Australian Joins Russian Expedition

Dr J. Garrett of the CSIRO Division of Atmospheric Physics will sail on the “Dmitri Mendeleev” to the Southern Ocean (45-50 degrees south) to deploy an instrumented buoy. The buoy, which will measure meteorological variables at the air-sea interface, is a prototype for those planned for a more extensive experiment planned for 1975.

Physics of Running

Readers who found the recent article (AP August 1973) on cricket balls interesting may care to study “A Theory of Competitive Running” by J.A. Keller, in the September issue of Physics Today. Keller deduces that different strategies should be used in 200 metres and 400 metres runs.

Indian Physics Journal

Pramana, a new journal of physics, commenced publication in July 1973. The journal, whose title is Sanskrit for “Source of valid knowledge”, is published by the Indian Academy of Sciences and the Indian Physics Association. The executive editor is Mr S. Arunachalam, IAS, Bangalore 560006, from whom further information can be obtained.

Interscan – A New Aircraft Landing System

The CSIRO Division of Radiophysics and the Department of Civil Aviation have developed a new, electronically scanned microwave system which offers a wide variety of approach paths, rather than the fixed glide path of existing guidance systems. The antenna design arose from CSIRO research in radioastronomy. A full-scale test installation is planned for the end of 1974.

Open Meeting of Ph.D. Committee in Western Australia

In October, some 200 staff and postgraduate students attended an open meeting of the Ph.D. Committee of the University of Western Australia. Discussions ranged over the need to coordinate the Ph.D. programme with projected requirements, sources of funds, final employment (mostly in tertiary teaching), guidance in the initial stages of research and vocational counselling. The success of the meeting led to a request for a similar meeting next year.

Solar Energy Studies Unit in CSIRO

A new unit has been established in CSIRO to study the most promising applications of solar energy in Australia, and to conduct feasibility studies. The leader of the unit is Mr R. Morris, formerly Chief of the Division of Mechanical Engineering, who has long been involved in this field of research.

Solar Energy Society Lecture

A public lecture will be presented by Dr George O.G. Lof, President of the International Solar Energy Society, on the topic: “Heating and Cooling of Buildings by Solar Energy” at Stephen Roberts Lecture Theatre, University of Sydney on Thursday, 21st February, 1974 at 7.30 p.m.

A similar lecture will be given in Melbourne at Clunies Ross House, Parkville on 27 February, 1974, at 8 p.m.

Professor Lof is one of the few people in the world to have lived for more than 10 years in a solar heated house, built to his own design in Denver. He is particularly well able to discuss the theoretical and practical possibilities for conditioning of buildings by utilisation of solar energy.

Light refreshments will be served after the meeting in Sydney. To assist in providing catering would you please indicate by mail your intention to attend, to:

Mr C.M. Sapsford, c/- School of Mech. & Ind. Eng., UNSW, Box 1, PO, Kensington, 2033.
INSTITUTE AFFAIRS

23rd COUNCIL MEETING

The 23rd Meeting of the AIP Council was held at Clunies Ross House, Parkville on 1–2 November, 1973. The President, Dr F. Jacka, was in the chair and all Branch Chairmen were present.

General Policy

The AIP, like all other institutions is faced with continuously rising costs in all spheres of its operation. Salaries, services, postage, stationery etc. and other costs, of course, have to be balanced by income. After a full discussion Council resolved that “in view of variations in costs there shall be an annual review of, and appropriate adjustment to, the subscription rates, based on the change in costs and the change in the level of activity of the Institute, to be effective from 1975”.

The policy therefore is for frequent small increases rather than infrequent larger ones, which should correspond in the main with individuals’ increases in salary. A subscription increase can be expected for 1975.

Council approved the revision of grade structure and the renaming of grades so that the present corporate grade of Associate (AAIP) shall become Member (MAIP), and Associate will become a non-corporate grade to include newly qualified physics graduates gaining the experience necessary to qualify for Grad.AIP and also professional persons qualified and engaged in disciplines other than physics.

The necessary changes in the Institute’s Articles to bring these changes into effect are being prepared for the Law Department and will be submitted to members at an Extraordinary General Meeting of the AIP, possibly at the time of the National Conference in Adelaide in May 1974.

It was also recommended that at the time of the above changes the abbreviated titles for corporate grades should be changed to Hon.FAIP, FAIP, MAIP and GAIP respectively (i.e. omitting the full stops).

Finance

The Honorary Treasurer reported that the budgeted surplus of $5,000 had not been achieved, the final figure being nearer to $2,000. The main reasons for this were the unexpected inflation of administrative costs (salaries, audit fees, printing, postage etc.), lack of membership increase, and an over-budgeting of subscription income.

Administration

There had been two important changes in the office administration. Firstly Mrs Jean Mackenzie, who had been the Assistant Secretary since the secretariat moved to Melbourne, had tendered her resignation with effect from 16 November 1973, and a reference to the great contribution that she has made to the Institute will be reported elsewhere in the Australian Physicist.

Secondly the International Solar Energy Society (ISES) had withdrawn from the Joint Office partnership, leaving the Australian Institute of Refrigeration, Air Conditioning and Heating (AIRAH) and the AIP to share the office. All these societies had steadily expanded their activities over recent years, and the collective workload had increased very considerably. On the resignation of Mrs Mackenzie and the withdrawal of ISES, the AIP and AIRAH agreed to each appoint its own full-time Assistant Secretary. Mrs Patricia Smith has been appointed Assistant Secretary to AIP and we are pleased to welcome her to our organisation.

Membership

The Honorary Registrar reported that as at the 17 October 1973 corporate membership stood at 1441 (a decrease of 9 since the last Council meeting), total membership was 1709 (an increase of 12), and Company Subscribers totalled 24 (a decrease of 1).

These net changes in membership include gains by election of new members and transfers from non-corporate to corporate grades, less losses by resignation and removal.

Tertiary qualifications which received official recognition for graduateship were:

B.App.Sc. (Physics) of The Capricornia Institute of Advanced Education.
B.App.Sc. (Physics) of The South Australian Institute of Technology.
B.App.Sc. (Physics) of The Western Australian Institute of Technology.
B.App.Sc. (Physics) of The Darling Downs Institute of Advanced Education.

Diploma in Physics of the New South Wales Institute of Technology.

The Australian Physicist

The Editor reported that the use of new printing methods had helped to reduced expenditure considerably, even against the general movement of cost increases, and the total cost of the Australian Physicist for the year would be very close to $5,000.

Further savings may be possible by bulk mailing copies of the Australian Physicist where there are several physicists working in the same institution. Members will be asked to cooperate in this by using their business addresses, wherever possible, rather than their home addresses for the Australian Physicist correspondence.
Reflecting the opinion of members, as reported by the Branch Chairman, Council voted to continue the same frequency of publication of the Australian Physicist.

The Editor would always welcome ideas and opinions for extending the value of the Australian Physicist.

Conferences, Summer Schools and Special Lectures

The 1973 Pawsey Memorial Lecture was held in Hobart on 28 September and was attended by 160 people. Professor W.N. Christiansen spoke on "The Giant Radio Telescopes in Australia". This paper will appear in a later issue of the Australian Physicist.

The 1974 Pawsey Memorial Lecture will be organised by the Queensland Branch, probably in the latter part of the year.

The 1974 Summer School will be held in Perth from 21–25 January. The topics will be geophysical.

The Tasmanian Branch is planning a Summer School in February 1975 on Astrophysics.

The National AIP Conference is being planned for Adelaide from 21–25 May 1974. The principal activities will be centred at Flinders University.

An International Conference on Optical Image Processing will be held in Sydney from 19–21 August 1974 immediately prior to the International Conference on Optical Measurement in Japan.

Professor Pippard is expected to visit Australia during September–October 1974 and the New South Wales Branch will coordinate his visits to other Branches and Universities.

Groups

The Biophysics Group, in conjunction with the Australian Regional Group Hospital Physicists' Association, organised the 13th Conference on Physics in Medicine and Biology, held in Adelaide from 21–26 May 1973. It was attended by 45 delegates, 30 of whom came from interstate. The final two days of the conference were held in conjunction with the ANZ Society of Nuclear Medicine. The 14th Conference will be held in Sydney from 20–24 May 1974. Membership of the Group stood at 59.

Perhaps the main development in the Education Group has been the establishment of a Victorian division, spear-headed by Dr Paul Clark (Monash University). A very successful inaugural meeting was held on 12 October 1973 at which The Open University and the techniques employed was discussed. Membership of the Group stood at 55.

The Nuclear and Particle Physics Group had a membership of 114. A school on "Intermediate Energy Physics, Particle Physics and Application of Nuclear Physics" was held in Melbourne in May 1973. A second school is being planned to be held at Goolwa, WA, from 17–20 February 1975.

The vacuum Physics Group had a financial membership of 55 but had not followed up its large number of unfinancial members. A Vacuum Physics conference and equipment exhibition will be held in Canberra from 11–13 February 1974.

Other Scientific Organisations

In the report of the 22nd Meeting of Council (Australian Physicist, July 1973) reference was made to the new Science Council proposed by the Minister of Science. The AIP council welcomed the proposal and offered full cooperation in the activities of the new body. Regrettably nothing further had been heard about the establishment of the Science Council.

The AIP has made representation to the Minister for Environment and Conservation in respect of two advisory bodies viz. the Australian Ionizing Radiation Advisory Council and the Advisory Committee on Environment and Conservation.

24th Council Meeting and 11th Annual General Meeting

The next Council Meeting is scheduled for 19–20 May 1974 in Adelaide immediately prior to the National Conference. It is hoped to be able to arrange the 11th Annual General Meeting in conjunction with the National Conference.

Amendments to By-Laws

Notice is hereby given to all members that, at the 23rd Council Meeting the following amendment was made to the By-Laws, concerning plebiscites —

By-Law 76 (3) was amended by the addition of a second sentence, to read:

76 (3) Each voter shall enclose the voting paper in a sealed envelope which together with a separate signed scrutiny slip shall be enclosed in a second sealed envelope and returned to the Returning Officer or his appointee. A reply-paid card which can be sealed shall be acceptable provided the scrutiny slip can be detached in accordance with these provisions.

K.H. Clarke, Honorary Secretary.
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Qld Branch: Mr R. E. Dunlop, Physics Department, QUT, George St., Brisbane, Qld 4000.

SA Branch: Mr K. H. Lloyd,
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Tas. Branch: Dr J. R. Fox, Department of Physics, University of Tasmania, GPO Box 252C, Hobart, Tasmania 7001.

Vic. Branch: Mr J. V. Sullivan, CSIRO Div. of Chemical Physics, PO Box 160, Clayton, Victoria 3168.

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Education Group: Mr P. E. Ciddor, National Standards Laboratory, University Grounds, Chippendale, NSW 2008.

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Further information may be obtained from—

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